DEPARTMENT OF ENERGY

10 CFR Parts 429 and 431

[Docket Number EERE–2013–BT–STD–0022]

RIN 1904–AD00

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 (NOPR) and announcement of public meeting.

SUMMARY: The Energy Policy and Conservation Act of 1975 (EPCA), as amended, prescribes energy conservation standards for various consumer products and certain commercial and industrial equipment, including refrigerated bottled or canned beverage vending machines (beverage vending machine). EPCA also requires the U.S. Department of Energy (DOE) to periodically determine whether more-stringent, amended standards would be technologically feasible and economically justified, and would save a significant amount of energy. In this NOPR, DOE proposes amended energy conservation standards for Class A and Class B beverage vending machines. DOE is also proposing to amend the definition for Class A equipment to more clearly differentiate Class A and Class B equipment, as well as to amend the definition of combination vending machine. In addition, DOE proposes to establish definitions and new energy conservations standards for Combination A and Combination B classes of beverage vending machines. This NOPR also announces a public meeting to receive comment on these proposed standards and associated analyses and results, and announces the availability of the NOPR technical support document (TSD).

DATES: DOE will hold a public meeting on Tuesday, September 29, 2015, from 10 a.m. to 3 p.m., in Washington, DC. The meeting also will be broadcast as a webinar. See section VII of this NOPR, ‘‘Public Participation,’’ for webinar registration information, participant instructions, and information about the capabilities available to webinar participants.

DOE will accept comments, data, and information regarding this NOPR before and after the public meeting, but no later than October 19, 2015. See section VII of this NOPR, ‘‘Public Participation,’’ for details.

Comments regarding the likely competitive impact of the proposed standard should be sent to the Department of Justice contact listed in the **ADDRESSES** section before September 18, 2015.

ADDRESSES: The public meeting will be held at the U.S. Department of Energy, Forrestal Building, Room 8E–089, 1000 Independence Avenue SW., Washington, DC 20585.

Any comments submitted must identify the NOPR for Energy Conservation Standards for Beverage Vending Machines, and provide docket number EERE–2013–BT–STD–0022 and/or regulatory information number (RIN) number 1904–AD00. Comments may be submitted using any of the following methods:

1. *Federal eRulemaking Portal: www.regulations.gov.* Follow the instructions for submitting comments.
2. *Email: BVM2013STD0022@ee.doe.gov.* Include the docket number and/or RIN in the subject line of the message.
3. *Postal Mail:* Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Office, Mailstop EE–5B, 1000 Independence Avenue SW., Washington, DC 20585–0121. If possible, please submit all items on a compact disc (CD), in which case it is not necessary to include printed copies.
4. *Hand Delivery/Courier:* Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Program, 950 L'Enfant Plaza SW., Suite 600, Washington, DC 20024. Telephone: (202) 586–2945. If possible, please submit all items on a CD, in which case it is not necessary to include printed copies.

Written comments regarding the burden-hour estimates or other aspects of the collection-of-information requirements contained in this proposed rule may be submitted to the Office of Energy Efficiency and Renewable Energy through the methods listed above and by email to *Chad_S._Whiteman@omb.eop.gov.*

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

Docket: The docket, which includes **Federal Register** notices, public meeting attendee lists and transcripts, 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, some documents listed in the index, such as those containing information that is exempt from public disclosure, may not be publicly available.

A link to the docket Web page can be found at: *http://www1.eere.energy.gov/buildings/appliance_standards/rulemaking.aspx/ruleid/73* . This Web page contains a link to the docket for this NOPR on the *www.regulations.gov* site. The *www.regulations.gov* Web page contains simple instructions on how to access all documents, including public comments, in the docket. See section VII of this NOPR, ‘‘Public Participation,’’ for further information on how to submit comments through *www.regulations.gov.*

EPCA requires the Attorney General to provide DOE a written determination of whether the proposed standard is likely to lessen competition. The U.S. Department of Justice Antitrust Division invites input from market participants and other interested persons with views on the likely competitive impact of the proposed standard. Interested persons may contact the Division at *energy.standards@atr.usdoj.gov* before September 18, 2015. Please indicate in the ''Subject'' line of your email the title and Docket Number of this rulemaking notice.

FOR FURTHER INFORMATION CONTACT:

Mr. John Cymbalsky, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Office, EE–2J, 1000 Independence Avenue SW., Washington, DC 20585–0121. Telephone: (202) 287–1692. Email: *refrigerated_beverage_vending_machines@ee.doe.gov.*

Ms. Sarah Butler, U.S. Department of Energy, Office of General Counsel, GC–33, 1000 Independence Avenue SW., Washington, DC 20585–0121, (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 Ms. Brenda Edwards at (202) 586–2945 or by email: *Brenda.Edwards@ee.doe.gov.*

SUPPLEMENTARY INFORMATION:

This notice of proposed rulemaking proposes to incorporate by reference into 10 CFR part 431 the testing methods contained in the following commercial standards:

(1) ASTM Standard E 1084–86 (Reapproved 2009), ‘‘Standard Test Method for Solar Transmittance (Terrestrial) of Sheet Materials Using Sunlight,’’ approved April 1, 2009.

Copies of ASTM standards may be purchased from ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA, 19428, (877) 909–2786, or at *www.astm.org.*

See IV.N for a further discussion of this standard.

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I. Synopsis of the Proposed Rule

Title III, Part A [1] of the Energy Policy and Conservation Act of 1975 (EPCA or the Act), Public Law 94–163 (42 U.S.C. 6291–6309, as codified), established the Energy Conservation Program for Consumer Products Other Than Automobiles.[2] These products include refrigerated bottled or canned beverage vending machines (beverage vending machines or BVMs), the subject of this NOPR. (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 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)) In accordance with these and other statutory provisions discussed in this NOPR, DOE proposes new and amended energy conservation standards for beverage vending machines. The proposed standards,

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

[2] All references to EPCA in this document refer to the statute as amended through the Energy Efficiency Improvement Act of 2015 (EEIA 2015), Pub. L. 114–11 (April 30, 2015).

[3] Because Congress included beverage vending machines in Part A of Title III of EPCA, the consumer product provisions of Part A (not the industrial equipment provisions of Part A–1) apply to beverage vending machines. DOE placed the regulatory requirements specific to beverage vending machines in Title 10 of the Code of Federal Regulations (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 beverage vending machines as ''equipment'' throughout this document because of their placement in 10 CFR part 431. Despite the placement of beverage vending machines 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 beverage vending machines. See 74 FR 44914, 44917 (Aug. 31, 2009).

which are described in terms of the maximum daily energy consumption (MDEC) as a function of refrigerated volume, are shown in Table I.1. Specifically, DOE is proposing to amend the energy conservation standards established by the 2009 BVM final rule for Class A and Class B beverage vending machines. In addition, DOE is proposing to establish two new equipment classes at 10 CFR 431.292, Combination A and Combination B, as well as new energy conservation standards for those equipment classes. These proposed standards, if adopted, would apply to all equipment listed in Table I.1 and manufactured in, or imported into, the United States on or after the date 3 years after the publication of the final rule for this rulemaking.

TABLE I.1—PROPOSED ENERGY CONSERVATION STANDARDS FOR BEVERAGE VENDING MACHINES

Equipment class *	Proposed energy conservation standards ** Maximum daily energy consumption (MDEC) *kWh/day* †
A	$0.041 \times V + 1.92$‡
B	$0.033 \times V + 1.42$‡
Combination A	$0.044 \times V + 1.64$‡
Combination B	$0.044 \times V + 1.36$‡

* See section IV.A.1 of this NOPR for a discussion of equipment classes.

** "V" is the representative value of refrigerated volume (ft^3) of the BVM model, as measured in accordance with the method for determining refrigerated volume adopted in the recently amended DOE test procedure for beverage vending machines and appropriate sampling plan requirements at 10 CFR 429.52(a)(3). 80 FR 45758 (July 31, 2015). See section III.B and V.A for more details.

† kilowatt hours per day.

‡ Trial Standard Level (TSL) 4.

A. Benefits and Costs to Customers

Table I.2 and Table I.3 present DOE's evaluation of the economic impacts of the proposed energy conservation standards on customers, or purchasers, of beverage vending machines, as measured by the average life-cycle cost (LCC) savings and the simple payback period (PBP).[4] This analysis is based upon the use of two refrigerants, CO_2 (R–744) and propane (R–290). These refrigerants were selected for analysis based on the recent actions of the U.S. Environmental Protection Agency's (EPA's) Significant New Alternatives Policy (SNAP) program,[5] including the listing of propane as acceptable in BVM applications under Rule 19 (80 FR 19454, 19491; April 10, 2015) and the change of status of R–134a to unacceptable in BVM applications beginning January 1, 2019 under Rule 20. 80 FR 42870, 42917–42920 (July 20, 2015). The selected refrigerants on which this proposal is based was also guided by visible trends within the BVM marketplace and feedback from interested parties during public meetings, in written comments, and during manufacturer interviews.

The average LCC savings are positive for all equipment classes and refrigerants, and the PBP is less than the average lifetime of the equipment, which is estimated to be 13.5 years.

TABLE I.2—IMPACTS OF PROPOSED ENERGY CONSERVATION STANDARDS ON CUSTOMERS OF BEVERAGE VENDING MACHINES—CO_2 REFRIGERANT

Equipment class	Life-cycle cost savings *2014$*	Payback period *years*
Class A	173	3.6
Class B	534	2.3
Combination A	1,344	1.4
Combination B	1,098	0.6

TABLE I.3—IMPACTS OF PROPOSED ENERGY CONSERVATION STANDARDS ON CUSTOMERS OF BEVERAGE VENDING MACHINES—PROPANE REFRIGERANT

Equipment class	Life-cycle cost savings *2014$*	Payback period *years*
Class A	265	1.1
Class B	838	1.3
Combination A	1,405	1.1
Combination B	1,153	0.5

DOE's analysis of the impacts of the proposed standards on customers is described in section V of this NOPR.

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 (2015 to 2048). Using a real discount rate of 8.5 percent, DOE estimates that the INPV in the case without amended standards for manufacturers of beverage vending machines is $ 62.7 million.[6] Under the proposed standards, DOE expects that INPV may change by approximately −$3.5 million to −$0.2 million, which is −5.6 percent to −0.2 percent. DOE also expects industry conversion costs associated with amended standards compliance to total $2.8 million.

DOE's analysis of the impacts of the proposed standards on manufacturers is described in section V.B.2 of this NOPR.

C. National Benefits and Costs [7]

DOE's analyses indicate that the proposed energy conservation standards for beverage vending machines would save a significant amount of energy. The cumulative energy savings amount to 0.223 quadrillion Btus (quads) for beverage vending machines purchased in the 30-year period that begins in the year of compliance with new and amended standards for Class A, Class B, Combination A, and Combination B beverage vending machines (2019–2048),[8] relative to the case without

[4] The average LCC savings are measured relative to the efficiency distribution in the no-new-standards case, which depicts the market in the compliance year (see section IV.F.6 of this notice). The simple PBP, which is designed to compare specific efficiency levels, is measured relative to the baseline model (see section IV.C.1 of this notice). DOE acknowledges that not all BVM customers are also the entity that is responsible for the energy costs of operating the beverage vending machine in the field. However, there are many different contracting mechanisms for leasing and operating beverage vending machines, which are influenced by many factors, including the capital cost of the machine and the annual operating costs. As such, DOE believes that a simple "customer" LCC-model accurately demonstrates the cost-effectiveness of the potential energy efficiency improvements resulting from any new or amended standards, regardless of by whom the costs and benefits are borne.

[5] The Environmental Protection Agency's (EPA) Significant New Alternatives Policy (SNAP) program, which is the U.S. government regulatory program responsible for maintaining the list of alternatives to ozone-depleting substances allowed for use within specific applications in the United States, has taken two rulemaking actions that concern refrigerants for the U.S. refrigerated vending machine market. See section IV.C.2 for more details.

[6] All monetary values in section I.B of this notice are expressed in 2014 dollars; discounted values are discounted to 2014 unless explicitly stated otherwise.

[7] All monetary values in section I.C of this notice are expressed in 2014 dollars and are discounted to 2014.

[8] The standards analysis period for national benefits covers the 30-year period, plus the life of equipment purchased during the period. In the past DOE presented energy savings results for only the 30-year period that begins in the year of compliance. In the calculation of economic impacts, however, DOE considered operating cost savings measured over the entire lifetime of products purchased in the 30-year period. DOE has chosen to modify its presentation of national energy savings to be consistent with the approach used for its national economic analysis.

amended standards. This represents a savings of 39 percent relative to the energy use of this equipment in the case without amended standards (referred to as the ''no-new-standards case'').[9]

The cumulative net present value (NPV) of total customer costs and savings of the proposed standards for beverage vending machines range from $0.42 billion (at a 7-percent discount rate) to $1.10 billion (at a 3-percent discount rate [10]). This NPV expresses the estimated total value of future operating-cost savings minus the estimated increased product costs for beverage vending machines purchased in 2019–2048.

In addition, the proposed standards would have significant environmental benefits. The energy savings described above are estimated to result in cumulative emission reductions (for equipment purchased in 2019–2048) of 13 million metric tons (MMt) [11] of carbon dioxide (CO_2), 60 thousand tons of methane (CH_4), 11 thousand tons of sulfur dioxide (SO_2), 20 thousand tons of nitrogen oxides (NO_X), 0.2 thousand tons of nitrogen oxide (N_2O), and 0.03 tons of mercury (Hg).[12] The cumulative reduction in CO_2 emissions through 2030 amounts to 1.83 MMt, which is equivalent to the emissions resulting from the annual electricity use of about 250,000 homes.

The value of the CO_2 reductions is calculated using a range of values per metric ton of CO_2 (otherwise known as the social cost of carbon, or SCC) developed by a recent Federal interagency process.[13] The derivation of the SCC values is discussed in section IV.K of this NOPR. DOE estimates that the present monetary value of the CO_2 emissions reduction is between $0.1 and $1.2 billion, with a value of $0.4 billion using the central SCC case represented by $40.0 per metric ton in 2015. DOE also estimates the present monetary value of the NO_X emissions reduction is between $1.8 and $18.8 million at a 7-percent discount rate and between $4.4 and $45.1 million at a 3-percent discount rate.[14]

Table I.4 summarizes the national economic costs and benefits expected to result from these proposed standards for beverage vending machines.

TABLE I.4—SUMMARY OF NATIONAL ECONOMIC BENEFITS AND COSTS OF PROPOSED ENERGY CONSERVATION STANDARDS FOR BEVERAGE VENDING MACHINES*

Category	Present Value *million 2014$*	Discount Rate %
Benefits		
Customer Operating Cost Savings	520	7
	1,301	3
CO_2 Reduction Monetized Value ($12.2/metric ton case)**	85	5
CO_2 Reduction Monetized Value ($40.0/metric ton case)**	400	3
CO_2 Reduction Monetized Value ($62.3/metric ton case)**	638	2.5
CO_2 Reduction Monetized Value ($116.8/metric ton case)**	1,220	3
NO_X Reduction Monetized Value (at $2,723/ton)**	10	7
25	3	
Total Benefits †	930	7
	1,725	3
Costs		
Customer Incremental Installed Costs	103	7
201	3	
Net Benefits		
Including CO_2 and NO_X Reduction Monetized Value	837	7%
1,524	3	

* This table presents the costs and benefits associated with beverage vending machines shipped in 2019–2048. These results include benefits to customers that accrue after the last year of analyzed shipments (2048) from the equipment purchased during the 30-year analysis period. The costs account for the incremental variable and fixed costs incurred by manufacturers due to the standard, some of which may be incurred in preparation for the rule.

** The CO_2 values represent global monetized values of the SCC, in 2014$, in 2015 under several scenarios of the updated SCC values. The first three cases use the averages of SCC distributions calculated using 5 percent, 3 percent, and 2.5 percent discount rates, respectively. The fourth case represents the 95th percentile of the SCC distribution calculated using a 3-percent discount rate. The SCC time series used by DOE incorporates an escalation factor. The value for NO_X is the average of high and low values found in the literature.

† Total benefits for both the 3-percent and 7-percent cases are derived using the series corresponding to SCC value of $40.0/metric ton in 2015.

[9] The no-new-standards case represents a mix of efficiencies above the minimum efficiency level (EL 0). Please see section IV.F.6 for a more detail description of associated assumptions.

[10] These discount rates are used in accordance with the Office of Management and Budget (OMB) guidance to Federal agencies on the development of regulatory analysis (OMB Circular A–4, September 17, 2003), and section E, ''Identifying and Measuring Benefits and Costs,'' therein. Further details are provided in section IV.G of this notice.

[11] A metric ton is equivalent to 1.1 short tons. Results for CH_4, SO_2, NO_X, N_2O, and Hg are presented in short tons.

[12] DOE calculated emissions reductions relative to the *Annual Energy Outlook 2014* (*AEO2014*) reference case, which generally represents current legislation and environmental regulations for which implementing regulations were available as of October 31, 2013.

[13] *Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866,* Interagency Working Group on Social Cost of Carbon, United States Government (May 2013; revised July 2015) (Available at *https://www.whitehouse.gov/sites/default/files/omb/inforeg/scc-tsd-final-july-2015.pdf).*

[14] DOE is currently investigating valuation of avoided Hg and SO_2 emissions.

The benefits and costs of these proposed standards for beverage vending machines sold in 2019–2048 can also be expressed in terms of annualized values. The monetary values for the total annualized net benefits are the sum of (1) the national economic value of the benefits in reduced operating costs, minus (2) the increases in equipment purchase and installation costs, plus (3) the value of the benefits of CO_2 and NO_X emission reductions, all annualized.[15]

Although DOE believes that the values of operating cost savings and CO_2 emission reductions are both important, two issues are relevant. First, the national operating savings are domestic U.S. customer monetary savings that occur as a result of market transactions, whereas the value of CO_2 reductions is based on a global value. Second, the assessments of operating cost savings and CO_2 savings are performed with different methods that use different time frames for analysis. The national operating cost savings is measured for the lifetime of beverage vending machines shipped in the 30-year analysis period beginning the year compliance is required with the new and amended standards. Because CO_2 emissions have a very long residence time in the atmosphere,[16] the SCC values in future years reflect future CO_2 emissions impacts resulting from the emission of one ton of CO_2 in each year. These impacts continue well beyond 2100.

Estimates of annualized benefits and costs of the proposed standards (over a 30-year period) are shown in Table I.5. The results under the primary estimate are as follows. Using a 7-percent discount rate for benefits and costs other than CO_2 reduction, for which DOE used a 3-percent discount rate along with the average SCC series that has a value of $40.0 per metric ton in 2015,[17] the cost of the standards proposed in this rule is $10.2 million per year in increased equipment costs, while the benefits are $51.3 million per year in reduced equipment operating costs, $22.3 million from CO_2 reductions, and $1.0 million in reduced NO_X emissions. In this case, the annualized net benefit amounts to $64 million per year. Using a 3-percent discount rate for all benefits and costs and the average SCC series that has a value of $40.0 per metric ton in 2015, the cost of the standards proposed in this rule is $11.2 million per year in increased equipment costs, while the benefits are $72.5 million per year in reduced operating costs, $22.3 million from CO_2 reductions, and $1.4 million in reduced NO_X emissions. In this case, the net benefit amounts to $85 million per year.

DOE also calculated the low net benefits and high net benefits estimates by calculating the operating cost savings and shipments at the *AEO2014* low economic growth case and high economic growth case scenarios, respectively. The low and high benefits for incremental installed costs were derived using the low and high price learning scenarios. In addition, the low and high benefits estimates reflect low and high shipments scenarios (see section IV.G.1.c of this NOPR). The net benefits and costs for low and high net benefits estimates were calculated in the same manner as the primary estimate by using the corresponding values of operating cost savings and incremental installed costs.

TABLE I.5—ANNUALIZED BENEFITS AND COSTS OF PROPOSED ENERGY CONSERVATION STANDARDS FOR BEVERAGE VENDING MACHINES

	Discount rate	Primary estimate *	Low net benefits estimate *	High net benefits estimate *
				million 2014$/year
Benefits				
Operating Cost Savings	7%	51	48	80
	3%	73	65	106
CO_2 Reduction Monetized Value ($12.2/metric ton case) **.	5%	6	6	9
CO_2 Reduction Monetized Value ($40.0/metric ton case) **.	3%	22	21	31
CO_2 Reduction Monetized Value ($62.3/metric ton case) **.	2.5%	33	30	45
CO_2 Reduction Monetized Value ($116.8/metric ton case) **.	3%	68	63	94
NO_X Reduction Monetized Value (at $2,723/ton) **	7%	1.02	0.99	1.56
	3%	1.38	1.29	1.97
Total Benefits†	7% plus CO_2 range	59 to 120	55 to 112	91 to 176
	7%	75	69	112
	3% plus CO_2 range	80 to 142	72 to 131	117 to 206
	3%	96	86	139
Costs				
Incremental Equipment Costs	7%	10.20	15.24	9.90
	3%	11.18	15.57	10.46
Net Benefits				
Total †	7% plus CO_2 range	49 to 110	40 to 96	81 to 166

[15] DOE used a two-step calculation process to convert the time-series of costs and benefits into annualized values. First, DOE calculated a present value in 2015, the year used for discounting the NPV of total customer costs and savings, for the time-series of costs and benefits using discount rates of 3 and 7 percent for all costs and benefits except for the value of CO_2 reductions. For the latter, DOE used a range of discount rates, as shown in Table I.4. From the present value, DOE then calculated the fixed annual payment over a 30-year period (2019 through 2048) that yields the same present value. The fixed annual payment is the annualized value. Although DOE calculated annualized values, this does not imply that the time-series of cost and benefits from which the annualized values were determined is a steady stream of payments.

[16] The atmospheric lifetime of CO_2 is estimated of the order of 30–95 years. Jacobson, MZ (2005). ''Correction to ''Control of fossil-fuel particulate black carbon and organic matter, possibly the most effective method of slowing global warming.'' *J. Geophys. Res.* 110. pp. D14105.

[17] DOE used a 3-percent discount rate because the SCC values for the series used in the calculation were derived using a 3-percent discount rate (see section IV.K).

TABLE I.5—ANNUALIZED BENEFITS AND COSTS OF PROPOSED ENERGY CONSERVATION STANDARDS FOR BEVERAGE VENDING MACHINES—Continued

	Discount rate	Primary estimate *	Low net benefits estimate *	High net benefits estimate *
				million 2014$/year
	7%	64	54	103
	3% plus CO_X range	69 to 131	56 to 113	107 to 192
	3%	85	71	129

* This table presents the annualized costs and benefits associated with beverage vending machines shipped in 2019–2048. These results include benefits to customers that accrue after the last year of analyzed shipments (2048) from the equipment purchased in during the 30-year analysis period. The results account for the incremental variable and fixed costs incurred by manufacturers due to the standard, some of which may be incurred in preparation for the rule. The primary, low benefits, and high benefits estimates utilize projections of energy prices from the *AEO2014* reference case, low estimate, and high estimate, respectively, as well as the default shipments scenario along with the low and high shipments scenarios. In addition, incremental equipment costs reflect a medium decline rate for projected equipment price trends in the primary estimate, a low decline rate for projected equipment price trends in the low benefits estimate, and a high decline rate for projected equipment price trends in the high benefits estimate. The methods used to derive projected price trends are explained in technical support document.

** The CO_2 values represent global monetized SCC values, in 2014$, in 2015 under several scenarios. The first three cases use the averages of SCC distributions calculated using 5-percent, 3-percent, and 2.5-percent discount rates, respectively. The fourth case represents the 95th percentile of the SCC distribution calculated using a 3-percent discount rate. The SCC time series incorporates an escalation factor. The value for NO_X (in 2014$) is an average of high and low values found in the literature.

† Total benefits for both the 3-percent and 7-percent cases are derived using the series corresponding to the average SCC with a 3-percent discount rate ($40.0/metric ton case). In the rows labeled "7% plus CO_2 range" and "3% plus CO_2 range," the operating cost and NO_X benefits are calculated using the labeled discount rate, and those values are added to the full range of CO_2 values.

DOE's analysis of the national impacts of the proposed standards is described in section V.B.3 of this NOPR.

D. Conclusion

DOE has tentatively concluded that the proposed standards for beverage vending machines represent the maximum improvement in energy efficiency that is technologically feasible and economically justified, and would result in the significant conservation of energy. DOE further notes that equipment achieving these standard levels is already commercially available for all equipment classes covered by this proposal. DOE acknowledges that equipment using the SNAP-approved refrigerants (*i.e.,* CO_2 and propane) meeting the current or proposed standard levels is not available for all equipment classes, due to the limited use of CO_2 as a refrigerant to date and the fact that propane has only recently been approved for use in BVM applications. 80 FR 19454, 19491 (April 10, 2015). However, DOE notes that Class B beverage vending machines using CO_2 and that meet the proposed standard levels are already available. In addition, DOE believes that the existing industry experience in improving the efficiency of R–134a- and CO_2-based equipment is applicable and transferable to equipment using propane as a refrigerant. DOE has addressed the technical feasibility and economic implications of meeting the proposed standard levels utilizing CO_2 and propane refrigerants in the analyses presented in this NOPR and, based on these analyses, DOE has tentatively concluded that the benefits of the proposed standards to the nation (energy savings, positive NPV of customer benefits, customer LCC savings, and emission reductions) would outweigh the burdens (loss of INPV for manufacturers).

DOE also considered more-stringent energy efficiency levels as potential standards, and is 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 NOPR and related information collected and analyzed during the course of this rulemaking effort, DOE may adopt energy efficiency levels presented in this NOPR that are either higher or lower than the proposed standards, or some combination of levels that incorporate the proposed standards in part.

II. Introduction

The following section briefly discusses the statutory authority underlying this proposal, as well as some of the relevant historical background related to the establishment of standards for beverage vending machines.

A. Authority

Title III, Part B of the Energy Policy and Conservation Act of 1975, as amended, (EPCA or the Act), Public Law 94–163 (42 U.S.C. 6291–6309, as codified) established the Energy Conservation Program for Consumer Products Other Than Automobiles, a program covering most major household appliances (collectively referred to as "covered products"), which includes the beverage vending machine. (42 U.S.C. 6291(40)) As part of this program, EPCA directed DOE to prescribe energy conservation standards for beverage vending machines. (42 U.S.C. 6295(v)) In addition, under 42 U.S.C. 6295(m), DOE must periodically review its already established energy conservation standards for a covered product. DOE is undertaking this rulemaking to meet this EPCA requirement.

Pursuant to EPCA, DOE's energy conservation program for covered products consists essentially of four parts: (1) Testing, (2) labeling, (3) the establishment of Federal energy conservation standards, and (4) certification and enforcement procedures. The Secretary or the Federal Trade Commission, as appropriate, may prescribe labeling requirements for beverage vending machines. (42 U.S.C. 6294(a)(5)(A)) 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. 6293) Manufacturers of covered equipment must use the prescribed DOE test procedure as the basis for certifying to DOE that their equipment complies with the applicable energy conservation standards adopted under EPCA and when making representations to the public regarding the energy use or efficiency of that equipment. (42 U.S.C. 6293(c) and 6295(s)) Similarly, DOE must use these test procedures to determine whether the products comply with standards adopted pursuant to EPCA. *Id.*

DOE recently updated its test procedure for beverage vending machines in a final rule published July 31, 2015. 80 FR 45758 (July 31, 2015). In that final rule, DOE adopted several amendments and clarifications to the DOE test procedure in the new appendix A and B of subpart Q of 10 CFR part 431. As specified in the BVM test procedure final rule, manufacturers of beverage vending machines would be required to use appendix B to demonstrate compliance with any new and amended energy conservation standards adopted as a result of this rulemaking.

DOE must follow specific statutory criteria for prescribing new or amended standards for covered equipment. As indicated previously, any new or amended standard for a covered product must be designed to achieve the maximum improvement in energy efficiency that is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A)) Furthermore, DOE may not adopt any standard that would not result in the significant conservation of energy. (42 U.S.C. 6295(o)(3)) Moreover, DOE may not prescribe a standard: (1) For certain products, including beverage vending machines, 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))

DOE, in deciding whether a standard is economically justified, must determine, after receiving comments on the proposed standard, whether the benefits of the standard exceed its burdens by considering, to the maximum extent practicable, the following seven factors:

1. The economic impact of the standard on manufacturers and customers of 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 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 conservation; and

7. Other factors the Secretary of Energy considers relevant. (42 U.S.C. 6295(o)(2)(B)(i))

Further, EPCA, as codified, establishes a rebuttable presumption that a standard is economically justified if the Secretary finds that the additional cost to the customer of purchasing a product complying with an energy conservation standard level will be less than three times the value of the energy (and, as applicable, water) savings during the first year that the customer 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, as codified, 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 of 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 a standard for a type or class of covered product that has two or more subcategories. DOE must specify a different standard level than that which applies generally to such type or class of products for any group of covered products that have the same function or intended use if DOE determines that products within such group: (A) Consume a different kind of energy from that consumed by other covered products within such type (or class); or (B) have a capacity or other performance-related feature which other products within such type (or class) do not have and which justifies a higher or lower standard. (42 U.S.C. 6294(q)(1)). In determining whether a performance-related feature justifies a different standard for a group of products, DOE generally considers such factors as the utility to the customer of the feature and other factors DOE deems appropriate. *Id.* In a rule prescribing such a standard, DOE includes an explanation of the basis on which such a higher or lower level was established. (42 U.S.C. 6295(q)(2)) DOE followed a similar process in the context of this rulemaking.

Federal energy conservation requirements generally supersede State laws or regulations concerning energy conservation testing, labeling, and standards. (42 U.S.C. 6297(a) through (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 42 U.S.C. 6297(d)).

Finally, pursuant to EPCA any final rule for new or amended energy conservation standards promulgated after July 1, 2010 must address standby mode and off mode energy use. (42 U.S.C. 6295(gg)(3)) Specifically, when DOE adopts a standard for covered equipment 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 the 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) and (B)) DOE reviewed the operating modes available for beverage vending machines 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, beverage vending machines are 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 for the vast majority of equipment, DOE believes that such a mode does not constitute a ''standby mode,'' as defined by EPCA, for beverage vending machines. Therefore, DOE believes that beverage vending machines do not operate under standby and off mode conditions as defined in EPCA, and that the energy use of a beverage vending machine would be captured in any standard established for active mode energy use. As such, the new and amended energy conservation standards proposed in this NOPR do not specifically address standby and off mode energy consumption for the equipment.

DOE also reviewed this regulation pursuant to Executive Order 13563. 76 FR 3821, (January 21, 2011). Executive Order 13563 is supplemental to and explicitly reaffirms the principles, structures, and definitions governing regulatory review established in Executive Order 12866. To the extent permitted by law, agencies are required by Executive Order 13563 to: (1) Propose or adopt a regulation only upon a reasoned determination that its benefits justify its costs (recognizing that some benefits and costs are difficult to quantify); (2) tailor regulations to impose the least burden on society, consistent with obtaining regulatory objectives, taking into account, among other things, and to the extent practicable, the costs of cumulative regulations; (3) select, in choosing among alternative regulatory approaches, those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity); (4) to the extent feasible, specify performance objectives, rather than specifying the behavior or manner of compliance that regulated entities must adopt; and (5) identify and assess available alternatives to direct regulation, including providing economic incentives to encourage the desired behavior, such as user fees or marketable permits, or providing information upon which choices can be made by the public.

DOE emphasizes as well that Executive Order 13563 requires agencies to use the best available techniques to quantify anticipated present and future benefits and costs as accurately as possible. In its guidance, the Office of Information and Regulatory Affairs has emphasized that such techniques may include identifying changing future compliance costs that might result from technological innovation or anticipated behavioral changes. For the reasons stated in the preamble, DOE believes that this NOPR is consistent with these principles, including the requirement that, to the extent permitted by law, benefits justify costs and that net benefits are maximized. Consistent with Executive Order 13563, and the range of impacts analyzed in this rulemaking, the energy efficiency standards proposed herein by DOE achieve maximum net benefits.

B. Background

1. Current Standards

In a final rule published on August 31, 2009 (henceforth referred to as the 2009 BVM final rule), DOE prescribed the current energy conservation standards for beverage vending machines. 74 FR 44914 (August 31, 2009). The 2009 BVM final rule established energy conservation standards for Class A and Class B beverage vending machines, with a compliance date of August 31, 2012, as shown in Table II.1. DOE also established a class of combination machines, but did not set standards for combination machines, instead reserving a place for possible development of future standards for that equipment.

TABLE II.1—ENERGY CONSERVATION STANDARDS FOR BEVERAGE VENDING MACHINES, PRESCRIBED BY THE 2009 BVM FINAL RULE—COMPLIANCE DATE AUGUST 31, 2012

Class	Definition	Maximum daily energy consumption
A	Class A means a refrigerated bottled or canned beverage vending machine that is fully cooled, and is not a combination vending machine.	$0.055 \times V + 2.56$
B	Class B means any refrigerated bottled or canned beverage vending machine not considered to be Class A, and is not a combination vending machine.	$0.073 \times V + 3.16$
Combination	Combination means a refrigerated bottled or canned beverage vending machine that also has non-refrigerated volumes for the purpose of vending other, non-"sealed beverage" merchandise.	[reserved]

The 2009 BVM final rule document is currently available at *http://www.regulations.gov/#!documentDetail;D=EERE-2006-STD-0125-0005.*

2. History of Standards Rulemaking for Beverage Vending Machines

EPCA directed the Secretary to issue, by rule, no later than August 8, 2009, energy conservation standards for beverage vending machines. (42 U.S.C. 6295(v)) On August 31, 2009, DOE issued a final rule establishing performance standards for beverage vending machines to complete the first required rulemaking cycle. 74 FR 44914.

DOE is conducting the current energy conservation standards rulemaking pursuant to 42 U.S.C. 6295(m), which requires that within 6 years of issuing any final rule establishing or amending a standard, DOE shall publish either a notice of determination that amended standards are not needed or a NOPR proposing amended standards.

In initiating this rulemaking, DOE prepared a framework document, "Energy Conservation Standards Rulemaking Framework Document for Refrigerated Beverage Vending Machines" (framework document), which describes the procedural and analytical approaches DOE anticipates using to evaluate energy conservation standards for beverage vending machines. DOE published a notice that announced both the availability of the framework document and a public meeting to discuss the proposed analytical framework for the rulemaking. That notice also invited written comments from the public. 78 FR 33262 (June 4, 2013). This document is available at *http://www.regulations.gov/#!docketDetail;D=EERE-2013-BT-STD-0022*

DOE held the framework public meeting on June 20, 2013, at which it (1) presented the contents of the framework document; (2) described the various analyses DOE planned to conduct during the rulemaking; (3) sought comments from interested parties on these subjects; and (4) in general, sought to inform interested parties about, and facilitate their involvement in, the rulemaking. Major issues discussed at the public meeting included: (1) Equipment classes; (2) analytical approaches and methods used in the rulemaking; (3) impact of standards and burden on manufacturers; (4) technology options; (5) distribution channels and shipments; (6) impacts of outside regulations; and (7) environmental issues. At the meeting and during the comment period on the framework document, DOE received many comments that helped it identify and resolve issues pertaining to beverage vending machines relevant to this rulemaking.

DOE then gathered additional information and performed preliminary analyses to help review standards for this equipment. This process culminated in DOE publishing a notice to announce the availability of the preliminary analysis TSD and a public meeting to discuss the preliminary analysis results. 79 FR 46379 (August 8, 2014). In the preliminary analysis, DOE discussed and requested comment on the tools and methods DOE used in performing its preliminary analysis, as well as analyses results. DOE also sought comments concerning other relevant issues that could affect potential amended standards for beverage vending machines. *Id.*

The preliminary analysis provided an overview of DOE's technical and economic analyses supporting new and amended standards for beverage vending machines, discussed the comments DOE received in response to the framework document, and addressed issues raised by those comments. The preliminary analysis TSD also described the analytical framework that DOE used (and continues to use) in considering new and amended standards for beverage vending machines, including a description of the methodology, the analytical tools, and the relationships between the various analyses that are part of this rulemaking. Additionally, the preliminary analysis TSD presented in detail each analysis that DOE had performed for this equipment up to that point, including descriptions of inputs, data sources, methodologies, and results. These analyses included: (1) The market and technology assessment; (2) the screening analysis; (3) the engineering analysis; (4) the energy use analysis; (5) the markups analysis; (6) the LCC analysis; (7) the PBP analysis; (8) the shipments analysis; (9) the national impact analysis (NIA); and (10) a preliminary manufacturer impact analysis (MIA).

The preliminary TSD that presents the methodology and results of each of these analyses is available at: *http://www.regulations.gov/#!docketDetail;D=EERE-2013-BT-STD-0022.* In this NOPR, DOE is presenting additional and revised analysis in all of these areas.

The public meeting to review the preliminary analysis took place on September 16, 2014 (preliminary analysis public meeting). At the preliminary analysis public meeting, DOE presented the methodologies and results of the analyses prescribed in the preliminary analysis TSD. Comments received in response to the preliminary analysis have helped DOE identify and resolve issues related to the preliminary analyses and have helped refine the analyses presented in this NOPR. DOE discusses and responds to the comments received in response to the preliminary analysis in section IV of this NOPR.

III. General Discussion

DOE is proposing amended standards for Class A and Class B beverage vending machines. DOE is also proposing to amend the definition for Class A equipment to more unambiguously differentiate Class A and Class B beverage vending machines. In addition, DOE is proposing to amend the definition of combination beverage machine, expand the combination vending machine equipment category into Combination A and Combination B beverage vending machine classes, and promulgate new standards for those classes. In the subsequent sections, DOE discusses the scope of coverage, test procedure, compliance dates, technical feasibility, energy savings, and economic justification of the proposed standards.

A. Equipment Classes and Scope of Coverage

EPCA defines a beverage vending machine as ''a commercial refrigerator [18] that cools bottled or canned beverages and dispenses the bottled or canned beverages on payment.'' (42 U.S.C. 6291(40))

When evaluating and establishing energy conservation standards, DOE divides covered equipment into equipment classes by the type of energy used or by capacity or other performance-related features that justifies a different standard. In making a determination whether a performance-related feature justify differing standards, DOE must consider such factors as the utility to the customer of the feature and other factors DOE determines are appropriate. (42 U.S.C. 6295(q))

In the 2009 BVM final rule, DOE determined that unique energy conservation standards were warranted for Class A and Class B beverage vending machines and added the following definitions to 10 CFR 431.292 to differentiate such equipment:

Class A means a beverage vending machine that is fully cooled, and is not a combination vending machine.

Class B means any beverage vending machine not considered to be Class A, and is not a combination vending machine.

74 FR 44914,44967 (August 31, 2009).

DOE differentiated Class A and Class B beverage vending machines based on whether the refrigerated volume (V) of equipment was fully cooled, as DOE determined that this was the most significant criteria affecting energy consumption. *Id.* at 44924.

The 2009 BVM final rule also established a definition for combination vending machine at 10 CFR 431.292.

Combination vending machine means a beverage vending machine that also has non-refrigerated volumes for the purpose of vending other, non-''sealed beverage'' merchandise.

74 FR 44914, 44967 (August 31, 2009).

DOE considered the definition of beverage vending machine broad enough to include any vending machine that cools at least one bottled or canned beverage and dispenses it upon payment. DOE elected to establish combination machines as a separate equipment class because such machines may be challenged by component availability and such machines have a distinct utility that limits their energy efficiency improvement potential compared to Class A and B beverage vending machines. However, DOE did not establish standards for combination machines in the 2009 BVM final rule. *Id.* at 44920.

While DOE's existing definitions of Class A and Class B equipment distinguish equipment based on whether or not the refrigerated volume is ''fully cooled,'' DOE regulations have never defined the term ''fully cooled.'' In the framework document, DOE suggested a definition for ''fully cooled'' and further refined that definition in the BVM test procedure NOPR DOE published on August 11, 2014 (2014 BVM test procedure NOPR). 79 FR 46908, 46934. In response to comments received on both the framework document and 2014 BVM test procedure NOPR, DOE is proposing in this NOPR, to modify the definition of Class A to more unambiguously differentiate Class A and Class B equipment. Specifically, DOE proposes to use the presence of a transparent front on Class A beverage vending machines as a key distinguishing characteristic between Class A and Class B equipment and proposes to adopt that distinction as part of the Class A equipment class definition.

In this NOPR, DOE is also proposing to amend the definition of combination vending machine to better align with industry definitions and provide more clarity regarding the physical characteristics of the ''refrigerated'' and ''non-refrigerated'' volumes, or compartments. In addition, DOE is proposing to expand the class of combination vending machines established in the 2009 BVM final rule to differentiate Combination A and Combination B beverage vending machines based on similar criteria used to distinguish Class A and Class B beverage vending machines (*i.e.,* the presence of a transparent front). See section IV.A.1 of this NOPR for more discussion on the equipment classes addressed in this NOPR.

[18] EPCA defines commercial refrigerator, freezer, and refrigerator-freezer at 42 U.S.C. 6311(9)(A).

B. Test Procedure

The estimates of energy use and energy saving potential considered in the NOPR analysis are based on the performance of beverage vending machines when tested in accordance with appendix B of the recently amended DOE BVM test procedure located at 10 CFR 431.294. (See sections IV.B, IV.C, and IV.E of this NOPR for more discussion.) On July 31, 2015, DOE published an amended test procedure for beverage vending machines, referred to as the 2015 BVM test procedure final rule in the **Federal Register**. 80 FR 45758 (July 31, 2015). In the 2015 BVM test procedure final rule, DOE adopted several minor amendments to clarify DOE's test procedure for beverage vending machines and also adopted several amendments related to the impact of low power modes on the measured daily energy consumption of BVM models. 80 FR 45758 (July 31, 2015). DOE also reorganized the DOE test procedure into two new appendices, appendix A and appendix B to subpart Q to part 431 of Title 10 of the *Code of Federal Regulations* and adopted a minor change to the certification and reporting requirements for beverage vending machines at 10 CFR 429.52(b)(2) and 10 CFR 431.296.

In general, the DOE BVM test procedure, as amended, incorporates by reference American National Standards Institute (ANSI)/American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 32.1–2010 to describe the measurement equipment, test conditions, and test protocol applicable to testing beverage vending machines. DOE's test procedure also specifies that the measurement of ''refrigerated volume'' of beverage vending machines must be in accordance with the methodology specified in Appendix C of ANSI/ASHRAE Standard 32.1–2010.

In the 2015 BVM test procedure final rule, DOE also adopted several new clarifying amendments including:

(1) Eliminating testing at the 90 °F ambient test condition;

(2) clarifying the test procedure for combination vending machines;

(3) clarifying the requirements for loading BVM models under the DOE test procedure;

(4) clarifying the specifications of the test package;

(5) clarifying the next-to-vend beverage temperature test condition;

(6) specifying placement of thermocouples during the DOE test procedure;

(7) establishing testing provisions at the lowest application product temperature;

(8) clarifying certification and reporting requirements; and

(9) clarifying the treatment of certain accessories when conducting the DOE test procedure.

These test procedure amendments are all reflected in DOE's new appendix A, which became effective August 31, 2015 and must be used by manufacturers for representations and to demonstrate compliance with the energy conservation standards beginning January 27, 2016. 80 FR 45758 (July 31, 2015).

In addition to the amendments proposed in appendix A, appendix B includes provisions for testing low power modes. The test procedure found in appendix B is to be used in conjunction with any amended standards established as a result of this rulemaking. As such, manufacturers are not required to use appendix B until the compliance date of any new or amended standards. *Id.*

C. Compliance Dates

The new and amended standards proposed in this NOPR, if adopted, would apply to equipment manufactured beginning on the date 3 years after the publication date of any final rule in the **Federal Register**. DOE anticipates that any final rule would be published in 2016, resulting in a compliance date in 2019. In its analysis, DOE used a 30-year analysis period of 2019–2048.

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. 10 CFR part 430, subpart C, appendix A, section 4(a)(4)(i)

After DOE 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; and (3) adverse impacts on health or safety. 10 CFR part 430, subpart C, appendix A, section 4(a)(4)(ii)–(iv) Section IV.B of this NOPR discusses the results of the screening analysis for beverage vending machines, particularly the designs DOE considered, those it screened out, and those that are the basis for the TSLs 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 beverage vending machines, using the design parameters for the most efficient equipment available on the market or in working prototypes. The max-tech levels that DOE determined for this rulemaking are described in section IV.C.3 of this NOPR and in chapter 5 of the NOPR TSD.

E. Energy Savings

1. Determination of Savings

For each trial standard level (TSL), DOE projected energy savings from application of the TSL to equipment purchased in the 30-year period that begins in the year of compliance with new and amended standards for beverage vending machines (2019–2048).[19] The savings are measured over the entire lifetime of equipment purchased in the 30-year analysis 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 new and

[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. DOE also conducted a sensitivity analysis that considers impacts for products shipped in a 9-year period.

amended mandatory energy conservation standards.

DOE used its NIA spreadsheet models to estimate energy savings from new and amended standards. The NIA spreadsheet model (described in section IV.G of this NOPR) calculates savings in site energy, which is the energy directly consumed by products at the locations where they are used. Based on the site energy, DOE calculates national energy savings (NES) in terms of primary energy savings at the site or at power plants, and also in terms of full-fuel-cycle (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.G.3.a of this notice.

2. Significance of Savings

To adopt 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)) Although the term ''significant'' is not defined in the Act, the U.S. Court of Appeals for the District of Columbia Circuit, in *Natural Resources Defense Council* v. *Herrington,* 768 F.2d 1355, 1373 (D.C. Cir. 1985), indicated that Congress intended ''significant'' energy savings in the context of EPCA to be savings that were not ''genuinely trivial.'' The energy savings for the proposed standards (presented in section V.C of this NOPR) are nontrivial; therefore, DOE considers them ''significant'' within the meaning of section 325 of EPCA.

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)) The following sections discuss how DOE addressed each of those seven factors in this rulemaking.

a. Economic Impact on Manufacturers and Customers

In determining the impacts of a potential amended standard on manufacturers, DOE conducts an MIA, as discussed in section IV.I.3 of this NOPR, DOE first uses an annual cash-flow approach to determine the quantitative impacts. This step incorporates 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, such as 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, as discussed in section IV.I of this NOPR. Finally, DOE takes into account cumulative impacts of various DOE regulations and other regulatory requirements on manufacturers.

For individual customers, 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 customers in the aggregate, DOE also calculates the national NPV of the economic impacts applicable to a particular rulemaking. DOE also evaluates the LCC impacts of potential standards on identifiable subgroups of customers that may be affected disproportionately by a national standard.

b. Savings in Operating Costs Compared To Increase in Price (Life-Cycle Costs)

EPCA requires DOE to consider the savings in operating costs throughout the estimated average life of the covered product compared to any increase in the price of the covered product that are likely to result from the imposition of a standard. (42 U.S.C. 6295(o)(2)(B)(i)(II)) DOE conducts this comparison in its LCC and PBP analysis.

The LCC is the sum of the purchase price of a piece of equipment (including its installation) and the operating expense (including energy, maintenance, and repair expenditures) discounted over the lifetime of the equipment. The LCC analysis requires a variety of inputs such as equipment prices, equipment energy consumption, energy prices, maintenance and repair costs, equipment lifetime, and customer discount rates. To account for uncertainty and variability in specific inputs, such as equipment lifetime and discount rate, DOE uses a distribution of values, with probabilities attached to each value. For its analysis, DOE assumes that customers will purchase the covered equipment in the first year of compliance with amended standards.

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.

The LCC savings and PBP analysis for the considered efficiency levels are calculated relative to the case that reflects projected market trends in the absence of amended standards. DOE identifies the percentage of customers estimated to receive LCC savings or experience an LCC increase, in addition to the average LCC savings associated with a particular standard level. DOE's LCC analysis is discussed in further detail in section IV.F of this NOPR.

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 more detail in section IV.G.3 of this NOPR, DOE uses spreadsheet models to project national energy savings.

d. Lessening of Utility or Performance of Equipment

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

[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).

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 of the United States (Attorney General) to determine the impact, if any, of any lessening of competition likely to result from a proposed standard and to transmit such determination to the Secretary within 60 days of the publication of a proposed rule, together with an analysis of the nature and extent of the impact. (42 U.S.C. 6295(o)(2) (B)(ii)) DOE will transmit a copy of this proposed rule to the Attorney General with a request that the Department of Justice (DOJ) provide its determination on this issue. DOE will publish and respond to the Attorney General's determination in the final rule.

DOE considers any lessening of competition that is likely to result from amended standards. The Attorney General determines the impact, if any, of any lessening of competition likely to result from a proposed standard, and transmits such determination to the Secretary, together with an analysis of the nature and extent of such impact.

To assist the Attorney General in making such determination, DOE will provide DOJ with copies of this NOPR and the TSD for review. DOE will consider DOJ's comments on the proposed rule in preparing the final rule, and DOE will publish and respond to DOJ's comments in that document. DOE invites comment from the public regarding the competitive impacts that are likely to result from this proposed rule. In addition, stakeholders may also provide comments separately to DOJ regarding these potential impacts. See **ADDRESSES** section for information to send comments to DOJ.

f. Need for National Energy Conservation

DOE also considers the need for national energy conservation in determining whether a new or amended standard is economically justified. (42 U.S.C. 6295(o)(2)(B)(i)(VI)) In evaluating the need for national energy conservation, DOE expects that the energy savings from the proposed new and amended standards are likely to provide improvements to the security and reliability of the nation's energy system. (42 U.S.C. 6295(o)(2)(B)(i)(VI)) 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.L of this NOPR.

The proposed new and amended standards are also likely to result in environmental benefits in the form of reduced emissions of air pollutants and greenhouse gases associated with energy production and use. DOE conducts an emissions analysis to estimate how standards may affect these emissions, as discussed in section IV.J of this NOPR. DOE reports the emissions impacts from each TSL it considered in section V.A of this NOPR. DOE also estimates the economic value of emissions reductions resulting from the considered TSLs, as discussed in section IV.K of this NOPR.

g. Other Factors

EPCA allows the Secretary of Energy, in determining whether a standard is economically justified, to consider any other factors that the Secretary deems to be relevant. (42 U.S.C. 6295(o)(2)(B)(i)(VII)) To the extent interested parties submit any relevant information regarding economic justification that does not fit into the other categories described above, DOE could consider such information under ''other factors.''

2. Rebuttable Presumption

EPCA sets forth 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. (42 U.S.C. 6295(o)(2)(B)(iii)) DOE's LCC and PBP analysis generate values used to calculate the effects that proposed energy conservation standards would have on the payback period for customers. These analyses include, but are not limited to, the 3-year payback period contemplated under the rebuttable-presumption test.

In addition, DOE routinely conducts an economic analysis that considers the full range of impacts to customers, manufacturers, the nation, and the environment. (42 U.S.C. 6295(o)(2)(B)(i)) The results of this analysis serve as the basis for DOE's evaluation of the economic justification for a potential standard level (thereby supporting or rebutting the results of any preliminary determination of economic justification). The rebuttable presumption payback calculation is discussed in section V.B.1.c of this NOPR.

IV. Methodology and Discussion of Related Comments

This section addresses the analyses DOE performed for this rulemaking. In the subsections, DOE discusses each component of the analysis and summarizes and responds to comments received in response to the preliminary analysis pertaining to each of the analyses DOE conducts.

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 considered, including the nature of the equipment, the industry structure, and market characteristics for the equipment. This activity consists of both quantitative and qualitative efforts based primarily on publicly available information.

DOE reviewed relevant literature and interviewed manufacturers to develop an overall picture of the BVM market in the United States. Industry publications, trade journals, government agencies, and trade organizations provided the bulk of the information, including (1) manufacturers and their market shares, (2) shipments by equipment type, (3) detailed equipment information, (4) industry trends, and (5) existing regulatory and non-regulatory equipment efficiency improvement initiatives. The analysis developed as part of the market and technology assessment is described in chapter 3 of the NOPR TSD.

1. Equipment Classes

In this NOPR, DOE is proposing to amend the energy conservation standards established by the 2009 BVM final rule for the Class A and Class B beverage vending machines. DOE believes that Class A and Class B equipment classes continue to provide different utility to customers and have different energy profiles and applicable design options, as described below. As such, DOE believes it is appropriate to separately analyze and regulate Class A and Class B equipment. In addition, as noted previously, DOE is proposing to amend the definition for Class A equipment to more clearly and unambiguously describe the equipment characteristics that make up that class and differentiate it from Class B equipment, as well as to amend the definition of combination vending machine to better align with industry definitions and provide more clarity regarding the physical characteristics of the ''refrigerated'' and ''non-refrigerated'' volumes, or compartments.[21]

DOE is also proposing to define two new equipment classes at 10 CFR 431.292, Combination A and Combination B, as well as establish new energy conservation standards for those equipment classes. In the 2009 BVM final rule, DOE also established a definition for combination vending machines but elected not to set standards for them at that time. 74 FR 44914, 44920 (August 31, 2009). In considering standards for combination vending machines as part of this rulemaking, similar to Class A and Class B, DOE determined that the method of cooling and presence of a transparent front are important differentiating features for combination equipment.

Table IV.1 summarizes the new and amended definitions for the four equipment classes analyzed in this NOPR. The definitions, as well as the general characteristics and differentiating features, of the four equipment classes proposed in this NOPR are described in the following subsections.

TABLE IV.1—EQUIPMENT CLASSES FOR BEVERAGE VENDING MACHINES

Class	Definition
A	A refrigerated bottled or canned beverage vending machine that is not a combination beverage vending machine and in which 25 percent or more of the surface area on the front side of the beverage vending machine is transparent
B	Any refrigerated bottled or canned beverage vending machine that is not considered to be Class A and is not a combination vending machine
Combination A.	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.	A combination vending machine that is not considered to be Combination A

[21] The definition of combination vending machine established by DOE in the 2009 BVM final rule referenced the presence of ''non-refrigerated volumes'' to differentiate combination vending machines from other styles of refrigerated bottled or canned beverage vending machines. In the amended definition for combination vending machine DOE is proposing in this NOPR, DOE is referring instead to ''compartments,'' which DOE believes captures the same intent as the term ''volumes'' in the previous definition, but better indicates that the ''volumes'' are to be physically separate.

a. Class A and Class B Beverage Vending Machines

Class A and Class B equipment are currently differentiated based on the cooling mechanism employed by the different equipment. The distinguishing criterion between these two equipment classes is whether the equipment is fully cooled. 10 CFR 431.292.

At the time the definitions of Class A and Class B were established, DOE did not define the term ''fully cooled.'' In the framework document, DOE suggested defining ''fully cooled'' to mean a beverage vending machine within which each item in the beverage vending machine is brought to and stored at temperatures that fall within ±2 °F of the average beverage temperature, which is the average of the temperatures of all the items in the next-to-vend position for each selection.

In response to the framework document, DOE received many comments from interested parties regarding the definition of ''fully cooled.'' DOE proposed an alternative definition of ''fully cooled'' in the BVM test procedure NOPR that described ''fully cooled'' as ''a condition in which the refrigeration system of a beverage vending machine cools product throughout the entire refrigerated volume of a machine instead of being directed at a fraction (or zone) of the refrigerated volume as measured by the average temperature of the standard test packages in the furthest from the next-to-vend positions being no more than 10 °F above the integrated average temperature of the standard test packages.'' 79 FR 46908, 46934 (August 11, 2014). To accompany DOE's proposed definition of ''fully cooled,'' the 2014 BVM test procedure NOPR also proposed to adopt an optional test method that could be used to quantitatively differentiate between Class A and Class B equipment. 79 FR at 46917.

In response to the definition of ''fully cooled'' proposed in the BVM test procedure NOPR, several interested parties recommended that DOE consider an alternative differentiation between equipment types to better capture differences in energy consumption. Interested parties also suggested that the presence of a transparent or opaque front and/or the arrangement of products within the machine could be potential differentiating criteria that are more appropriate and consistent with the differentiation between equipment configurations applied in industry. Specifically, the California investor-owned utilities (CA IOUs), including Pacific Gas & Electric, Southern California Gas Company, Southern California Edison, and San Diego Gas and Electric, recommended that DOE consider an alternate differentiation between equipment types to better capture differences in energy consumption, and they suggested the consideration of the presence of a glass or opaque front and the arrangement of products within the machine. (Docket No. EERE–2013–BT–TP–0045, CA IOUs, No. 0005 at p. 1) Similarly, Sanden Vendo America Inc. (SVA) recommended that the product configuration would be more appropriate and consistent with the differentiation between equipment configurations applied in industry. (Docket No. EERE–2013–BT–TP–0045, SVA, Public Meeting Transcript, No. 0004 at p. 52).

Many interested parties also commented on the difficulty of establishing a quantitative temperature threshold to differentiate fully cooled equipment from non-fully cooled equipment that would be applicable across all BVM models. Specifically, Automated Merchandising Systems, Inc. (AMS) commented that a 10 °F temperature differential lacks empirical data. (Docket No. EERE–2013–BT–TP–0045, AMS, Public Meeting Transcript, No. 0004 at p. 54) The Coca-Cola Company (Coca-Cola) stated that they believe an 8 °F temperature threshold was acceptable to differentiate Class A, and they added that Class B machines sometimes vary by as much as 18 °F, depending on products vended and the dimensions of the machine. (Docket No. EERE–2013–BT–TP–0045, Coca-Cola, No. 0010 at p. 4) Coca-Cola also stated that the DOE expectation for all product temperatures to be maintained within a 2 °F window for fully-cooled beverage vending machine was unrealistic. (Docket No. EERE–2013–BT–TP–0045, Coca-Cola, No. 0010 at p. 4) SVA commented that 10 °F may be acceptable but stated that using physical differentiating characteristics, such as ''shelf'' versus ''stack'' style machines, may be more straightforward. (Docket No. EERE–2013–BT–TP–0045, SVA, No. 0008 at p. 2) The Northwest Energy Efficiency Alliance (NEEA) stated that many Class B vending machines typically had a temperature difference of much less than 10 °F, and urged DOE to conduct further investigation. (Docket No. EERE–2013–BT–TP–0045, NEEA, No. 0009 at p. 1)

Regarding the additional fully cooled verification test procedure, SVA stated that additional testing to confirm a model was fully cooled created additional burden. (Docket No. EERE–2013–BT–TP–0045, SVA, No. 0008 at p.

2) SVA and Coca-Cola also both noted that the introduction of additional thermocouples and the need to run additional thermocouple wire may introduce additional points of air leakage, interfere with proper airflow, and thereby affect the results of the test. (Docket No. EERE–2013–BT–TP–0045, SVA, No. 0008 at p. 2; Docket No. EERE–2013–BT–TP–0045, Coca-Cola, No. 0010 at p. 4)

In light of the extent and scope of the comments received in response to the amendments proposed in the 2014 BVM test procedure NOPR regarding the proposed definition of fully cooled, alternative criteria for differentiating Class A and Class B equipment, and the optional fully cooled verification test protocol, DOE wished to further consider potential classification options and criteria suggested by interested parties, as well as provide interested parties an additional opportunity to provide feedback on any proposals to amend the equipment class definitions. As such, DOE is responding to the comments presented by interested parties in response to the 2014 BVM test procedure NOPR and proposing an alternative approach to differentiate Class A and Class B equipment in this BVM energy conservation standard NOPR.

In considering the definition of ''fully cooled'' and the best way to clarify the differentiation of Class A and Class B equipment, DOE considered all the comments submitted by interested parties, as well as the manner in which equipment is currently categorized by DOE and industry. In general, DOE agrees with the comments from interested parties in that, in practice, the cooling method is often correlated with the product configuration and presence of a transparent front. Specifically, beverage vending machines with horizontal product rows are typically fully cooled and have a transparent front, while beverage vending machines with vertical product stacks are typically zone cooled and are fully opaque. This correlation occurs due to the inherent utility of a fully cooled beverage vending machine, which was acknowledged in DOE's proposed definition of ''fully cooled'' (79 FR 46915–46917 (August 11, 2014)) and in the 2009 BVM final rule (74 FR 44914, 44924 (August 31, 2009)). Moreover, DOE is not aware of any instances of BVM models that are not fully cooled but which have a transparent front and/or horizontal product configuration or BVM models that are fully cooled but which have and opaque front and/or vertical stacks. Thus DOE believes that, based on current equipment designs, using criteria of: (a) Whether the equipment is fully cooled, (b) whether the equipment has a transparent front; or (c) whether the vertical or horizontal product arrangement is horizontal or vertical, would result in virtually identical equipment categorization.

DOE also notes that, since DOE's engineering analysis represents typical, representative equipment designs for each equipment class (see section IV.C), the cooling method, the presence of a transparent or opaque front, and product arrangement are correlated in DOE's engineering analysis, as shown in Table IV.2.

TABLE IV.2—EQUIPMENT CLASSES DESIGN PARAMETERS FOR BEVERAGE VENDING MACHINES MODELED IN THE ENGINEERING ANALYSIS

Class	Cooling method	Transparent or opaque front	Vendible product orientation
A	Fully cooled	Transparent front	Horizontal product rows.
B	Zone cooled	Opaque front	Vertical product stacks.
Combination A	Fully cooled	Transparent front	Horizontal product rows.
Combination B	Zone cooled	Opaque front	Vertical product stacks.

DOE agrees with CA IOU and SVA's comments that alternative criteria, such as the presence of glass or the product configuration, may offer a more clear and unambiguous approach to differentiate Class A and Class B equipment than the cooling method, while continuing to preserve the same utility in each class of equipment. Specifically, DOE believes that the presence of a transparent front that allows a customer to view and select from all of the various next-to-vend product selections, which are all maintained at the appropriate vending temperature, is inherently related to the functionality of a beverage vending machine being ''fully cooled.'' DOE also notes that, theoretically, the presence of glass has a larger impact on the energy consumption of a given beverage vending machine than whether the equipment is fully cooled or whether the equipment has vertical or horizontal product arrangement. DOE believes that defining equipment classes based on a feature that is related to the unique utility and which has the largest impact on the energy use of the equipment is the most appropriate criterion to use to ensure that the utility provided by Class A equipment is maintained in the marketplace. In addition, since DOE believes that the cooling method and the presence of a glass or solid front is correlated in practice. As such, DOE believes that clarifying DOE's equipment class definitions using such an unambiguous product characteristic would not result in any changes to the classification of BVM models that are currently available on the market. 74 FR 44914, 44924 (August 31, 2009).

In light of this, DOE is proposing to amend the definition of Class A beverage vending machines to read as follows:

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

In this BVM energy conservation standard NOPR, DOE is not proposing to substantively modify the definition of Class B, since Class B is defined as the mutually exclusive converse of Class A. However, DOE is proposing to make a minor editorial change to include the term ''that'' to improve readability of the definition. That is, a Class B beverage vending machine would be defined as a refrigerated bottled or canned beverage vending machine that: (1) Is not considered to be Class A; and (2) is not a combination vending machine.

DOE notes that the proposed definition of Class A is similar to and consistent with DOE's classification and definition of ''closed transparent'' and ''closed solid'' commercial refrigeration equipment. 10 CFR 431.62.

In addition to the amended definition for Class A beverage vending machines, which DOE is proposing based on comments from interested parties, DOE notes that a quantitative criteria is necessary to clearly determine whether a given BVM model ''has a transparent front.'' As such, DOE is also proposing to specify the procedures DOE will use in enforcement testing to clearly and unambiguously classify Class A and Class B beverage vending machines based on percentage of transparent surface area on the front side of the beverage vending machine. Specifically, DOE is proposing language to clarify the procedure by which DOE will: (1) Determine the surface area of beverage vending machines; and (2) determine whether such surface area is transparent. However, similar to DOE's proposal for a fully cooled verification test in the 2014 BVM test procedure NOPR, these procedures would not be required for rating and certification of specific BVM models. 79 FR 46908, 46917 (August 11, 2014). Under the proposal, manufacturers would continue to be able to certify equipment as Class A or Class B based knowledge of the specific equipment dimensions and characteristics. However, DOE will use these procedures in enforcement testing to verify the appropriate equipment classification for all cases. As such, where the appropriate equipment classification is not abundantly clear, manufacturers may elect to perform the test to ensure they are categorizing their equipment properly; however, DOE reiterates that such testing is not required. To clarify that such procedures are only optional for manufacturers, DOE is proposing to add such procedures to the product-specific enforcement provisions at 10 CFR 429.134.

To determine the surface area, DOE is proposing that the total surface area of the front side of the beverage vending machine, from edge to edge, be determined as the total length multiplied by the total height of a beverage vending machine. DOE is also proposing to specify that the transparent surface area consists of all areas composed of transparent material on the front side of a beverage vending machine, and that the non-transparent surface area consists of all areas composed of material that is not transparent on the front side of a beverage vending machine. The sum of the transparent and non-transparent surface areas should equal the total surface area of the front side of a beverage vending machine, as shown in Figure IV.1.

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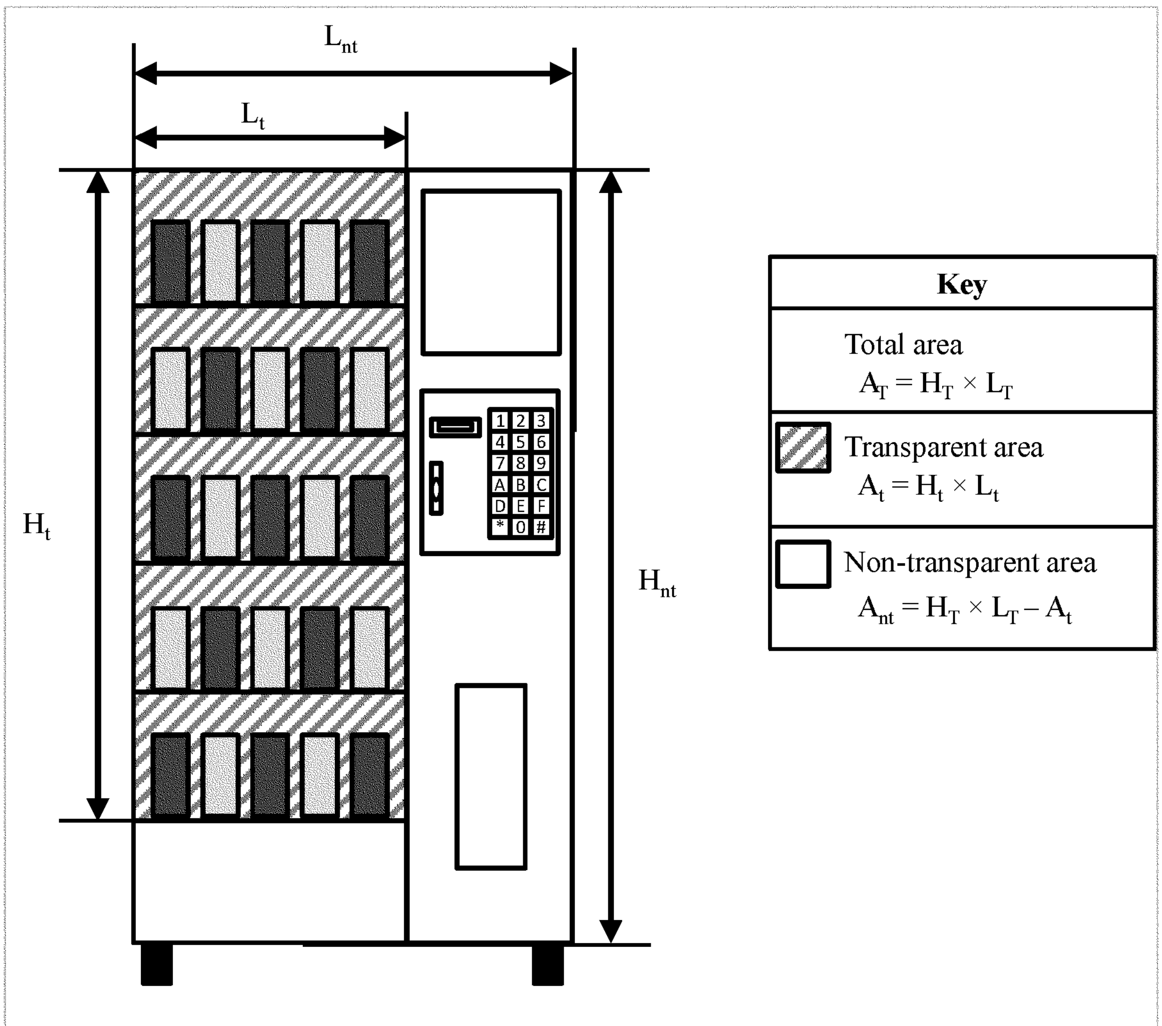

Figure IV.1 Determination of Transparent and Non-Transparent Area for Beverage Vending Machines

To determine whether a material is transparent, DOE is proposing to adopt the definition of transparent that is applicable to commercial refrigeration equipment, as adopted in the 2014 commercial refrigeration equipment test procedure final rule. 10 CFR 431.62; 79 FR 22277, 22286–87, and 22308 (April 21, 2014). Under this definition, the term ''transparent'' applies to any material with greater than or equal to 45 percent light transmittance, as determined in accordance with the ASTM Standard E 1084–86 (Reapproved 2009), ''Standard Test Method for Solar Transmittance (Terrestrial) of Sheet Materials Using Sunlight,'' at normal incidence and in the intended direction of viewing. In the commercial refrigeration equipment test procedure NOPR, DOE had originally proposed that a transparent material was any material with greater than or equal to 65 percent light transmittance, consistent with the definition of total display area in the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Standard 1200 (I–P)-2010 (AHRI 1200–2010), ''Performance Rating of Commercial Refrigerated Display Merchandisers and Storage Cabinets.'' 78 FR 64295, 64301–02 (October 28, 2013). However, DOE adopted a threshold of 45 percent in the final rule based on comments from interested parties regarding the characteristics of low-emissivity and high performance glass. 79 FR 22277, 22287 (April 21, 2014). DOE believes that the threshold of 45 percent light transmittance to determine transparency is equally applicable to materials that are typically used to manufacture both commercial refrigeration equipment and beverage vending machines.

Therefore, to determine whether a given material is transparent or not, DOE proposes that such material be tested in accordance with ASTM Standard E 1084–86 (Reapproved 2009) and, if the visible transmittance is greater than or equal to 45 percent, that material would be deemed to be transparent and considered in the transparent area of the beverage vending machine. When determining material properties, DOE notes that the utility of the transparent material is only applicable if the viewer can clearly see the refrigerated products contained within the refrigerated volume of the beverage vending machine. As such, DOE believes that the transparency of the beverage vending machine cabinet materials should be determined with consideration of all the materials used to construct the wall segment(s). That is, transparency should be determined for all the materials between the refrigerated volume and the ambient environment; only if the aggregate performance of all those materials yields a light transmittance of greater than or equal to 45 percent would that area be treated as transparent. For example, if a beverage vending machine wall segment was composed of sheet metal, insulation, and an opaque plastic covering, with light transmittance of 0, 0, and 0.5, respectively, the aggregate light transmittance of the side wall would be 0 and the area of that side wall would not be treated as transparent.

In accordance with the proposed, amended definition for Class A, any given BVM model would be classified as Class A or Class B based on the relative transparent and non-transparent areas on the front side of the beverage vending machine. If at least 25 percent of the surface area on the front side of the beverage vending machine is transparent, and the beverage vending machine is not a combination vending machine, then the beverage vending machine would be considered to be Class A. Conversely, if greater than 75 percent of the surface area on the front side of the beverage vending machine is not transparent, and the beverage vending machine is not a combination vending machine, than the beverage vending machine would be considered to be Class B. DOE's proposed Class A definition only considers transparent area on the front side of beverage vending machine when determining the appropriate equipment class for beverage vending machines.

DOE reiterates that this test method would be optional and would not be required for equipment certification or testing by manufacturers. Specifically, the determination of the light transmittance of a transparent material based on testing in accordance with ASTM Standard E 1084–86 (Reapproved 2009) would not be required in all cases to classify a BVM basic model as Class A or Class B, and manufacturers would continue to be able to specify the appropriate equipment class without utilizing this test method. However, the determination of the light transmittance of a transparent material would still be determined in accordance with ASTM Standard E 1084–86 (Reapproved 2009) and DOE proposes to use this test method to determine equipment classification in enforcement testing. Thus, incorporation of a quantitative test procedure is not anticipated to add to the complexity or burden of conducting the DOE test procedure for most models of beverage vending machines.

Regarding the proposed definition of ''fully cooled,'' DOE notes that many interested parties expressed concern about DOE's temperature differential of 10 °F between the average next-to-vend temperature and the average temperature of standard test packages placed in the furthest from next-to-vend position during the test period. Many interested parties questioned the supporting data underlying DOE's proposed temperature threshold and encouraged DOE to collect additional data. In response to these comments, DOE notes that the originally proposed 10 °F temperature differential was proposed based on the best information available to DOE. Specifically, DOE based the proposed temperature threshold on input from manufacturers provided in response to the framework document. (AMS, No. 0017 at p. 6)[22] However, DOE acknowledges that AMS also noted that the number they suggested at the framework document public meeting was not based on empirical data. (Docket No. EERE–2013–BT–TP–0045, AMS, Public Meeting Transcript, No. 0004 at p. 54)

To better inform the appropriate temperature threshold for classification of Class A and Class B beverage vending machines, and in response to comments received on the 2014 BVM test procedure NOPR, DOE analyzed additional data from 28 BVM units (11 Class A and 17 Class B). For these 28 units, DOE included standard test packages in the next-to-vend and furthest from next-to-vend beverage locations, as proposed in the 2014 BVM test procedure NOPR. 79 FR 46908, 46917 (August 11, 2014). DOE compared the integrated average temperature of the next-to-vend standard test packages to the average of all the furthest from next-to-vend standard test package measurements collected throughout the test (*i.e.,* a spatial and temporal average over the entire test period). Based on the collected data, DOE determined that, consistent with comments from interested parties, the proposed 10 °F temperature differential may be too stringent a criterion and may inadvertently classify some BVM models that have opaque fronts and products oriented in vertical stacks as ''fully cooled'' equipment, even though

[22] A notation in this form provides a reference for information that is in the docket of DOE's rulemaking to develop energy conservation standards for beverage vending machines (Docket No. EERE–2011–BT–STD–0022, which is maintained at *www.regulations.gov*). This particular notation refers to a comment: submitted by Automated Merchandising Systems, Inc. (AMS); appearing in document number 0017 of the docket; and appearing on page 6 of that document. Comments submitted on other dockets will use a similar format but will include the docket number at the beginning of the citation.

the refrigerated volume is not designed or intended to be fully cooled. For example, for equipment with a small or very well insulated refrigerated volume, passive convention will act to cool more of the refrigerated volume than just the ''intentionally refrigerated'' next-to-vend beverage selections.

In light of this additional analysis, DOE agrees with the comments of interested parties stating that it is difficult to establish a strict range that will be universally applicable to all types of Class A and Class B beverage vending machines. Specifically, DOE's data suggests that Class B equipment may have temperature differences of less than 2 °F between the next-to-vend and furthest from next-to-vend beverage locations. Conversely, as Coca-Cola points out, Class A machines can also have temperature differentials of up to 7 °F. (Docket No. EERE–2013–BT–TP–0045, Coca-Cola, No. 0010 at p. 4)

DOE believes that modifying the definitions of Class A and Class B to rely on the presence of a transparent front allows for clear and unambiguous differentiation of equipment classes, while continuing to reflect the intent and utility of fully cooled versus non-fully cooled equipment. Further, DOE believes referencing the presence of a transparent front to identify Class A equipment aligns with DOE's and industry's interpretation of fully cooled, Class A machines to date. Therefore, DOE does not believe the proposed amendment of the Class A definition and associated optional test protocols would change the equipment class or energy conservation standard level for any equipment that is currently covered under existing standards. As such, DOE is proposing that the amended Class A and Class B definitions be effective 30 days after the publication in the **Federal Register** of any final rule establishing such a definition.

Regarding Coca-Cola's comment that 2 °F is too stringent a tolerance for all the standard test packages in the machine, DOE notes that DOE did not propose such a requirement and agrees with Coca-Cola that maintaining all the standard test packages in the next-to-vend positions within 2 °F of the specified average beverage temperature may not be feasible for all fully cooled equipment designs.

In response to SVA and Coca-Cola's concerns regarding testing burden of the proposed fully cooled verification test procedure and the potential for increased air infiltration, DOE notes that, based on the amendments being proposed in this NOPR, the fully cooled verification test procedure would not be required. However, DOE is proposing to adopt optional specifications and criteria to determine surface area and transparency to allow for clear and unambiguous verification of the appropriate equipment class for any covered BVM models where the appropriate equipment class is not clear based on the physical equipment characteristics. Because the test methods to determine surface area and transparency would not be required for certification testing and is not proposed to be part of the BVM test procedure at 10 CFR 431.296, manufacturers would not be required to take any additional temperature measurements beyond what is currently specified in ANSI/ASHRAE Standard 32.1–2010, DOE believes that the proposed optional test method would not increase the burden associated with conducting the DOE BVM test procedure.

DOE requests comment on the proposed amendment to the Class A equipment class definition. Specifically, DOE requests comment on whether the presence of a transparent front is always correlated with fully cooled equipment (section VII.E of this NOPR).

DOE requests comment on the proposed optional test protocol to determine transparent and non-transparent surface areas and whether Class A equipment typically has at least 25 percent of the surface area on the front side of the unit that is transparent or if another quantitative threshold would be more appropriate (section VII.E of this NOPR).

DOE requests comment on the proposed definition of transparent. Specifically, whether 45 percent light transmittance is an acceptable value for the glass or other transparent materials that are typically used to construct the front panel on Class A equipment (section VII.E of this NOPR).

b. Combination Vending Machines

In the 2009 BVM final rule, DOE established a definition for combination vending machines (74 FR 44914, 44920; August 31, 2009). That definition describes a combination beverage vending machine as a refrigerated bottled or canned beverage machine that also has non-refrigerated volumes for the purpose of vending other, non-''sealed beverage'' merchandise. 10 CFR 431.292. However, the 2009 BVM final rule did not consider or differentiate equipment within the combination vending machine equipment category or address any specific criteria that could be used to differentiate ''refrigerated'' and ''non-refrigerated.''

In its recent test procedure rulemaking, culminating in the 2015 BVM test procedure final rule, DOE considered the applicability of the combination vending machine definition to equipment designs it has encountered on the market, and considered stakeholder comments on the definition of ''combination vending machine.'' 80 FR 45758 (July 31, 2015). In the 2015 BVM test procedure final rule, DOE clarified the test procedure for combination vending machines and noted that such equipment must include compartments that are physically separated, while acknowledging that some combination equipment designs may employ a common product delivery chute between the refrigerated and non-refrigerated compartments for the purposes of delivering vendible merchandise to the customer. DOE also gave notice that it would seek to further clarify the definition of ''combination vending machine'' in this BVM energy conservation standard NOPR. *Id* at 45765–67.

As such, in consideration of the input of various interested parties throughout both the test procedure and energy conservation standards rulemaking processes, as well as of the range of equipment designs that DOE has observed for sale on the market, DOE is proposing, in this NOPR, an amended definition of ''combination vending machine.'' Specifically, DOE proposes to amend the definition of ''combination vending machine'' to more clearly and unambiguously establish the distinction between ''refrigerated'' and ''non-refrigerated'' compartments contained in a combination beverage vending machine. Specifically, DOE proposes that the determination of whether a compartment is refrigerated or non-refrigerated is based on whether a compartment is designed to be refrigerated, as demonstrated by the presence of temperature controls. The proposed definition is as follows:

Combination vending machine means a bottled or canned beverage vending machine containing two or more compartments 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.

DOE requests comment on the proposed amendment to the definition of ''combination vending machine'' (section VII.E of this NOPR).

DOE also believes that, similar to Class A and Class B equipment classes, the transparency of the front side of the vending machine can differentiate certain styles of combination vending machines that provide a unique utility in the marketplace because their specific design attributes allow the equipment to be stocked with a wider variety of product selections that can be viewed directly through the equipment's transparent front. As such, in this NOPR, DOE is also proposing to define two new equipment classes at 10 CFR 431.292, Combination A and Combination B, and proposes to define those equipment classes as follows:

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 proposes that the same definition of transparent and same 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. 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) should be considered in the calculation of transparent and non-transparent surface area for a beverage vending machine, as shown in Figure IV.2. Therefore, the transparent area would be determined as a sum of the transparent areas on the front side of a combination vending machine that are not surrounding compartments not designed to be refrigerated (*i.e.,* transparent areas surrounding compartments designed to be refrigerated and associated areas for product selection and delivery). The total area for a combination beverage vending machine would also be determined disregarding the surface area surrounding the compartment(s) not designed to be refrigerated. That is, the total area of the front side of the combination vending machine would be calculated as the total height multiplied by the total width from edge to edge minus the surface area surrounding any compartment(s) not designed to be refrigerated. This ''total area'' also represents a summation of the transparent and non-transparent areas not surrounding compartments not designed to be refrigerated, as shown in Figure IV.2. The relative transparent area on the front side of combination vending machines would be determined as the transparent area over the total area, similar to the calculation for Class A and B beverage vending machines, as discussed in section IV.A.1.a.

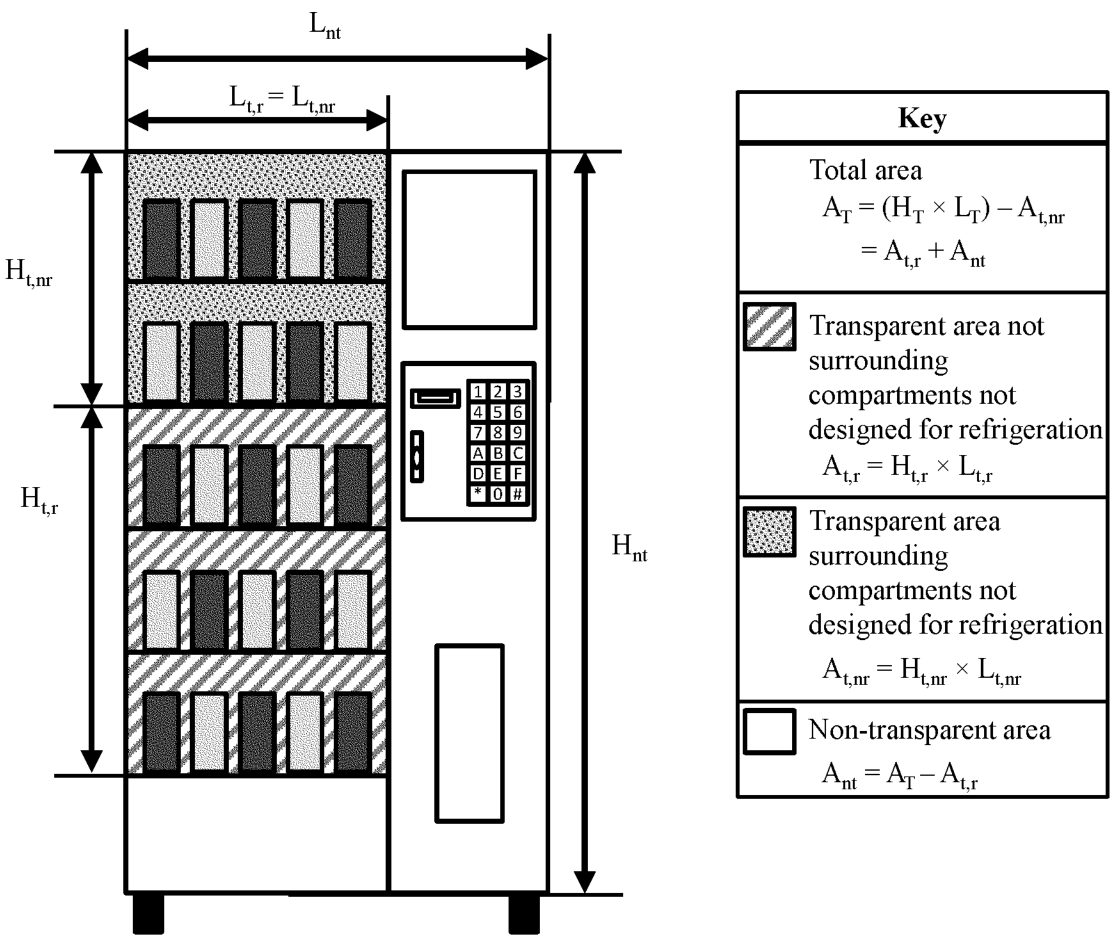

Figure IV.2 Determination of Transparent and Non-Transparent Area for a Combination Vending Machine with Products Arranged Horizontally

DOE requests comment on the proposed definition for Combination A and Combination B (section VII.E of this NOPR).

DOE also requests comment on DOE's proposal to apply the optional test protocol for determining the surface area and transparency of materials to combination vending machines, except that the surface areas surrounding the refrigerated compartments that are not designed to be refrigerated would be excluded (section VII.E of this NOPR).

In response to the framework document and preliminary analysis, DOE received input from interested parties regarding the design, construction, and sales volume of combination machines. In preparing the analyses presented in this NOPR, DOE used additional data from publicly available literature, as well as interviews with manufacturers, as the basis for its analysis of combination vending machine equipment classes. In considering setting standards for Combination A and Combination B beverage vending machines, as proposed, DOE is also interested in information regarding the design, market prevalence, and energy performance of such combination vending machines.

AMS commented that DOE and manufacturers have expended and will continue to expend large amounts of effort and expense to improve combination machines even though they compose a small amount of the market. (AMS, No. 29 at p. 6)

In response to AMS's comment regarding the small market share of combination vending machines, DOE notes that it revised the market share of combination vending machines based on input received during the manufacturer interview process (see section IV.I.3 of this NOPR). In the analysis for this NOPR, DOE found that combination vending machines represent 18 percent of the market, as opposed to 1 percent that was found in the preliminary analysis. Thus, DOE believes new energy conservation standards for combination machines represent a potential for national energy savings. In addition, since DOE is proposing standards for combination vending machines for the first time, the baseline efficiency for such equipment is much lower than for similar Class A or Class B equipment. Therefore, larger potential savings are available for combination vending machines than for Class A and Class B equipment on a per model basis. As such, DOE continues to analyze and propose standards for this equipment in this NOPR.

DOE requests comment on its updated estimate of market share for combination vending machines (section VII.E of this NOPR).

As noted in the 2015 BVM test procedure final rule, DOE believes that both appendix A and appendix B of the amended BVM test procedure are applicable to combination vending machines. 80 FR 45758 (July 31, 2015). To clarify the applicability of certain test procedure provisions and requirements to combination vending machines, DOE adopted several clarifications to the 2015 BVM test procedure to make the treatment of combination vending machines more specific and precise. These clarifications include explicitly stating the applicability of the BVM test procedure to combination vending machines and clarifying that only the refrigerated compartment of a combination vending machine is to be evaluated in the refrigerated volume calculation and loaded with standard test packages and standard product. *Id.* at 45765–67. However, any lighting or other energy-consuming features in the non-refrigerated compartment would be fully energized during the test procedure and operated in the same manner as any lighting or features in the refrigerated compartment.

Appendix A of the BVM test procedure is applicable to combination vending machines for the purposes of making any representations regarding the energy consumption of such equipment beginning January 27, 2016. 80 FR 45758 (July 31, 2015). Beginning on the compliance date of any energy conservation standards established for combination vending machines as a result of this rulemaking, manufacturers would be required to use appendix B of the BVM test procedure for the purposes of demonstrating compliance with any such energy conservation standards and when making representations regarding the energy consumption of covered equipment.

2. Machines Vending Perishable Goods

DOE notes that there are beverage vending machines that are capable of vending certain perishable products and, as such, may require more strict temperature control than beverage vending machines that only vend non-perishable products, such as bottled or canned soda, juice, or water. DOE notes such perishable products may or may not be sealed beverages but that, if a vending machine is refrigerated and is capable of or can be configured to vend sealed beverages for at least one of the product selections, then the vending machine meets DOE's definition of beverage vending machine and must comply with DOE's regulations for this equipment.

Based on input from interested parties provided in response to the framework document and as stated in chapter 2 of the preliminary analysis TSD, DOE believes that machines capable of vending perishable goods are generally not materially different from other beverage vending machines, and that the necessary levels of temperature maintenance needed to preserve perishables are achieved through the application of control settings rather than through design changes. In addition, such equipment can be tested using DOE's existing method of testing and does not have significantly different energy consumption profiles from other beverage vending machines when tested using DOE's methodology. Therefore, DOE does not believe separate equipment classes and standard levels are warranted for beverage vending machines that are capable of vending perishable goods, and DOE is not proposing a separate class for such equipment in this NOPR. As such, equipment that vends perishable products along with at least one sealed beverage must be tested in accordance with the DOE test procedure and must meet applicable energy conservation standards. Vending machines that are not capable of vending sealed beverages or are not refrigerated do not meet DOE's definition of beverage vending machine and, as such, are not subject to standards, test procedures, and certification and reporting requirements for beverage vending machines.

DOE requests comment on its position that machines capable of vending perishable goods do not warrant separate classes due to their physical similarity to refrigerated beverage vending machines used to vend non-perishable products (section VII.E of this NOPR).

3. Technology Assessment

As part of the technology assessment, DOE developed a list of technologies to consider for improving the efficiency of beverage vending machines. DOE considers as design options all technologies that meet the screening criteria and that produce quantifiable results under the DOE test procedure.

DOE typically uses information about existing and past technology options and prototype designs to help determine which technologies manufacturers use to attain higher energy performance levels. In consultation with interested parties, DOE develops a list of technologies for consideration in its screening and engineering analyses.

Initially, these technologies encompass all those that DOE believes are technologically feasible. Since many options for improving equipment efficiency are available in existing equipment, equipment literature and direct examination of BVM units currently on the market provided much of the information underlying this analysis. While DOE notes that the majority of equipment use R–134a as a refrigerant, which will no longer be available for BVM applications at the time compliance would be required with any amended standards established as part of this final rule (80 FR 42870, 42917–42920; July 20, 2015), DOE believes that the majority of technology options considered in DOE's analysis and presented in the following list are applicable to all beverage vending machines, regardless of the refrigerant utilized. Specifically, DOE considered the following technologies in this NOPR analyses:

- higher-efficiency lighting
- higher-efficiency evaporator fan motors
- higher-efficiency evaporator fan blades
- improved evaporator design
- evaporator fan motor controllers
- low-pressure-differential evaporators
- insulation improvements (including foam insulation thickness increase and use of improved materials such as vacuum insulated panels)
- improved Glass Pack (for Class A and Combination A equipment)
- higher-efficiency compressors
- variable speed compressors
- increased condenser performance
- higher-efficiency condenser fan motors
- higher-efficiency condenser fan blades
- microchannel heat exchangers
- higher efficiency expansion valves
- improved anti-sweat heaters
- lighting controls (including timers and/or sensors)
- refrigeration low-power modes

Chapter 3 of the TSD includes the detailed description of all technology options DOE identified for consideration in this rulemaking.

B. Screening Analysis

The purpose of the screening analysis is to evaluate the technologies identified in the technology assessment to determine which technologies to consider further and which technologies to screen out. DOE consulted with industry, technical experts, and other interested parties in developing a list of energy-saving technologies for the technology assessment. DOE then applied the screening criteria to determine which technologies were unsuitable for further consideration in this rulemaking. Chapter 4 of the NOPR TSD contains details about DOE's screening criteria.

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

1. *Technological feasibility.* DOE will consider technologies incorporated in commercial products or in working prototypes to be technologically feasible.

2. *Practicability to manufacture, install, and service.* If mass production and reliable installation and servicing of a technology in commercial equipment could be achieved on the scale necessary to serve the relevant market at the time the standard comes into effect, then DOE will consider that technology practicable to manufacture, install, and service.

3. *Adverse impacts on product utility or product availability.* If DOE determines that a technology would have a significant adverse impact on the utility of the product to significant subgroups of customers, or would result in the unavailability of any covered product type with performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially the same as products generally available in the United States at the time, it will not consider this technology further.

4. *Adverse impacts on health or safety.* If DOE determines that a technology will have significant adverse impacts on health or safety, it will not consider this technology further.

10 CFR Part 430, Subpart C, Appendix A, 4(a)(4) and 5(b)

These four screening criteria do not include the propriety status of design options. As noted previously, DOE will only consider efficiency levels achieved through the use of proprietary designs in the engineering analysis if they are not part of a unique path to achieve that efficiency level. DOE does not believe that any of the technologies identified in the technology assessment are proprietary, and thus, did not eliminate any technologies for that reason. Through a review of each technology, DOE found that the following technologies identified met all four screening criteria to be examined further in the analysis and decrease daily energy consumption (DEC) as measured by the BVM test procedure:

- Higher efficiency lighting
- higher efficiency evaporator fan motors
- higher efficiency evaporator fan blades
- evaporator fan motor controllers
- improved evaporator design
- low-pressure differential evaporators
- improvements to anti-sweat heaters
- improved or thicker insulation
- defrost mechanism
- higher efficiency compressors
- variable speed compressors
- microchannel heat exchangers
- improved condenser design
- higher efficiency condenser fan motors
- higher efficiency condenser fan blades
- improved glass pack design (for Class A and Combination A machines)
- lighting controls
- refrigeration low-power modes

C. Engineering Analysis

The engineering analysis establishes the relationship between an increase in energy efficiency of the equipment and the corresponding increase in manufacturer selling price (MSP) associated with that efficiency level. This relationship serves as the basis for cost-benefit calculations for individual customers, manufacturers, and the nation. DOE typically structures its engineering analysis using one of three approaches: (1) the design-option approach, (2) the efficiency-level approach, or (3) the cost-assessment (reverse engineering) approach. The next paragraphs provide overviews of these three approaches.

A design-option approach identifies individual technology options (from the market and technology assessment) that can be used alone or in combination with other technology options to increase the energy efficiency of a given BVM unit. Under this approach, cost estimates of the baseline equipment and more-efficient equipment that incorporates design options are based on manufacturer or component supplier data or engineering computer simulation models. Individual design options, or combinations of design options, are added to the baseline model in descending order of cost-effectiveness.

An efficiency-level approach establishes the relationship between manufacturer cost and increased efficiency at predetermined efficiency levels above the baseline. Under this approach, DOE typically assesses increases in manufacturer cost for incremental increases in efficiency, without identifying the technology or design options that would be used to achieve such increases.

A reverse-engineering, or cost-assessment, approach involves disassembling representative units of beverage vending machines, and estimating the manufacturing costs based on a ''bottom-up'' manufacturing cost assessment; such assessments use detailed data to estimate the costs for parts and materials, labor, shipping/packaging, and investment for models that operate at particular efficiency levels.

As discussed in the framework document and preliminary analysis, DOE employed the design-option approach to develop the relationship between energy use of a beverage vending machine and MSP. The decision to use this approach was made due to several factors, including the lack of numerous discrete levels of equipment efficiency currently available on the market and the prevalence of relatively easily implementable energy-saving technologies applicable to this equipment. More specifically, DOE identified design options for analysis and used a combination of industry research and teardown-based cost modeling to determine manufacturing costs, then employed numerical modeling to determine the energy consumption of each combination of design options employed in increasing equipment efficiency. The resulting range of equipment efficiency levels and associated manufacturer production costs (MPCs) were converted to MSPs using information regarding typical manufacturer markups. Typical manufacturer markups are presented in chapter 5 of the NOPR TSD.

DOE requests feedback on the manufacturer markup values used to convert MPC to MSP (section VII.E of this NOPR).

DOE revised the engineering analysis presented in the preliminary analysis based on the feedback of stakeholders, information obtained through interviews with manufacturers, additional industry research, and recent regulatory changes implemented by EPA's SNAP program. 80 FR 19454, 19491 (April 10, 2015) and 80 FR 42870, 42917–42920 (July 20, 2015). In particular, DOE conducted analyses for equipment using propane (R–290) refrigerant, in addition to CO_2 (R–744) and did not consider R–134a further in downstream analysis after 2019. In addition, DOE adjusted baseline assumptions for combination vending machines, included more representative costs for several design options, and revised lighting assumptions.

1. Baseline Equipment and Representative Sizes

For each of the two classes of equipment with current standards (Class A and Class B), DOE developed baseline configurations containing design options consistent with units designed to perform at a level that approximates the existing 2009 BVM standard. DOE based its representative size assumptions for Class A and Class B equipment on the representative sizes assumed in the 2009 BVM rulemaking and input from manufacturers during the framework and preliminary analysis phases of this rulemaking, as well as data gathered from supplemental sources. DOE believes that these representative sizes continue to reflect the design and features of current baseline equipment for Class A and Class B equipment.

For Combination A and Combination B equipment, DOE set its baseline efficiency level differently than for Class A and Class B equipment, since there are no current regulatory standards for this equipment. Specifically, DOE modeled the baseline level of efficiency for the Combination A and Combination B equipment as representing the least-efficient technology generally found in the BVM market currently for each design option analyzed. That is, the baseline efficiency level for Combination A and Combination B equipment represented the least-efficient combination of technologies available, which in some cases a baseline efficiency level with higher energy consumption than any physical combination BVM unit DOE analyzed.

Representative sizes for Combination A and Combination B were established in the preliminary analysis based on equipment available in the current market and have been maintained for this NOPR. Specific details of the representative sizes chosen for analysis and design options representing each of the baseline equipment definitions for Class A, Class B, Combination A, and Combination B beverage vending machines are described in more detail in appendix 5A of the NOPR TSD.

In response to the preliminary analysis, DOE received several comments regarding the methodology it used for setting baseline levels in the engineering analysis. SVA questioned DOE's assumption about the baseline not including low-power states and asserted that most manufacturers turn off lights prior to testing energy consumption, which is representative of low power mode. (SVA, No. 33 at p. 49) [23] Crane recommended that technologies like lighting controls in low power mode and electronically commutated motors (ECMs) are already being utilized and should not be design options to improve efficiency. (Crane Merchandising System, Inc., No. 33 at pp. 53–54). SVA stated that they did not know of additional technologies to reduce energy consumption and that manufacturers are already almost at their maximum efficiencies. (SVA, No. 30 at p.1 and No. 33 at p. 99) AMS added that it has implemented most of the listed technologies and the increased cost associated with these has been significant but the energy impacts are unknown. (AMS, No. 29 at p. 2)

In the engineering analysis for Class A and Class B equipment, DOE used the current standard level as the baseline energy consumption level. The current DOE standards are available at 10 CFR 431.296. All impacts of design options that DOE examined to improve efficiency are calculated from that level. Based on its analysis of the DOE BVM certification database as well as the list of ENERGY STAR® qualified beverage vending machines, DOE agrees with Crane and SVA that much of the equipment currently available on the market exceeds the minimum energy performance required by the current DOE standards. DOE further agrees with AMS and SVA that equipment that exceeds the current standards does so through the use of efficiency improvements beyond the baseline design, including design options that DOE uses in its analysis supporting this NOPR.

Most of the design options analyzed in this NOPR were observed by DOE in some portion of the equipment currently on the market. The presence of these design options in equipment that exceeds the current standard level serves as validation of the energy performance improvements over the baseline level that are possible with these design options. However, DOE also realizes that no two manufacturers may necessarily use the same design option pathways to improve energy performance. As such, DOE notes that its engineering analyses represent just one potential pathway to achieve the efficiency levels modeled in downstream analyses.

[23] A notation in this form provides a reference for information that is in the docket of DOE's rulemaking to develop test procedures for beverage vending machines (Docket No. EERE–2013–BT–STD–0022, which is maintained at *www.regulations.gov*). This particular notation refers to a comment: (1) Submitted by Royal Vendors, Inc.; (2) appearing in document number 11 of the docket; and (3) appearing on page 3 of that document.

In response to SVA and Crane's comments regarding current manufacturer use of lighting controls, energy management systems, and low power modes to meet or exceed current energy conservation standards, DOE acknowledges that energy management systems that cannot be altered by the operator are allowed to be enabled during testing according to the current DOE test procedure. However, the engineering analysis supporting the 2009 BVM final rule did not assume the use of any such energy management system in any of the design options analyzed or in the pathway to the adopted standard level (Chapter 5 of the 2009 BVM final rule TSD; Docket No. EERE–2006–STD–0125, No. 79). While manufacturers may elect to employ whatever mix of technology options they see fit, DOE's analyses from the 2009 rulemaking did not indicate that the use of energy management systems or low power modes would be required to meet the standard levels set forth in the 2009 BVM final rule. Similarly, in this NOPR, the baseline equipment performance assumes that all lighting and accessories are on for the duration of the test and no low power modes or energy management systems are enabled. As such, DOE believes that the baseline energy performance level is achievable without the use of any energy management systems and, thus, has included them as a design option for improving the efficiency of BVM equipment.

Additionally, AMS expressed concern that the MDEC requirement for Class B machines is easier to attain than the MDEC for Class A machines. (AMS, No. 29 at p. 2–3) DOE understands that Class A units experience different heat transfer profiles than comparably sized and equipped Class B units. However, DOE is directed to independently establish energy conservation standards that are technologically feasible and economically justified for each class of covered equipment. In the 2009 BVM final rule, DOE established standards for Class A and Class B equipment based on full and independent engineering and economic analyses of the baseline equipment configurations and design options available for each equipment class. In light of inputs obtained during that rulemaking and to date in the current rulemaking, DOE intends to preserve Class A and Class B as distinct classes with separate, independently determined standard levels.

DOE requests comment on whether equipment is tested with all lighting and accessories on for the duration of the test and no low power modes or energy management systems enabled (section VII.E of this NOPR).

DOE requests information on whether the current standard level for Class A and Class B machines is achievable without the use of any energy management systems (section VII.E of this NOPR).

2. Refrigerants

At the time of this analysis, hydrofluorocarbon (HFC) refrigerants, and specifically R–134a, are used in most beverage vending machines on the market currently in the United States. In addition, based on equipment certification reports received by DOE, public statements from major end users of beverage vending machines such as Coca-Cola,[24] and information DOE obtained through confidential manufacturer interviews (see section IV.I.3), DOE has come to understand that CO_2 refrigerant is used in a small but growing portion of the BVM market.

As discussed earlier, the refrigerants that are available for use in the U.S. refrigerated vending machine market are changing as a result of two recent rulemaking actions by EPA's SNAP. First, EPA published proposed Rule 19 (Docket No. EPA–HQ–OAR–2014–0198) on July 9, 2014, that proposed, among other things, to list several hydrocarbons—isobutane and propane—and the hydrocarbon blend R–441A as acceptable alternatives under SNAP in the BVM application, subject to certain use conditions. 79 FR 38811. A final rule adopting these proposals became effective on May 11, 2015, and was published in the **Federal Register** on April 10, 2015. 80 FR 19454, 19491. EPA's second rulemaking under SNAP, Proposed Rule 20 (Docket No. EPA–HQ–OAR–2013–0748), was published on August 6, 2014 and proposed to change the status certain refrigerants to unacceptable for certain applications, including R–134a for BVM application, 79 FR 46126. A final rule corresponding to Proposed Rule 20 was published in the **Federal Register**on July 20, 2015. 80 FR 42870, 42917–42920 (July 20, 2015). This rule changes the status of R–134a for new vending machines to unacceptable beginning on January 1, 2019. Therefore, equipment complying with the amended BVM standards DOE is proposing in this NOPR would do so using the refrigerants allowable under the newly amended SNAP listings.

Due to the EPA SNAP rulemaking actions that were ongoing at the time of the preliminary analysis and to the small but growing prevalence of equipment using non-HFC refrigerants in the U.S. market, DOE received a number of stakeholder comments related to refrigerants in this rulemaking.

In comments in response to the preliminary analysis, NEEA drew DOE's attention to the ongoing[25] SNAP rulemakings and questioned their impacts on the final rule. The National Automatic Merchandising Association (NAMA) also commented that EPA's proposed SNAP ruling would introduce a new and significant variable that is not represented in the current data. (NAMA, No. 32 at p. 4)

In a joint written submission, the Alliance to Save Energy, American Council for an Energy-Efficient Economy, Appliance Standard Awareness Project (ASAP), Natural Resources Defense Council, and NEEA (Joint Comment) stated that DOE should examine possible efficiency improvements from the use of hydrocarbon refrigerants (Joint Comment, No. 27 at p. 2). NAMA and AMS expressed concern about the cost of hydrocarbon refrigeration systems, as well as their performance and reliability. (NAMA, No. 32 at p. 2; AMS, No. 29 at p. 2)

Additionally, DOE received comments specific to the use of CO_2 as a refrigerant. NAMA expressed concern about meeting the current DOE MDEC standards for Class A equipment using CO_2 because of the inherently lower efficiency of CO_2 compressors. (NAMA, No. 32 at p. 2) SVA commented that CO_2 refrigeration systems are less energy efficient than R–134a, but cost 50 percent more. (SVA, No. 30 at p. 1)

In response to the comments from stakeholders and due to the changes in allowable refrigerants for BVM applications arising as a result of EPA SNAP Final Rule 20 (80 FR 42870, 42917–42920; July 20, 2015), DOE analyzed the performance of Class A, Class B, Combination A, and Combination B equipment utilizing CO_2 refrigerant (R–744) and propane refrigerant (R–290) in this rulemaking.

DOE notes that while CO_2 has been approved for use in the United States in refrigerated beverage vending applications by EPA SNAP for several years, other hydrocarbons, including propane, were only recently listed as acceptable alternatives for use in refrigerated beverage vending applications in the United States with

[24] One example of such a public statement is available at *http://www.coca-colacompany.com/innovation/coca-cola-installs-1-millionth-hfc-free-cooler-globally-preventing-525mm-metrics-tons-of-co2.*

[25] At the time of the comment period for the BVM preliminary analysis, both SNAP rulemakings were in the proposal stage, and thus still ongoing.

EPA's recent publication of final rule 19, which became effective on May 11, 2015. 80 FR 19454, 19491. Although DOE is not aware of any commercially available BVM models using propane as a refrigerant, DOE has based this NOPR analysis on the use of propane as an alternative refrigerant, in addition to CO_2, based on use of propane as a refrigerant in other similar, self-contained commercial refrigeration applications. (See *e.g.,* Docket No. EPA–HQ–OAR–2014–0198, The Environmental Investigation Agency, No. 0134) EPA also listed R–450A, an HFC/HFO blend, as acceptable for retrofitting BVMs (79 FR 62863 (October 21, 2014)) and is evaluating R–450A and other similar blends as acceptable for new beverage vending machines. However, DOE did not evaluate these refrigerants in this NOPR, as DOE is not aware of any commercially available BVM models using R–450A or other hydrocarbon blends as a refrigerant or of any significant research and development efforts on the part of domestic BVM manufacturers to commercialize this technology in the near future.

In the engineering analysis for this NOPR, DOE first conducted analysis for each equipment class based on equipment using R–134a refrigerant, the refrigerant found in the majority of equipment available today and therefore providing the most specific and comprehensive data available. DOE then conducted analysis on each equipment class, using CO_2 and propane refrigerants, by adjusting the R–134a analysis to account for the performance differences attributable to the new refrigerants. This methodology allowed DOE to leverage the large existing base of experience, data, and models for sale utilizing R–134a while ensuring that its engineering model and downstream analyses properly addressed the refrigerant landscape applicable at the time when compliance with amended standards would be required.

In conducting its CO_2 analysis, DOE used inputs that align with SVA's comment regarding a lower efficiency for CO_2 refrigeration systems. DOE adjusted its engineering analysis to account for an increase in energy use for a beverage vending machine that uses CO_2 versus a similarly equipped unit using R–134a. Specifically, DOE used a 6-percent compressor power increase, based on a separate analytical comparison of HFC and CO_2 compressors, to account for the inherent relative inefficiency of CO_2. This figure was reviewed with manufacturers during interviews and through requests for public comment on the preliminary analysis. DOE also analyzed components for CO_2 refrigeration systems such as compressors and refrigeration coils as having higher costs than those for HFC refrigeration systems. Additionally, as CO_2 models were currently available on the market for purchase at the time of this analysis, DOE was able to procure, test, and tear down CO_2 equipment to use in corroborating its analysis.

For propane equipment, DOE used a similar methodology to that applied for CO_2. The engineering analysis used adjusted values for compressor performance, incorporating a 15-percent reduction in energy consumption as compared to an R–134a compressor, as well as adjustments to the cost of the compressor, heat exchangers, and other system components. These factors were developed through a separate, focused analysis targeting the inherent differences in performance potential between HFC and hydrocarbon refrigerants. For a detailed explanation of the methodology used in adjusting the analysis conducted on equipment using R–134a refrigerant for analyzing CO_2 and propane beverage vending machines in this NOPR, please see chapter 5 of the NOPR TSD.

Commensurate with NAMA and SVA's comments, DOE found in its analysis that, because of the decreased efficiency of CO_2 compressors as compared to R–134a compressors, more design options would need to be implemented for equipment using CO_2 refrigerant than equipment using R–134a or propane in order to achieve the same efficiency level. However, DOE's analysis showed that both the current standard level and all of the efficiency levels analyzed, including the proposed standard level, could be met by equipment using any refrigerant. Specifically, DOE established efficiency levels for the LCC, NIA, and national energy savings (NES) analyses that could be reached using any of the refrigerants analyzed. An MPC and an MSP were assigned to each efficiency level by weighting the refrigerant-specific MSPs associated with reaching that efficiency level based on the modeled market share of each refrigerant. For more information on DOE's efficiency level selection and the formulation of market shares by refrigerant, see sections IV.E and IV.G.1 of this NOPR, respectively.

To refine its engineering analysis for beverage vending machines further, DOE requests comment and data from interested parties on several topics related to the refrigerants analyzed in the engineering analysis and their relative performance characteristics. Specifically, DOE requests information on the efficiency of CO_2 and propane compressors in BVM applications (section VII.E of this NOPR).

DOE requests comment on the conclusion that both the current standard level and all of the efficiency levels analyzed could be met by equipment using any refrigerant (section VII.E of this NOPR).

DOE requests information on the additional costs associated with CO_2 and propane refrigeration systems, respectively, including but not limited to additional costs for the compressor, evaporator, condenser, and refrigerant tubing (section VII.E of this NOPR).

DOE requests comment and information on the use of propane, isobutane, and other hydrocarbon refrigerants in current commercially available BVM models or on significant research and development efforts on the part of domestic BVM manufacturers to commercialize this technology in the near future (section VII.E of this NOPR).

DOE requests comment on the likelihood of manufacturers using propane versus isobutane refrigerant since both have been added to the list of acceptable substitutes for use in BVM applications by EPA SNAP. If it is likely that isobutane would also be implemented in BVM applications, DOE requests similar information on the efficiency of isobutane compressors and additional costs associated with isobutane refrigeration systems, including but not limited to additional costs for the compressor, evaporator, condenser, and refrigerant tubing (section VII.E of this NOPR).

3. Design Options Analyzed and Maximum Technologically Feasible Efficiency Level

In response to the preliminary analysis, DOE received several comments with specific feedback regarding the design options analyzed. Specifically, SVA commented that the physical size constraint of certain evaporator fan applications did not allow for ECM motors, and NAMA stated that more insulation would make beverage vending machines larger and impact its market acceptance. (SVA, No. 33 at p. 40 and NAMA, No. 32 at p. 1) Additionally, AMS commented that additional insulation may be added to the beverage vending machines, but this would affect the size of machine, its product capacity, and market acceptance. (AMS, No. 29 at p. 2) SVA and NAMA commented that by 2019 all machines will have light-emitting diode (LED) lighting. (SVA, No. 33 at p. 88, NAMA, No. 32 at p. 2)

DOE based the specifications used in most of the design options for the engineering analysis on observations of what is currently in use in the market, including components and features incorporated by manufacturers of beverage vending machines as well as suppliers of those components. This information was gathered from the physical procurement and teardown of models and from confidential interviews conducted with manufacturers of beverage vending machines and other types of commercial refrigerated equipment. This methodology indicated that ECM evaporator motors are included in some Class A models currently produced. Additionally, DOE did not find there to be significant size differences between ECMs and other fan motor types.

In response to NAMA and AMS, DOE notes that the design options considered included the specifications for the foam insulation, which were 1 inch and 1.125 inches in the design options in the analysis. Both of these are commonly found insulation thicknesses in units being sold currently on the market, demonstrating in the market that these foam thicknesses are not prohibitive to implement.

DOE is aware of the increasing market share of beverage vending machines using LED lighting, and all of the standard levels proposed in this NOPR are at levels where the engineering analysis indicates LEDs will be a part of the least-cost path to achieving the proposed level. The comments by SVA and NAMA support this finding.

Regarding the concerns expressed by AMS over the levels of cost incurred by manufacturers in potentially improving the efficiency of combination vending machines, DOE is analyzing these machine types in parallel as a separate equipment class alongside the Class A and Class B equipment analyzed in this rulemaking. Any new standards for combination vending machines would only be promulgated after a thorough assessment of the costs and benefits to manufacturers, customers, and the nation, and would be set at a level deemed technologically feasible and economically justified. This will include an investigation of manufacturer product and capital conversion costs as part of the MIA.

In addition to these comments regarding the implementation of design options, DOE received comments regarding use of variable speed compressors, which were not analyzed in the engineering analysis for the preliminary analysis. In its written statement, the Joint Comment drew DOE's attention to Embraco, a manufacturer of variable speed compressors, and commented that DOE should incorporate variable speed compressors into their engineering analysis and refer to 2011 residential refrigerator rule for guidance. (Joint Comment, No. 27 at p. 1) ASAP also asked if DOE had considered variable speed compressors manufactured by Embraco. (ASAP, No. 33 at p. 31) AMS commented that fractional horsepower variable speed compressors were not available in the United States anymore since they have been made obsolete by the supplier. (AMS, No. 33 at p. 27)

DOE agrees with the Joint Comment that at least one variable speed compressor model with a suitable operating capacity range is available to BVM manufacturers. However, DOE is not aware of any beverage vending machines on the market or in prototype that use this or any other model of variable speed compressor. Additionally, in public comments and during manufacturer interviews, DOE was not provided any specific data on the performance or reliability of this technology were it to be implemented in beverage vending machines. In response to the comment regarding residential refrigerators, DOE agrees that the residential refrigerator rulemaking provides good guidance regarding the calculation of potential savings associated with the technology. However, DOE is concerned that the operating characteristics of beverage vending machines, including extended pull-down periods, may differ sufficiently from those experienced by other applications in which variable speed compressors have been effectively implemented. For this reason, DOE does not believe that the residential refrigerator experience provides adequate data regarding the potential energy impacts of variable speed compressors in BVM applications. Without application-specific energy and cost data for this technology in beverage vending machines or similar applications, DOE is not able to adequately predict the potential energy savings from such a technology and assess its cost-effectiveness against other design options. Additionally, DOE is not aware of any variable speed compressors using refrigerants allowable under the new EPA SNAP rules with operating capacity ranges nominally applicable to beverage vending machines.

DOE requests comment on whether the conversion to use of any alternative refrigerant may impact the availability or relevance of any design options currently observed in equipment on the market (section VII.E of this NOPR).

DOE requests data on the use of variable speed compressors in beverage vending machines (section VII.E of this NOPR).

In the previous stages of this rulemaking, DOE requested comment regarding the maximum technologically feasible level of performance attainable with technologies currently on the market. During the preliminary analysis, DOE reviewed a wide range of information sources from which to draw data on baseline and improved vending machine performance. DOE assembled this information into cost-efficiency curves extending from the baseline to max tech for each equipment class and configuration examined through the use of the design options listed in Table IV.3. DOE reviewed and revised these cost-efficiency curves in this NOPR based on feedback from interested parties and input from manufacturers provided during the course of manufacturer interviews. DOE believes that these cost-efficiency curves capture the feasible levels of equipment performance to the extent possible at this stage in the analysis.

TABLE IV.3—DESIGN OPTIONS MODELED IN THE ENGINEERING ANALYSIS

Design option	Notes
Higher efficiency lighting.	*e.g.,* LEDs
Higher efficiency evaporator fan motors.	*e.g.,* Electronically commutated motors
Evaporator fan controls.	
Improved evaporator design.	
Insulation increases or improvements.	*e.g.,* Thicker insulation, vacuum insulated panels
Improved glass pack.	Class A and Combination A only
Higher efficiency condenser fan motors.	*e.g.,* Electronically commutated motors
Improved condenser design.	
Higher efficiency compressors.	
Lighting low power modes.	*e.g.,* Lighting timers
Refrigeration low power modes.	*e.g.,* Timer-based cabinet temperature rise

4. Manufacturer Production Costs

In its engineering analysis, DOE estimates costs for manufacturers to produce equipment at the baseline and at increasingly higher levels of energy efficiency. In this NOPR, DOE based this manufacturer production cost model upon data from physical disassembly of units available on the market, corroborated with information from manufacturer literature, discussions with industry experts, input from manufacturer interviews (see section IV.I.3 of this NOPR), and other sources. The baseline units modeled in the engineering analysis incorporated refrigerants allowable under SNAP regulations at the time of the effective date of any new or amended standards, namely propane and CO_2. As such, the manufacturer production costs at the baseline and increasing levels of efficiency all reflect the costs incurred in producing equipment using acceptable refrigerants under the final SNAP regulations issued in 2015. The incremental cost associated with producing a given BVM unit using propane or CO_2 refrigerant, as compared to a similar BVM unit using R–134a refrigerant is accounted for through the use of these refrigerant-specific cost curves. Chapter 5 of the TSD provides a detailed description of the manufacturing cost analysis.

D. Markups Analysis

DOE uses manufacturer-to-customer markups to convert the MSP estimates from the engineering analysis into customer purchase prices, which are subsequently used in the LCC and PBP analysis to evaluate how the increased cost of higher efficiency equipment compares to the annual and lifetime energy and operating cost savings resulting from such efficiency improvements. Accordingly, DOE estimates markups for baseline and all higher efficiency levels that are applied to the MSPs from the engineering analysis to obtain final customer purchase prices.

In order to develop markups, DOE identified distribution channels (*i.e.,* how the equipment is distributed from the manufacturer to the customer). Once proper distribution channels for each of the equipment classes were established, DOE relied on economic data from the U.S. Census Bureau and input from the industry to determine to what extent equipment prices increase as they pass from the manufacturer to the customer (see chapter 6 of the TSD).

DOE identified three distribution channels, as described below:

(1) Equipment Manufacturer →Vending Machine Operator (*e.g.,* bottler, beverage distributor, large food operator)

(2) Equipment Manufacturer →Distributor →Vending Machine Operator

(3) Equipment Manufacturer →Distributor →Site Owner

In the preliminary analysis public meeting, DOE was informed of an additional distribution channel wherein the equipment passes directly to large food service operators. (Crane Merchandising Systems, Public Meeting Transcript, No. 33 at pp. 63–64) DOE assumed that this distribution channel can be treated the same as the first distribution channel above, in which equipment goes directly from the manufacturer to the end user.

DOE requests comment on distribution channels for beverage vending machines (section VII.E of this NOPR).

E. Energy Use Analysis

The purpose of the energy use analysis is to establish an estimate of annual energy consumption (AEC) of beverage vending machines now and over the 30-year analysis period and to assess the energy-savings potential of different equipment efficiencies. DOE uses the resulting estimated AEC in the LCC and PBP analysis (section IV.F of this NOPR) to establish the customer operating cost savings of efficiency improvements considered. DOE also uses the estimate of energy use at the baseline and at higher levels of efficiency to estimate NES in the NIA (section IV.G of this NOPR).

The energy use analysis assessed the estimated AEC of a beverage vending machine as installed in the field. DOE recognizes that a variety of factors may affect the actual energy use of a beverage vending machine in the field, including ambient conditions, use and stocking profiles, and other factors. However, very limited data exist on field energy consumption of beverage vending machines. As such, in the energy use analysis DOE estimated that the DEC produced by the DOE test procedure is representative of the average daily energy consumption of that BVM unit in an indoor environment. However, for beverage vending machines installed outdoors, DOE developed a methodology to account for the impact of ambient conditions on the average AEC. Therefore, to model the AEC of each BVM unit, DOE separately estimated the energy use of equipment installed indoors and outdoors, to account for the impact of ambient temperature and relative humidity on field-installed BVM energy use.

As presented in the preliminary analysis, to determine AEC of BVM units installed indoors, DOE estimated that the DEC modeled in the engineering analysis and measured according to the DOE test procedure would be representative of the average energy consumption for that equipment every day of the year. Specifically, DOE believes beverage vending machines that are typically located inside industrial and commercial buildings are exposed to relatively constant temperature and relative humidity conditions throughout the year. DOE also believes that the nominal test conditions of (75 °F and 45 percent relative humidity) are sufficiently representative of conditioned spaces such that further adjustment of the tested energy consumption is not necessary for beverage vending machines located indoors.

To estimate the AEC from the DEC, DOE then multiplied the DEC values for a given BVM unit by 365 days per year. DOE estimated that Class A and Combination A beverage vending machines and a majority of Class B and Combination B beverage vending machines would all be installed inside.

However, DOE understands that some Class B and Combination B beverage vending machines are installed outdoors. Class B and Combination B beverage vending machines installed outdoors will be subject to potentially more variable ambient temperature and relative humidity conditions than BVM units installed indoors. These differences also vary depending on which climatic region the beverage vending machine is located.

During the 2009 BVM rulemaking, DOE modified its energy consumption model developed in the engineering analysis to reflect the equipment's thermal and compressor performance characteristics and to simulate the realistic performance of the machine exposed to varying temperature and relative humidity conditions (Chapter 7 of the 2009 BVM final rule TSD; Docket No. EERE–2006–STD–0125, No. 79). For the current analysis, DOE simplified its analysis by developing linear relationships between the modeled DEC as determined in accordance with the DOE test procedure and the AEC for Class B and Combination B beverage vending machines installed outdoors, as presented in the preliminary analysis. As such, DOE estimated the AEC of a given Class B or Combination B beverage vending machine installed outside by multiplying the DEC value by the linear equation determined from based on the 2009 BVM rulemaking analysis.

DOE estimated the fraction of Class B machines located in outdoor settings, based on publicly available data from college campuses,[26] and found that 16 percent of Class B machines were installed outdoors. DOE believes that

[26] *Beverage vending machine Outdoor Location and Elevated (90 °F) Outdoor Temperature Analysis.* Lawrence Berkeley National Laboratory. June 2014. Available at *http://eetd.lbl.gov/sites/all/files/lbnl-6744e.pdf.*

these data from college campuses are reasonably representative of BVM locations nationally due to the wide variety of building types and outdoor spaces on large college campuses, which can be correlated with the likely BVM locations expected.

DOE requests comment on the conclusion that data from college campuses are reasonably representative of BVM locations nationally and on their use in estimating the proportion of Class B and Combination B beverage vending machines installed outdoors (section VII.E of this NOPR).

DOE determined AEC estimates for each of the eight equipment class and refrigerant combinations modeled in the engineering analysis and presented in Table IV.4. That is, Class A, Class B, Combination A, and Combination B beverage vending machines were modeled individually for each of the two refrigerants used in these NOPR analyses: Propane (R–290) and CO_2 (R–744). However, while the engineering analysis considered three specific sizes (small, medium, and large) for Class A and Class B equipment, and two specific sizes (medium and large) for Combination A and B equipment, DOE based its energy use analysis on a ''representative size'' BVM for each equipment class. DOE determined this representative size based on a weighted average of the equipment sizes modeled in the engineering analysis. Because DOE does not believe there is a large spread of available refrigerated volumes in a given equipment class and because DOE does not anticipate the distribution of refrigerated volumes to change as a function of efficiency, DOE believes this simplifying assumption is justified and will not affect the results in a meaningful way. The representative sizes DOE used in its analysis for each equipment class are presented in Table IV.4.

TABLE IV.4—REPRESENTATIVE SIZE, IN TERMS OF REFRIGERATED VOLUME (ft^3), FOR EACH EQUIPMENT CLASS AND REFRIGERANT COMBINATION MODELED IN THE ENERGY USE ANALYSIS

Equipment class	Refrigerant	Representative refrigerated volume ft^3
Class A	CO_2	30.0
	Propane	
Class B	CO_2	23.4
	Propane	
Combination A.	CO_2	10.3
	Propane	
Combination B.	CO_2	4.3
	Propane	

DOE's methodology for estimating the energy use of Class A, Class B, Combination A, and Combination B beverage vending machines is discussed in more detail in chapter 7 of the NOPR TSD. In the following paragraph, DOE responds to specific comments received by interested parties on the energy use methodology DOE developed in the preliminary analysis.

In response to the preliminary analysis, DOE received several comments regarding the prevalence of beverage vending machines installed outdoors. AMS and NAMA agreed that Class A machines are almost exclusively used indoors. (AMS, No. 29 at p. 4; NAMA, No. 32 at p. 5) AMS added that, although they produce Combination A machines that are rated for outdoor use, they acknowledge that this is a minor portion of shipments and should be considered negligible. (AMS, No. 29 at p. 4) Natural Resources Canada (NRCan) asked for the source of the 25 percent outdoor installations used in 2009 and if that information is more accurate than the 16 percent assumption used now. (NRCan, No. 33 at p. 81) NEEA was unsure if 16 percent of machines were really representative of outdoor use and whether using distributions from college campuses was representative. (NEEA, No. 33 at p. 71–72)

DOE appreciates the comments from AMS and NAMA corroborating DOE's assumptions regarding Class A and Combination A equipment. Based on these comments, DOE has continued to assume that all Class A and Combination A beverage vending machines are installed indoors in this NOPR analysis. In response to the comments from NRCan regarding the source of the percentage of Class B machines installed outdoors in the 2009 BVM rulemaking, DOE based that estimate on engineering judgment and requested comment from manufacturers on this assumption. 74 FR 44927 (August 31, 2009). No additional data were provided to inform this analysis, and as such, DOE concluded that the percentage of Class B machines installed outdoors was reasonably representative of BVM installations throughout the country.

In response to NEEA's comment, DOE estimated the fraction of Class B beverage vending machines installed outdoors based on data regarding the BVM locations and types of vending machines found at six colleges and universities around the country. These campuses are thought to be fairly representative of the general BVM population because they have a mix of building types that mirror some of the major markets for beverage vending machines, including retail, commercial lodging, offices, public assembly, and outdoor spaces (see chapter 7 in the TSD for a full discussion of the building types represented in the sample from college campuses). From this research, DOE determined that 16 percent of Class B beverage vending machines are installed outside and believes that this assumption is more reliable than the assumption of 25 percent used in the 2009 BVM final rule.

In the preliminary analysis, DOE developed state-level (including the District of Columbia) adjustment factors to determine the AEC of beverage vending machines located outdoors in different regions of the country. Such adjustment factors would make it possible for DOE to model variability in the percentage of beverage vending machines installed outdoors in different climates, if such data were available. In the preliminary analysis, DOE requested such data from interested parties. DOE received several comments regarding the use of adjustment factors to estimate the location-specific AEC for Class B and Combination B equipment in each state (including the District of Columbia) and DOE's request for additional data regarding the variability of equipment installed outdoors by state or climate region. NEEA asked how the adjustment factors were calculated and what they would be used for. (NEEA, No. 33 at p. 73–74) Southern California Edison (SCE) asked if the adjustment factor accounted for some of the accessories that may be left off by cold weather heaters. (SCE, No. 33 at p. 74–75) NEEA suggested that DOE consider that more product would be dispensed in warmer weather and that may have an impact on the adjustment as well. (NEEA, No. 33 at p. 77–78)

In response to NEEA's comment regarding the methodology used in developing the adjustment factors to determine the AEC by state, the adjustment factor for each state was determined by dividing the outdoor AEC for each state by the national average AEC reported in Tables 7.4.1 and 7.4.2 of the 2009 BVM final rule TSD. The adjustment factor was applied to the calculated average AEC of a given beverage vending machine, determined using the scaling factor described above to translate the tested DEC of a given BVM model to an AEC value. In the preliminary analysis, DOE intended to apply the adjustment factors to generate state-level estimates of energy use for outdoor equipment that reflect relative numbers of units installed outdoors by state. Such data could then be averaged based on population-weights to generate a nationally representative average AEC for outdoor equipment.

This level of data specificity would be necessary to accommodate for regional or state-level variation in the installation of outdoor units. In the preliminary analysis, DOE requested comment on any regional variation in the incidence of BVM equipment installed outdoors, but did not receive any input or data from interested parties. DOE was also not able to identify any data that would support state-level or regional variation in the percentage of Class B and Combination B BVM units installed outdoors. As such, in the energy use analysis performed for this NOPR, DOE determined that there are insufficient data to support variations in outdoor installations in different climate areas and has assumed one nationally representative value. DOE thus believes that using state-level adjustment factors are not necessary and opted to use a national average AEC for outdoor equipment to simplify the analysis. This simplification does not affect the accuracy of the annual energy use results, since the adjustment factors were generated based on the national average AEC.

DOE requests comment on its decision to disregard the adjustment factors calculated in the preliminary analysis thereby simplifying the energy use analysis by using the national average AEC values (section VII.E of this NOPR).

In response to SCE's comment regarding the adjustment factor for accessories, such as cold weather heaters, DOE reiterates that these factors are based on modeling performed in support of the 2009 BVM final rule. In the 2009 BVM final rule, DOE did not model the energy use of cold weather heaters due to lack of information on their use and control and because they are not measured as part of the DOE test procedure rating. DOE had no data on how the energy use of these heaters would be impacted by the design options considered at each efficiency level. As such, DOE's analysis assumes that the incremental energy use of any electric resistance heating elements energized to prevent freezing in cold temperatures is not directly affected by improved efficiency levels considered by DOE in the BVM analysis and has not been considered in the analysis.

DOE lacks sufficient data to consider the incidence of cold weather heaters in the energy use analysis or control methodologies for this technology. DOE notes that, potentially, not all beverage vending machines installed outdoors in climates experiencing extended periods below 32 °F outside would include such a feature, as some Class B and Combination B beverage vending machines installed outdoors may be moved inside during cold-weather periods. In addition, even based on conservative assumptions regarding the likely use of electric heaters in beverage vending machines installed outdoors, the energy use of cold weather heaters in outdoor Class B and Combination B equipment would be small compared to the annual energy use of the machine. As such, DOE believes that accounting for the energy use of cold weather heaters in the energy use analysis would not significantly impact the national average energy consumption values used in the LCC and downstream analyses. Since DOE lacks sufficient data on which to base assumptions regarding representative control strategies and operational characteristics of such BVM accessories, and because DOE believes the impact of any such heaters on the national average energy consumption values would be small, DOE elected to continue to use the unmodified regression developed in the preliminary analysis, which does not account for the energy use of cold weather heaters, to estimate the national average AEC of outdoor Class B and Combination B equipment.

DOE requests comment regarding whether the analysis should account for the impact of any incremental energy use associated with cold weather heaters on the national average energy consumption of Class B and Combination B equipment (section VII.E of this NOPR). If so, DOE also requests data on the incidence and control methodology of cold weather heaters in BVM equipment installed in cold climates (section VII.E of this NOPR).

Regarding NEEA's comment that variables such as purchasing patterns may vary seasonally and impact energy use, DOE did not account for such influences since there are no robust data regarding how increased equipment usage increases energy use above the tested value or the extent of changes in number or frequency of purchases in different climatic conditions. As such, DOE continues to estimate that the energy use of the beverage vending machines as tested in accordance with the DOE test procedure is reasonably representative of equipment energy usage in the field for indoor installations, and has applied the climate based scaling factors as described to estimate outdoor annual energy use.

DOE also acknowledges that most beverage vending machines are located inside conditioned spaces and will add to the building cooling load in the summer and reduce the building heating load in the winter. However, DOE notes that in its energy use analysis, DOE is most interested in the incremental improvements in energy consumption achieved by different design options and not the entire heat load contributed by a beverage vending machine. Based on similar analysis performed on self-contained commercial refrigeration equipment in support of recently published amended energy conservation standards for commercial refrigeration equipment, DOE believes that the net effect of these impacts are fairly modest in most cases. 78 FR 55890, 55926 (September 11, 2013). DOE also believes that the added complexity of determining the overall impact on building space-conditioning loads is not justified given the variety of building types, BVM locations (*e.g.,* outside, inside, or in vestibules), and HVAC system designs that would need to be taken into account.

DOE requests comment on the energy use analysis methodology used to estimate the AEC of Class A, Class B, Combination A, and Combination B beverage vending machines located indoors and outdoors, as applicable (section VII.E of this NOPR).

DOE requests comment on any other variables DOE should account for in its estimate of national average energy use for beverage vending machines (section VII.E of this NOPR).

F. Life-Cycle Cost and Payback Period Analyses

New or amended energy conservation standards usually decrease equipment operating expenses and increase the initial installed price. DOE analyzes the net effect of new or amended standards on customers by evaluating the net LCC. To evaluate the net LCC, DOE uses the cost-efficiency relationship derived in the engineering analysis and the energy costs derived from the energy use analysis. Inputs to the LCC calculation include the installed cost of equipment to the customer (customer purchase price plus installation cost), operating expenses (energy expenses and maintenance and repair costs), the lifetime of the unit, and a discount rate.

Because the installed cost of equipment typically increases while operating costs typically decrease under new standards, there is a time in the life of equipment having higher-than-baseline efficiency when the net operating-cost benefit (in dollars) since the time of purchase is equal to the incremental first cost of purchasing the equipment. The time required for equipment to reach this cost-equivalence point is known as the PBP.

DOE uses Monte Carlo simulation and probability distributions to incorporate uncertainty and variability in the LCC and PBP analysis. DOE used Microsoft Excel combined with Crystal Ball™ (a commercially available program) to develop LCC and PBP spreadsheet models that incorporate both Monte Carlo simulation and probability distributions. The LCC subgroup analysis includes an assessment of impacts on customer subgroups.

DOE determined several input values for the LCC and PBP analysis including (1) customer purchase prices; (2) electricity prices; (3) maintenance, service, and installation costs; (4) equipment lifetimes; (5) discount rates; (6) equipment efficiency in the no-new-standards case; and (7) split incentives. The approach and data DOE used to derive these input values are described below.

1. Customer Purchase Prices

DOE multiplied the MSPs estimated in the engineering analysis by the supply-chain markups to calculate customer purchase prices for the LCC and PBP analysis. DOE determined, on average, 15 percent of this equipment passes through a distributor or wholesaler, and 85 percent of the equipment is sold by a manufacturer directly to the end user. In the LCC and PBP analysis, approximately 15 percent of the Monte Carlo iterations include a distributor or wholesaler markup, while 85 percent of the iterations use a markup factor of 1.0, indicative of no additional markup on top of the MSPs (besides sales tax).

DOE developed a projection of price trends for beverage vending machines in the preliminary analysis that, based on historical price trends, projected the MSP to decline by 1 percent from the 2014 MSP estimates through the 2019 assumed compliance date of new or amended standards. The preliminary analysis also projects an approximately 40 percent decline from the MSP values estimated in 2013 to the end of the 30-year NIA analysis period used in the NOPR.

DOE received comments from stakeholders regarding the price learning in the life-cycle cost analysis. AMS disagreed with the current price trend because the impacts of the EPA SNAP program are not able to be included in the calculations. (AMS, No. 29 at p. 4) SVA commented that DOE should consider price trend differences between Class A glass front beverage vending machines and conventional (Class B) beverage vending machines. (SVA, No. 30 at p. 2) Advocates commented that price trends as used in the preliminary analysis are sufficient and that prices for overall BVM units are not likely to decline as quickly as LED and accessory prices. (Joint Comment, No. 27 at p. 2)

DOE acknowledges the Advocates' comment supporting price trends. Regarding AMS's comment concerning the impact of SNAP on price trends of BVM equipment, DOE's analysis accounts for the impact of the SNAP rules on the U.S. beverage vending machine market.[27] Specifically, this analysis reflects the promulgation of final rule 19 (80 FR 19454), which allows for the use of certain hydrocarbon refrigerants in BVM applications, and final rule 20, which changed the status of R–134a to unacceptable for BVM applications 80 FR 42870, 42917–42920 (July 20, 2015). See appendix 8C of the NOPR TSD for a detailed discussion of the price trend numbers. In response to SVA's comment, DOE agrees that it would be better to have data very specific to individual equipment class price trends. However, such data are not available. The Producer Price Index (PPI) used in the analysis of price trends embodies the price trends of beverage vending machines as well as other vending machines. DOE performed a sensitivity analysis with price trends held constant, and found that doing so did not impact the selection of efficiency levels for TSLs. (See appendix 10D of the NOPR TSD.) Because DOE believes there is evidence of price learning in many appliances and equipment, and historical evidence of real price decline in beverage vending machines, DOE continued to include price learning based scenario for the NOPR.

DOE re-examined the data available and updated the price trend analysis for this NOPR analysis. DOE continued to use the automatic merchandising machines PPI but included historical shipments data from the U.S. Census Bureau's Current Industrial Reports to examine the decline in inflation adjusted PPI as a function of cumulative beverage vending machine shipments. Using these data for the beverage vending machines price trends analysis and DOE's projections for future shipments yields a price decline of roughly 10 percent over the period of 2014 through 2048. For the LCC model, between 2014 and 2019, the price decline is 1 percent. DOE used this revised price trend in the NOPR analysis, which reflects analytical techniques more consistent with the methodology DOE has preferentially used for other appliances. See appendix 8C of the TSD for further details on the price learning analysis.

2. Energy Prices

DOE derived electricity prices from the EIA energy price data for regional average energy price data for the commercial and industrial sectors (manufacturing facilities). DOE used projections of these energy prices for commercial and industrial customers to estimate future energy prices in the LCC and PBP analysis. EIA's Annual Energy Outlook 2014 (*AEO2014*) was used as the default source of projections for future energy prices.

DOE developed estimates of commercial and industrial electricity prices for each state and the District of Columbia. DOE derived average regional energy prices from data that are published annually based on EIA Form 826. DOE then used EIA's *AEO2014* price projections to estimate regional commercial and industrial electricity prices in future years. DOE assumed that 60 percent of installations were in commercial locations and 40 percent were in industrial locations.

3. Maintenance, Repair, and Installation Costs

DOE considered any expected changes to maintenance, repair, and installation costs for the beverage vending machines covered in this rulemaking. Typically, small incremental changes in equipment efficiency incur little or no changes in repair and maintenance costs over baseline equipment. The repair cost is the cost to the customer for replacing or repairing components in the BVM equipment that have failed. The maintenance cost is the cost to the customer of maintaining equipment operation. There is a greater probability that equipment with efficiencies that are significantly higher than the baseline will incur increased repair and maintenance costs, as such equipment is more likely to incorporate technologies that are not widely available or are less reliable than conventional, baseline technologies.

DOE based repair costs for baseline equipment on data in a Foster-Miller Inc.[28] report with adjustments to account for LED lighting. Maintenance costs include both preventative maintenance and annualized cost of refurbishment. Two ENERGY STAR

[27] Docket No. EPA–HQ–OAR–2014–0198 and Docket No. EPA–HQ–OAR–2013–0748.

[28] Foster-Miller, Inc. *Vending Machine Service Call Reduction Using the VendingMiser,* February 18, 2002. Report BAY–01197. Waltham, MA.

reports indicate that beverage vending machines are refurbished every 4 to 5 years; therefore, DOE estimated that beverage vending machines undergo refurbishment every 4.5 years. DOE used RSMeans [29] data for preventative maintenance costs and used data from the 2009 BVM final rule [30] for the annualized cost of refurbishment.

In the 2009 BVM rulemaking, DOE assumed that more-efficient beverage vending machines would not incur increased installation costs. Further, DOE did not find evidence of a change in repair or maintenance costs by efficiency level with the exception of repair cost decreases for efficiency levels that used LED lighting.

NAMA commented that more efficient equipment uses newer, more expensive technology with no proven track record and, as such, higher efficiency levels will yield higher repair costs. (NAMA, No. 32 at p. 3) DOE also received comment that different refrigerants might have different maintenance costs. (SCE, Public Meeting Transcript, No. 33 at p. 93)

DOE has not included different installation, maintenance, and repair costs for equipment with greater efficiency than the baseline efficiency models given the uncertainty of whether costs might actually increase or decrease with more efficient equipment. DOE has no information to suggest that maintenance costs vary with efficiency. DOE's repair costs are based on the annualized repair cost for baseline equipment from data in the Foster-Miller Inc. 2002 report,[31] adjusted for fewer lighting repairs and replacements (due to longer lifetimes of LED fixtures as compared to fluorescents), and to reflect 2014 prices (see chapter 8 of the NOPR TSD). DOE does not currently have sufficient data regarding the individual cost and lifetime or failure rate of each technology to account for variations in higher efficiency technologies.

Regarding SCE's comment that refrigerants might have different maintenance and repair costs, DOE accounted for this by applying the same assumptions regarding increased cost of refrigeration system components used in the engineering analysis (see chapter 5 of the TSD) to the refrigeration system components and costs from the Foster Miller report. Specifically, DOE assumed that CO_2 and propane refrigeration systems were 50 percent more expensive than R–134a refrigeration systems. As such, this results in a higher average annual repair cost for CO_2 and propane beverage vending machines of approximately $30 relative to equipment that uses HFC. DOE acknowledges that propane may incur higher maintenance costs due to more stringent safety requirements; however, such increased costs are difficult to quantify at this time, as propane has only very recently become an approved refrigerant on the EPA SNAP list. 80 FR 19454, 19491 (April 10, 2015).

DOE requests comment on the maintenance and repair costs modeled in the LCC analysis and especially appreciates additional data regarding differences in maintenance or repair costs that vary as a function of refrigerant, equipment class, or efficiency level (section VII.E of this NOPR).

4. Equipment Lifetime

DOE used information from various literature sources and input from manufacturers and other interested parties to establish average equipment lifetimes for use in the LCC and subsequent analyses. The 2009 final rule assumed that average BVM lifetime is 10 years. 74 FR 44914, 44927 (August 31, 2009). For this NOPR, a longer average lifetime of 13.5 years is assumed based on refurbishments occurring twice during the life of the equipment at an interval of 4.5 years. This estimate is based on a 2010 ENERGY STAR webinar,[32] which reported average lifetimes of 12 to 15 years, and data on the distribution of equipment ages in the stock of beverage vending machines in the Pacific Northwest from the Northwest Power and Conservation Council 2007 Regional Technical Forum [33] (RTF), which observed the age of the units in service to be approximately 8 years on average. Also, in response to the framework document, AMS commented that their machines were built to last 15 years (AMS, No. 17 at p. 12). DOE further assumed in the preliminary analysis that more efficient equipment will not have different lifetimes than the baseline equipment. SVA agreed with DOE's assumption that new technologies will not impact equipment lifetimes. (SVA, No. 30 at p. 2) DOE did not find evidence to the contrary, so it has maintained this assumption in the current analysis. This is supported by the comment made by AMS regarding the lifetime of their equipment.

In the preliminary analysis stage in the rulemaking, DOE received comments about equipment lifetimes. NEEA requested confirmation that refurbishments are included in maintenance and repair costs. (NEEA No. 33 at p. 116) NEEA requested clarification on when DOE was accounting for refurbishments in their analysis. (NEEA, No. 33 at p. 108) AMS agreed that the lifetime estimations presented are a reasonable approximation of real-world BVM lifetimes. AMS also stated that they believe the efficiency level will have an impact on BVM lifetimes. AMS believes that designs for higher efficiency include technologies that are less mature and would likely lower the lifetimes of the equipment until these technologies are more mature. (AMS, No. 29 at p.5)

As discussed in section IV.F.3 of this NOPR, refurbishment costs are included in the maintenance costs, and a discussion of how maintenance and repair costs are derived is in chapter 8 of the NOPR TSD. DOE acknowledges AMS's comment regarding efficiency levels' potential impact on BVM lifetimes. However, without reliable data, DOE did not have justification to establish different lifetimes based on the considered efficiency levels. DOE believes a lifetime of 13.5 years across efficiency levels is a representative lifetime assumption for beverage vending machines. DOE used this assumption in its analysis for this NOPR.

DOE notes that assumptions regarding equipment lifetime and refurbishment cycles also affect DOE's shipments model, which is discussed in section IV.G.1 of this NOPR.

DOE requests comment on the assumed lifetime of beverage vending machines and if the lifetime of beverage vending machines is likely to be longer or shorter in the future (section VII.E of this NOPR).

DOE requests comment on its assumption that a beverage vending machine will typically undergo two

[29] *RSMeans Facilities Maintenance & Repair 2010,* 17th Annual Edition. 2009. Kingston, MA.

[30] U.S. Department of Energy—Office of Energy Efficiency and Renewable Energy. *Chapter 8 Life-Cycle Cost And Payback Period Analyses, Beverage Vending Machines Final Rule Technical Support Document.* 2009. Washington, DC. (Last accessed January 2015.) *https://www1.eere.energy.gov/buildings/appliance_standards/commercial/pdfs/bvm_final_fr_tsd_chapter_8.pdf.*

[31] Foster-Miller, Inc. Vending Machine Service Call Reduction Using the VendingMiser, February 18, 2002. Report BAY–01197. Waltham, MA.

[32] USEPA (2010) Always Count Your Change, How ENERGY STAR Refrigerated Vending Machines Save Your Facility Money and Energy. Available online: *http://www.energystar.gov/ia/products/vending_machines/Vending_Machine_Webinar_Transcript.pdf.* Accessed May 16, 2014.

[33] 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.

refurbishments during the course of its life and if refurbishments are likely to increase or decrease in the future (section VII.E of this NOPR). DOE also requests comment on the applicability of this assumption to all equipment classes (section VII.E of this NOPR).

DOE requests further input or evidence regarding any technology options considered that would be expected to reduce overall equipment lifetimes and if so, by how much (section VII.E of this NOPR).

5. Discount Rates

DOE developed discount rates by estimating the average cost of capital to companies that purchase beverage vending machines covered under this rulemaking. DOE commonly uses the cost of capital to estimate the present value of cash flows to be derived from a typical company project or investment. Most companies use both debt and equity capital to fund investments, so the cost of capital is the weighted-average cost to the firm of equity and debt financing.

6. Equipment Efficiency in the No-New-Standards Case

To accurately analyze the incremental costs and benefits of the proposed standard levels, DOE's analyses consider the projected distribution of equipment efficiencies in the no-new-standards case (the case without new energy efficiency standards). That is, DOE calculates the percentage of customers who would be affected by a standard at a particular efficiency level (in the LCC and PBP analysis, discussed in this section IV.F), as well as the national benefits (in the NIA, discussed in section IV.G) and impacts on manufacturers (in the MIA, discussed in section IV.I) recognizing that a range of efficiencies currently exist in the market place for beverage vending machines and will continue to exist in the no-new-standards case.

To estimate the efficiency distributions for each equipment class, DOE relied on all publicly available energy use data. Specifically, the market efficiency distribution was determined separately for each equipment class and for each refrigerant. For equipment for which certification information was available in the DOE certification[34] and ENERGY STAR databases,[35] these data were used to determine the efficiency distribution of models within the equipment class, which only included Class B CO_2 equipment.

For Class A and Class B equipment that is not represented in DOE's combined BVM models database (Class A CO_2 equipment and Class A and Class B propane equipment), were assumed to be all ENERGY STAR compliant in the no-new-standards case. DOE made this assumption because DOE believes that, given the desire by most major bottlers for ENERGY STAR-listed equipment, if a manufacturer were to redesign a case to use a new refrigerant, it is likely that they would also bring the model up to ENERGY STAR performance levels. Or, if a manufacturer did not reengineer the model to meet the ENERGY STAR level independently, DOE assumed that it is likely that a manufacturer would use the same case and basic accessory set (*i.e.,* non-refrigeration system components) available on other similar ENERGY STAR-listed models using R–134a, changing only the compressor, as opposed to building separate less efficient components for the propane cases. Under these assumptions, DOE determined the ENERGY STAR performance level for each equipment class and refrigerant based both on the absolute DEC level, as well as the design option set included in such level. Both analysis approaches resulted in selection of the first efficiency level above the baseline, or EL 1, for Class A and Class B propane equipment and for Class A CO_2 beverage vending machines. Therefore, all shipments of Class A and Class B propane, as well as Class A CO_2 are assumed to be at EL 1, which corresponds to the ENERGY STAR level for Class A equipment and slightly below ENERGY STAR for Class B equipment (ENERGY STAR is EL 2 for Class B equipment).

DOE requests comment on its assumption that all baseline Class A and Class B propane and Class A CO_2 equipment would be EL 1 (section VII.E of this NOPR).

For Combination A and Combination B beverage vending machines, DOE notes that very little data exist regarding the efficiency distribution of such equipment. However, DOE has observed that all manufacturers of Combination A and Combination B equipment also produce Class A and/or Class B equipment. Therefore, based on the same analysis methodology used for Class A and Class B propane equipment and Class A CO_2 equipment, DOE estimated the efficiency distribution of Combination A and Combination B equipment based on the design option set reflected in the efficiency distribution for Class A and Class B equipment that are currently available on the market. Specifically, DOE assumed that it is likely that a manufacturer would use the same basic cabinet design and feature set available on combination vending machines as are available on similar Class A or Class B equipment, as opposed to developing separate, less efficient designs for their combination models. However, DOE notes that there are some BVM manufacturers that produce only Class A and/or Class B equipment and that these manufacturers typically produce the most efficient units. To reflect this fact, DOE assumed that the design option set corresponding to the ENERGY STAR levels for Class A and Class B equipment, which is the most common design, represented the maximum efficiency for combination equipment and an equivalent market share for combination equipment. That is, the market share at the ENERGY STAR level for Class A and Class B equipment was assumed to be applicable to the efficiency level corresponding to a similar equipment design (but not necessarily similar DEC) for Combination A and Combination B equipment, respectively. The remaining shipments were equally distributed between the ''ENERGY STAR equivalent'' efficiency level and the baseline efficiency level, or EL 0.

To project this efficiency distribution over the analysis time frame in the no-new-standard case, DOE assumed that the efficiency distribution that currently exists in the market would be maintained over the analysis period (2019–2048). Chapter 8 of this NOPR TSD provides more detail about DOE's approach to developing no-new-standards case efficiency distributions.

DOE requests comment on its assumption that Combination A and Combination B beverage vending machines have efficiency distributions similar to Class A and Class B equipment because manufacturers will use the same cabinet and similar components in the combination machines as the conventional Class A and Class B equipment (section VII.E of this NOPR).

In the preliminary analysis stage of this rulemaking, DOE received several comments regarding the efficiency distribution of BVM equipment and underlying data. AMS disagreed with the current approach to estimate the efficiencies of equipment shipments because of the impact of the EPA SNAP program and the optimistic assumption of 93 percent Energy Star compliance. AMS also stated that since combination machines are not subject to DOE rules, shipments of combination machines with operating efficiencies less than EL0

[34] *https://www.regulations.doe.gov/ccms.*

[35] *http://www.energystar.gov/productfinder/product/certified-vending-machines/results.*

are more common. (AMS, No. 29 at p. 5–6) SVA commented that Class A and B data in the Energy Star and CCMS databases are too low due the lighting systems being shut down during testing. (SVA, No. 30 at p. 2)

In response to AMS's comment regarding the impact of EPA's SNAP on ENERGY STAR compliance, DOE notes that it independently developed efficiency distributions for each equipment class and refrigerant. As stated previously, for Class A CO_2 equipment and Class A and B propane equipment, DOE developed no-new-standards case efficiency distributions based on the assumed efficiency level of equipment when actual model performance data did not exist. Based on DOE's engineering data, DOE does not anticipate difficulty in these alternative refrigerants meeting ENERGY STAR performance levels. DOE notes that some Class B CO_2 BVM models are currently certified in the ENERGY STAR database and propane is inherently a more efficient refrigerant than CO_2.

Regarding the efficiency distribution of combination machines, as stated above, DOE assumed that combination vending machines enter the market at efficiency levels similar to, but slightly less than, the comparable Class A and Class B efficiency distributions. In response to AMS's comment, each efficiency level is uniquely defined for each equipment class and EL0 represents the baseline efficiency for Combination A and Combination B equipment. DOE acknowledges that Combination A and Combination B equipment classes may be less efficient than Class A and B equipment because these classes have not previously been subject to standards. Therefore, DOE designed the EL0 level for these classes to reflect the minimum efficiency combination equipment that may currently exist in the market. Based on the definition of EL0 as the baseline or minimum efficiency for each equipment class, it is not possible for equipment to have lower efficiency than the baseline. See chapter 5 of the NOPR TSD for a discussion of the technology options that define the baseline Combination A and B equipment, which define EL0.

In response to SVA's comment regarding the accuracy of the ENERGY STAR and CCMS data for Class A and Class B equipment, DOE acknowledges that currently manufacturers can utilize certain types of lighting controls within the ENERGY STAR and CCMS testing databases that comply with the DOE test procedure for beverage vending machines at 10 CFR 431.294. Specifically, ASHRAE Standard 32.1–2010, which is currently incorporated by reference in the DOE test procedure, specifies that machines may be tested with energy management controls that are ''permanently operational and not capable of being adjusted by a machine operator'' operable. However, in absence of other information, DOE decided to continue using the ENERGY STAR and CCMS data to develop no-new-standards case efficiency levels. DOE notes that the recently published 2015 BVM test procedure final rule adopted a new Appendix A that contains the test procedure that should currently be used to certify equipment with existing energy conservation standards. Several clarifications were adopted in Appendix A, including the specification that, while energy management systems that cannot be adjusted by the machine operator may be employed, all lighting is to be illuminated to the maximum extent throughout the test. DOE notes that such treatment may be different than SVA's interpretation of the test procedure at the time of commenting, as SVA submitted their comment prior to the publication of the test procedure final rule.

7. Split Incentives

DOE acknowledges that in most cases the purchasers of beverage vending machines (a bottler or a vending services company) do not pay the energy costs for operation and thus would not directly reap any energy cost savings from more-efficient equipment. However, DOE believes that BVM owners would seek to pass on higher equipment costs to the users who pay the energy costs, if possible. DOE understands that the BVM owner typically has a financial arrangement with the company or institution on whose premises the beverage vending machine is located, in which the latter may pay a fee or receive a share of the revenue from the beverage vending machine. Thus, DOE expects that BVM owners could modify the arrangement to effectively pass on higher equipment costs. Therefore, DOE's LCC and PBP analysis uses the perspective that the company or institution on whose premises the beverage vending machine is located pays the higher equipment cost and receives the energy cost savings. DOE acknowledges that there is uncertainty about the pass-through of higher equipment costs, and thus it requests comments concerning the extent to which such pass-through occurs in the BVM market.

DOE also received comments about the split incentives used in the LCC analysis in the preliminary analysis stage of the rulemaking. AMS commented that it has no direct knowledge of the financial arrangements between BVM owners and the party that pays for the energy costs and whether increased costs can be passed to the party that pays the energy costs. (AMS, No. 29 at p. 5) SVA commented that additional equipment costs would not be passed along to those who pay the energy costs. (SVA, No. 30 at p. 2) NEEA commented that it was aware of one large bottler that passes the electricity cost directly through the vended product. (NEEA, Public Meeting Transcript, No. 33 at p. 97)

DOE acknowledges the comments regarding whether energy costs are passed onto the beverage vending machine owners, but given the uncertainty on the subject and absence of better information, DOE believes that its approach is reasonable to apply.

G. National Impact Analysis

The NIA assesses the NES and the NPV from a national perspective of total customer costs and savings expected to result from new or amended energy conservation standards at specific efficiency levels (*i.e.,* TSL) for each equipment class of beverage vending machines. DOE calculates the NES and NPV based on projections of annual equipment shipments, along with the AEC and total installed cost data from the LCC analysis. For the NOPR analysis, DOE forecasted the energy savings, operating cost savings, equipment costs, and NPV of customer benefits for equipment sold from 2019 through 2048 (the expected year in which the last standards-compliant equipment is shipped during the 30-year analysis).

DOE evaluates the impacts of new and amended standards by comparing base-case without such standards with standards-case projections. The no-new-standards case characterizes energy use and customer costs for each equipment class in the absence of any amended energy conservation standards. DOE compares these no-new-standards case projections with projections characterizing the market for each equipment class if DOE adopted the new and amended standards at each TSL. For the standards cases, DOE assumed a ''roll-up'' scenario in which equipment at efficiency levels that do not meet the standard level under consideration would ''roll up'' to the efficiency level that just meets the proposed standard level, and equipment already being purchased at efficiency levels at or above the proposed standard level would remain unaffected.

DOE uses a spreadsheet model to calculate the energy savings and the national customer costs and savings from each TSL. The NOPR TSD and other documentation that DOE provides during the rulemaking help explain the models and how to use them, and interested parties can review DOE's analyses by interacting with these spreadsheets. The NIA spreadsheet model uses average values as inputs (rather than probability distributions of key input parameters as used in the LCC). To assess the effect of input uncertainty on NES and NPV results, DOE developed its spreadsheet model to conduct sensitivity analyses by running scenarios on specific input variables.

For the current analysis, the NIA used projections of energy price trends from the *AEO2014* reference case. In addition, DOE analyzed scenarios that used inputs from the *AEO2014* low economic growth and high economic growth cases. These cases have lower and higher energy price trends, respectively, compared to the reference case. NIA results based on these cases are presented in appendix 10E of the NOPR TSD.

A detailed description of the procedure to calculate NES and NPV and inputs for this analysis are provided in chapter 10 of the NOPR TSD.

1. Shipments Analysis

DOE uses forecasts of annual product shipments to calculate the national impacts of standards (NES and NPV) and to calculate the future cash flows of manufacturers.[36] DOE developed shipments forecasts based on an analysis of key market drivers for the particular equipment. In DOE's shipments model, shipments of equipment are driven by stock replacements assuming that the overall population of beverage vending machines will slightly decrease over the next several decades.

In the preliminary analysis, DOE estimated that the current stock of units installed in the field is 2.6 million. While it is true that new geographical locations may add vending machines to the current stock, DOE stated that many places are removing vending machines, and as such, that total stock will continue to decline. In the preliminary analysis, DOE used publicly available reports from ENERGY STAR on the market penetration of ENERGY STAR qualified machines to estimate total sales from 2005 to 2012. These reports indicated that shipments of new equipment have remained stagnant at approximately 100,000, and DOE assumed this would continue into the future. Therefore, in the preliminary analysis, DOE estimated that the total stock of beverage vending machines would decline to 1.51 million by 2019, and then stabilize at around 1.45 million through to 2050. DOE also estimated that all new shipments of BVM units were to replace existing equipment at the end of its useful life, consistent with the assumption of declining stock and the fact that the number of retiring units far exceeds units shipped.

SVA commented that DOE's shipments assumptions are too high. Sanden estimated that shipments are closer to 35,000 units a year and have been decreasing the past 7 years. (SVA, No. 30 at p. 3) An unidentified commenter during the public meeting stated that DOE's estimate of 100,000 shipments is too high. (Public Meeting Transcript, No. 33 at p. 107) In discussion of shipments, AMS stated that their equipment would all be classified as size Medium Class A and their combination machines would be classified in the small volume category. (AMS, No. 29 at p. 4)

DOE revised its shipments estimate in the NOPR analysis based on available information and estimates provided by manufacturers in response to the preliminary analysis phase of this rulemaking through the manufacturer interview process (see section IV.I.3 of this NOPR) to 45,000 new shipments per year in 2014. DOE modeled historical shipments for the period between 2006 and 2014 by assuming shipments of beverage vending machines decreased linearly from approximately 100,000 units per year, which was assumed in the 2009 BVM final rule (74 FR 44914, 44928, (August 31, 2009)) to 45,000 units per year. Based on these shipments, by 2014, the estimated stock has dropped from approximately 3M to 2.2M units surviving. DOE notes that if shipments were maintained around 45,000 units per year over the 30-year analysis period, this would result in a dramatic decline in overall stock of beverage vending machines in the United States and would reflect many current BVM owners removing BVM units from the marketplace permanently. Specifically, constant shipments of 45,000 would result in an 80 percent permanent reduction in BVM stock to approximately 600,000 units starting around 2030. Such a scenario would represent a significant change in the availability of vending machines in the nation and viability of the BVM industry, and DOE has not been able to identify any literature, data, or information that would support such a drastic change in the distribution of BVM units in the United States. As noted in chapter 9 of the preliminary analysis TSD, DOE referenced any available market literature as well as information regarding trends to limit availability of sugary beverages and snack food, particularly in schools, but notes that such information is extremely limited. DOE also notes that the types of vended products available in beverage vending machines are not limited to soda or other sugary beverages and that sales of water, energy drinks, and sports drinks have been increasing over the past several years.[37] Lacking any data indicating or supporting a significant reduction in availability or deployment of beverage vending machines, DOE believes it is reasonable to assume that the current estimate of 45,000 new shipments per year represents a low point and that shipments will recover overtime to maintain reasonably constant stocks of beverage vending machines into the future.

For the shipments model in this NOPR, DOE increased the historical shipments values between 1998 and 2006 by 18 percent to reflect the fact that the 2009 BVM final rule shipments model addresses only Class A and Class B equipment, not combination equipment. DOE estimates that combination machines represent 18 percent of total beverage vending machine shipments, as discussed further in section IV.G.1.a. Increasing the shipments and stock of beverage vending machines assumed in the 2009 BVM final rule resulted in a stock of 3.1 M BVM units in the United States in 2006. Between 2006 and 2014 DOE estimated that, consistent with SVA's observation that shipments have been declining over the past several years, shipments declined linearly from 118,000 in 2006 to 45,000 in 2014. Based on these shipments, by 2014, the estimated stock has dropped to 2.2M units surviving in 2014.

DOE modeled future shipments of new beverage vending machines from 2014–2048 based on data from Vending Times Census of the Industry 2014[38] that reported BVM stock trends in the commercial and industrial building sectors, as well as specific commercial and industrial building sectors where

[36] DOE uses all available data on manufacturer model availability, shipments, or national sales to develop estimates of the number of BVM units of each equipment class sold in each year of the analysis period. In general one would expect a close correspondence between shipments and sales and a reasonable correlation between model availability and sales.

[37] Vending Times Census of the Industry 2013 and 2014. Available at *www.vendingtimes.com.*

[38] Vending Times Census of the Industry 2014. Available at *www.vendingtimes.com.*

beverage vending machines are commonly deployed. For each commercial and industrial building sector, DOE modeled an average annual percentage reduction in stock, as shown in Table IV.5, based on an assumed percentage reduction in BVM units for different commercial building uses. The number of buildings for each sector was also evaluated based on data available from the 2012 Commercial Building Energy Consumption Survey (CBECS),[39] and an average increase in number of buildings was calculated by comparing 2012 CBECS data to historical 2003 CBECS data. Such a method accounts for the estimated growth in commercial buildings and decline in BVM units deployed in each commercial and industrial building sector individually. Then, to calculate the estimated BVM stock in future years through 2048, a building weighted average of average annual stock reductions was calculated for the industry overall and applied to current stock information starting in 2014. The estimated stock in 2048, based on this method is 1.8M, a 20 percent decrease from the 2.2M estimated in 2014. When accounting for the growth in number of buildings in the applicable commercial and industrial building sectors, this represents a decline in average saturation of beverage vending machines from 0.77 beverage vending machines per building in 2014 to 0.35 beverage vending machines per building in 2048.

TABLE IV.5—AVERAGE ANNUAL PERCENT REDUCTION IN BVM STOCK AND GROWTH IN NUMBER OF BUILDINGS FOR EACH INDUSTRIAL SECTOR AND THE INDUSTRY OVERALL

Commercial and industrial building sector *	Average annual % reduction in BVM stock	Annual growth in # of buildings (est. from CBECS data) *
Plants, Factories	0.29%	3.01%
Schools & Colleges and Universities	0.74	0.09
Public Locations	0.38	−0.80
Government and Military	0.29	2.03
Offices, Office Complexes	0.74	2.54
Hospitals, Nursing Homes	1.47	2.41
Other Locations	0.45	1.27
Total	0.55	1.78

* Note that the commercial and industrial building sectors assumed in this analysis correspond to those referenced in the 2013 Vending Times Census of the Industry. DOE mapped the CBECS building types to these commercial and industrial building sectors and provides a description of that mapping in chapter 9 of the NOPR TSD.

For more information on DOE's shipments estimates, the shipments analysis assumptions, and details on the calculation methodology, refer to chapter 9 of the NOPR TSD.

DOE requests comment on its assumptions regarding historical shipments between 1998 and 2014 (section VII.E of this NOPR). DOE also requests data from manufacturers on historical shipments, by equipment class, size, and efficiency level, for as many years as possible, ideally beginning in 1998 until the present (section VII.E of this NOPR).

DOE requests comment on its assumptions regarding future shipments. Specifically, DOE requests comment on the stock of BVM units likely to be available in the United States or in particular commercial and industrial building sectors over time (section VII.E of this NOPR). DOE also requests comment on the number of beverage vending machines that are typically installed in each location or building in each industry and if this is likely to increase or decrease over time (section VII.E of this NOPR).

DOE requests comment on its assumptions regarding likely reduction in stock in different commercial and industrial building sectors in which beverage vending machines are typically installed (section VII.E of this NOPR). DOE also requests comment on other factors that might be influencing an overall reduction in BVM stock and if this trend is likely to continue over time (section VII.E of this NOPR).

In this shipments analysis, DOE assumed that the lifetimes of beverage vending machines will remain constant over the 30-year analysis period. However, DOE notes that the number of refurbishments a piece of equipment undergoes and its approximate lifetime will impact its persistence in the market and the need for new units to replace retiring old stock.

DOE also notes that changes in the availability of new refrigerants and limitation of certain other refrigerants for BVM applications may impact the overall BVM market in the United States and, specifically, the future shipments of new beverage vending machines through 2048. However, DOE has no data on which to base any assumptions regarding how changes in refrigerant availability would impact shipments now or in the future. However, DOE notes that it does not expect the specific refrigerant used in a given beverage vending machine to impact demand for beverage vending machines and overall equipment stocks over time. As such, DOE maintains that the historical Vending Times data and stock-based analysis approach that DOE employed to develop shipment assumptions for this NOPR are appropriate and represent the best available information about future shipments of beverage vending machines.

DOE requests comment on the impact of the EPA SNAP rules on future shipments of beverage vending machines, by equipment class, refrigerant, and efficiency level (section VII.E of this NOPR).

a. Market Share by Equipment Class

Given a total volume of shipments, DOE estimates the shipments of each equipment class based on the estimated market share of each equipment class. In the preliminary analysis, DOE assumed that 98 percent of shipments were Class A and Class B, split equally between these two classes, and that Combination A and Combination B each represented 1 percent of the total BVM market.

In response to the preliminary analysis, NAMA commented that almost all shipments by their members are

[39] *http://www.eia.gov/consumption/commercial/reports/2012/preliminary/index.cfm.*

Class A. (NAMA, No. 32 at p. 4) NAMA also commented that Class A equipment from their members would be considered ''medium volume.'' (NAMA, No. 32 at p. 4) NAMA also commented on market share, stating that most are Class A, but some will become Combination A. NAMA stated that there is no data to support market share proportioning. (NAMA, No. 32 at p. 3)

DOE received comments regarding shipments of combination machines. AMS produces machines that would be classified as Combination A, but cannot comment on the market share of their shipments. (AMS, No. 29 at p. 6) SVA commented that it does not manufacture combination machines, but believes that 25 percent is a high number of combination machines in the market relative to bottle vending machines. (SandenVendo, No. 33 at p. 68)

DOE agrees with commenters that the market share of Class A equipment is quite large and possibly larger than Class B. Based on the comments made in response to the preliminary analysis and additional quantitative information provided during manufacturer interviews (see section IV.I.3 of this NOPR), DOE revised the market share assigned to each of the equipment classes, as shown in Table IV.6.

TABLE IV.6—MARKET SHARE OF EACH EQUIPMENT CLASS ASSUMED DURING THE PRELIMINARY ANALYSIS AND NOPR ANALYSIS

Equipment class	Preliminary analysis market share	NOPR Market share
Class A	49%	54.3%
Class B	49	27.7
Combination A	1	9.3
Combination B	1	8.7

In this NOPR analysis, DOE tentatively assumed that the market share for each equipment class was maintained over the 30-year analysis period and did not change as a function of standard level or as a function of changes in refrigerant availability resulting from the two recent EPA SNAP rulemakings. 80 FR 19454, 19491 (April 10, 2015) and 80 FR 42870, 42917–42920 (July 20, 2015). That is, in 2048, Class A, Class B, Combination A, and Combination B continued to represent 54.3, 27.7, 9.3, and 8.7 percent of the market, respectively. DOE made this assumption because it does not have data or information to suggest that the relative shipments of different equipment classes would change over time and, if so, in what direction and on what basis.

In response to SVA's comment, DOE notes that in the preliminary analysis the market share of Combination A and Combination B machines was only 2 percent and, in the NOPR analysis it has been revised to 18 percent based on input manufacturers provided during the manufacturer interviews (see section IV.I.3 of this NOPR).

b. Market Share by Refrigerant

Once DOE has defined shipments by equipment class, DOE also defines the shipments within each equipment class by refrigerant. In the preliminary analysis, DOE assumed a shipments scenario through 2048 in the absence of any changes in refrigerant availability that would result from the promulgation of final rules under EPA's SNAP program, which proposed to change the status of R–134a to unacceptable, and proposed to list propane as acceptable for BVM applications. 79 FR 46126 (August 6, 2014); 79 FR 38811 (July 9, 2014).[40] Specifically, under this ''no change in refrigerant availability'' scenario, DOE assumed 50 percent of beverage vending machine equipment in each equipment class would be CO_2 equipment by 2020. DOE based this assumption based on a public commitment made by Coca-Cola to be ''HFC free by 2015,'' acknowledging that bottlers represent approximately 90 percent of the BVM market[41] and assuming that Coca-Cola represents approximately half of the bottler BVM market[42] DOE assumed that, if Coca-Cola achieves their goal of 100 percent of their machines using CO_2 refrigerant by 2020,[43] it is likely that some other smaller BVM operators may have transitioned to CO_2 refrigerant-based machines based on their availability and proven performance in the market by that time. DOE assumed this applied to all equipment classes equivalently and requested comment from manufacturers on this assumption in the preliminary analysis.

In response, DOE received comments about shipments of CO_2 based equipment. SVA agreed with DOE's assumption that 50 percent of shipments will use CO_2 as a refrigerant by 2020 or earlier, but that since CO_2 has a slightly higher energy consumption than R–134a, any reduction in DEC levels, especially for Class A equipment, could slow the rate of transition as manufactures try to develop equipment that meets MDEC requirements. (SVA, No. 30 at p. 3)

In this NOPR analysis, DOE revised the assumptions regarding the relative shipments of each refrigerant based on recent regulatory actions under EPA's SNAP program, which listed propane and other hydrocarbon refrigerants as acceptable for BVM applications (80 FR 19454, 19491(April 10, 2015)) and changed the status of the industry-standard refrigerant R–134a to unacceptable beginning on January 1, 2019 (80 FR 42870, 42917–42920; July 20, 2015). Specifically, in this NOPR DOE modeled a shipments scenario assuming that all shipments of new BVM equipment would use CO_2 or propane as a refrigerant beginning on January 1, 2019, as required by Final Rule 20. *Id.*

Given the greater market experience with CO_2, DOE assumed that CO_2 would represent 60 percent of the market and propane would represent 40 percent of the market for all equipment classes beginning in 2019 and continuing through the end of the analysis period (2048). Specifically, due to the listing of CO_2 as an acceptable refrigerant for BVM applications several years ago by EPA SNAP, as well as a commitment by Coca-Cola (the largest equipment purchaser) to move away from HFC refrigerants in the near future, the

[40] DOE notes that both rules were only proposed at the time of the preliminary analysis.

[41] Northwest Power and Conservation Council Regional Technical Forum. 2007. ''Characterization of Energy Efficiency Opportunities in Vending Machines for the Northwestern US Market.''

[42] R744, ''Coca-Cola to approve 9 models of CO_2 vending machine—exclusive interview,'' Available online *http://www.r744.com/news/view/3466.*

[43] To date, Coca-Cola is slightly behind their stated goal of 2015. The Coca-Cola Company (2014) 2013/2014 Global Reporting Initiative Report. Available online *http://assets.coca-colacompany.com/1a/e5/20840408404b9bc484ebc58d536c/2013-2014-coca-cola-sustainability-report-pdf.pdf.*

market has already seen evolution towards the widespread use of CO_2. In response to SVA's comment regarding the rate of adoption of CO_2 equipment, DOE believes that 2019 provides manufacturers sufficient time to develop new equipment designs to meet MDEC requirements.

However, DOE acknowledges that propane-based BVM models have only very recently become authorized under SNAP and that there is much more limited industry experience with this refrigerant. DOE has based this NOPR analysis on the use of propane as an alternative refrigerant, in addition to CO_2, and assumed that propane-based BVM models will represent 40 percent of shipments by 2019. As mentioned in the engineering analysis, DOE believes this assumption is reasonable based on use of propane as a refrigerant in other, similar, self-contained commercial refrigeration applications. (See, *e.g.,* Docket No. EPA–HQ–OAR–2014–0198, The Environmental Investigation Agency, No. 0134)

DOE's shipments analysis and assumptions are discussed in more detail in chapter 9 of the NOPR TSD.

DOE requests comment on its assumptions regarding the relative market share of each refrigerant by equipment class (section VII.E of this NOPR).

c. High and Low Shipments Assumptions

DOE recognizes that there is a considerable amount of uncertainty associated with forecasting future shipments of beverage vending machines. As such, in addition to the primary shipments scenario presented above, DOE also estimated low and high shipments scenarios as sensitivities on the primary scenario. The low and high shipments scenarios include the same assumptions regarding market share by equipment class and refrigerant, which is that just the magnitude of total shipments of new beverage vending machines is varied among the scenarios. Specifically, for the low shipments scenario, DOE assumed that shipments declined to 45,000, as suggested by manufacturers, but recover only to 100,000 shipments per year and result in a stock of 1.3 M at the end of the analysis period. This is in contrast to the primary shipments scenario, in which shipments recover past 100,000 BVM units per year and contribute to an overall BVM stock of 1.8 M BVM units at the end of the analysis period. Under the low shipments scenario, the surviving stock of beverage vending machines is 1.34 M BVM units, a 40 percent reduction in units installed in the United States. Conversely, the high shipments scenario assumes the same overall decline in stock assumed in the primary shipment case; that is, a stock of 1.8 M BVM units in 2048. However, the high shipments scenario assumes that shipments recover more quickly than in the primary shipments case. The high shipments scenario assumes shipments of new beverage vending machines recover over the next 10 years and are maintained at approximately 135,000 new BVM units per year from 2024 through 2048. While the high shipments scenario reflects the same stock estimate as the primary shipments scenario in 2048, because the high shipments scenario assumes a faster recovery of shipments; approximately 33 percent more BVM units are shipped between 2019 and 2048 than under the primary shipments scenario. These two sensitivity scenarios are discussed in more detail in chapter 9 of the NOPR TSD.

DOE requests comment on the high and low shipments scenarios (section VII.E of this NOPR).

2. Forecasted Efficiency Trends

A key component of DOE's NIA is the energy efficiencies forecasted over time for the no-new-standards case (without new standards) and each of the standards cases. The forecasted efficiencies represent the annual shipment-weighted energy efficiency of the equipment under consideration during the forecast period (*i.e.,* from the assumed compliance date of a new standard to 30 years after compliance is required).

As discussed above, DOE developed a distribution of efficiencies in the no-new-standards case for the assumed compliance year of new standards for each BVM equipment class. Because no information was available to suggest a different trend, DOE assumed that the efficiency distribution in the no-new-standards case would remain the same in future years. In each standards case, a ''roll-up'' scenario approach was applied to establish the efficiency distribution for the compliance year. Under the ''roll-up'' scenario, DOE assumed: (1) Equipment efficiencies in the no-new-standards case that do not meet the standard level under consideration would ''roll-up'' to meet the new standard level; and (2) equipment efficiencies above the standard level under consideration would not be affected. The ''roll-up'' was a more conservative approach over the ''market shift'' approach. In a market shift approach it is assumed that a given number of customers will prefer to buy equipment above the baseline. Therefore, in a standards case scenario customers will continue to purchase above the new baseline by shifting to an efficiency level that keeps their purchase the same number of efficiency levels above the new baseline until they no longer can do so because the market becomes compressed by the maximum available efficiency level.

DOE received comments during the preliminary analysis regarding the NIA analysis. Sanden commented that energy consumption levels will increase as new interactive technologies are used in beverage vending machines. (SVA, No. 30 at p. 3) NEEA commented that a company may decide to move from the baseline to EL4 not the next EL that minimizes costs. (NEEA No. 33 at p. 117)

DOE acknowledges the comments on forecasted efficiency distributions and that customers may choose to skip efficiency levels; however, without better information DOE chose to stay with the more conservative approach of rolling up to the next efficiency level to minimize costs, which is consistent with expected business behavior in competitive markets. In response to SVA's comments, DOE also acknowledges that customers may be influenced by a variety of factors that would prevent them from simply shifting their purchasing behavior to an energy efficiency level equivalently higher than the new standard-level equipment due to the increased availability of beverage vending machines with new customer interactive technologies, such as digital graphics display screens, that increase the energy consumption of BVM models compared to units without such screens.

DOE also recognizes that recent changes in refrigerant availability resulting from the two recent EPA SNAP rulemakings may have an impact on forecasted efficiency distributions under the no-new-standards case. 80 FR 19454, 19491 (April 10, 2015) and 80 FR 42870, 42917–42920 (July 20, 2015). However, DOE did not account for such in this NOPR analysis, as DOE does not have data or information to suggest how efficiency distributions of different equipment classes or refrigerants would change over time and, if so, in what direction and on what basis as a result of these changes.

DOE requests comment on the impact of the recent EPA SNAP rulemakings changing the availability of certain refrigerants for the BVM application on future efficiency distributions (section VII.E of this NOPR).

3. National Energy Savings Analysis

The inputs for determining the NES are: (1) Annual energy consumption per unit; (2) shipments; (3) product or equipment stock; (4) national energy consumption; and (5) site-to-source conversion factors. As discussed in the energy use analysis, DOE calculated the national energy consumption by multiplying the number of units (stock) of each type of equipment (by vintage or age) by the unit energy consumption (also by vintage). Vintage represents the age of the equipment.

DOE calculated annual NES based on the difference in national energy consumption for the no-new-standards case (without new efficiency standards) and for each higher efficiency standard.[44] Cumulative energy savings are the sum of the annual NES over the period in which equipment shipped in 2019–2048 are in operation.

DOE uses a multiplicative factor called ''site-to-source conversion factor'' to convert site energy consumption (at the commercial building) into primary or source energy consumption (the energy input at the energy generation station required to convert and deliver the energy required at the site of consumption). These site-to-source conversion factors account for the energy used at power plants to generate electricity and for the losses in transmission and distribution, as well as for natural gas losses from pipeline leakage and energy used for pumping. For electricity, the conversion factors vary over time due to projected changes in generation sources (that is, the power plant types projected to provide electricity to the country). The factors that DOE developed are marginal values, which represent the response of the system to an incremental decrease in consumption associated with amended energy conservation standards.

For this NOPR, DOE used conversion factors based on the U.S. energy sector modeling using the National Energy Modeling System (NEMS) Building Technologies (NEMS–BT) version that corresponds to *AEO2014* and which provides national energy forecasts through 2040. Within the results of NEMS–BT model runs performed by DOE, a site-to-source ratio for commercial refrigeration was developed. The site-to-source ratio was held constant beyond 2040 through the end of the analysis period (30 years plus the life of equipment).

[44] The no-new-standards case represents a mix of efficiencies above the minimum efficiency level (EL 0). Please see section IV.F.6 for a more detail description of associated assumptions.

a. Full-Fuel-Cycle Analysis

DOE has historically presented NES in terms of primary energy savings. On August 18, 2011, DOE published a final statement of policy in the **Federal Register** announcing its intention to use FFC measures of energy use and greenhouse gas and other emissions in the NIA and emissions analyses included in future energy conservation standards rulemakings. 76 FR 51281. While DOE stated in that document that it intended to use the Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) model to conduct the analysis, it also said it would review alternative methods, including the use of NEMS. After evaluating both models and the approaches discussed in the August 18, 2011 document, DOE published an amended statement of policy, articulating its determination that NEMS is a more appropriate tool for this purpose. 77 FR 49701 (August 17, 2012).

The approach used for this NOPR, and the FFC multipliers that were applied, are described in appendix 10D of the TSD. NES results are presented in both primary and in terms of FFC savings; the savings by TSL are summarized in terms of FFC savings in section I.C of this NOPR.

4. Net Present Value Analysis

The inputs for determining NPV are: (1) Total annual installed cost, (2) total annual savings in operating costs, (3) a discount factor to calculate the present value of costs and savings, (4) present value of costs, and (5) present value of savings. DOE calculated the net savings for 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 calculated savings over the lifetime of equipment shipped in the forecast period. DOE calculated NPV as the difference between the present value of operating cost savings and the present value of total installed costs.

For the NPV analysis, DOE calculates increases in total installed costs as the difference in total installed cost between the no-new-standards case and standards case (*i.e.,* once the standards take effect). Because the more-efficient equipment bought in the standards case usually costs more than equipment bought in the no-new-standards case, cost increases appear as negative values in calculating the NPV.

DOE expresses savings in operating costs as decreases associated with the lower energy consumption of equipment bought in the standards case compared to the no-new-standards case. Total savings in operating costs are the product of savings per unit and the number of units of each vintage that survive in a given year.

DOE multiplied monetary values in future years by the discount factor to determine the present value of costs and savings. DOE estimates the NPV of customer benefits using both a 3-percent and a 7-percent real discount rate as the average real rate of return on private investment in the U.S. economy. DOE uses these discount rates in accordance with guidance provided by the U.S. Office of Management and Budget (OMB) to Federal agencies on the development of regulatory analysis. (OMB Circular A–4 (Sept. 17, 2003), section E, ''Identifying and Measuring Benefits and Costs'') 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 ''societal rate of time preference,'' which is the rate at which society discounts future consumption flows to their present.

H. Customer Subgroup Analysis

In analyzing the potential impact of new or amended standards on commercial customers, DOE evaluates the impact on identifiable groups (*i.e.,* subgroups) of customers, such as different types of businesses that may be disproportionately affected by a national standard level. A customer subgroup comprises an identifiable subset of the population that might be affected disproportionately by new or amended energy conservation standards. The purpose of the subgroup analysis is to determine the extent of this disproportional impact. In comparing potential impacts on the different customer subgroups, DOE may evaluate variations in regional electricity prices, energy use profiles, and purchase prices that might affect the LCC of an energy conservation standard to certain customer subgroups. In the preliminary analysis, DOE requested feedback from interested parties regarding relevant subgroups for consideration and did not receive specific comments regarding customer subgroups to be analyzed. For this rulemaking, DOE identified manufacturing and/or industrial facilities that purchase their own beverage vending machines as a relevant subgroup. These facilities typically have higher discount rates and lower electricity prices than the general population of BVM customers. These two conditions make it likely that this subgroup will have the lowest LCC savings of any major customer subgroup.

DOE determined the impact on this BVM customer subgroup using the LCC spreadsheet model. DOE conducted the LCC and PBP analysis for customers represented by the subgroup. The results of DOE's LCC subgroup analysis are summarized in section V.B.1.b of this NOPR and described in detail in chapter 12 of the TSD.

DOE requests comment on the identification and analysis of beverage vending machine customer subgroups (section VII.E of this NOPR).

I. Manufacturer Impact Analysis

1. Overview

DOE performed a MIA to determine the financial impact of amended energy conservation standards on manufacturers of beverage vending machines, and to estimate the potential impact of such standards on employment and manufacturing capacity. The MIA has both quantitative and qualitative aspects. The quantitative part of the MIA primarily relies on the Government Regulatory Impact Model (GRIM), an industry cash-flow model with inputs specific to this rulemaking. The key GRIM inputs are data on the industry cost structure, equipment costs, shipments, and assumptions about markups and conversion expenditures. The key output is the INPV. Different sets of assumptions (*i.e.,* markup and shipments scenarios) will produce different results. The qualitative part of the MIA addresses factors such as product characteristics, impacts on particular subgroups of firms, and important market and product trends. 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 conducted structured, detailed interviews with manufacturers and prepared a profile of the BVM industry. During manufacturer interviews, DOE discussed engineering, manufacturing, procurement, and financial topics to identify concerns and to inform and validate assumptions used in the GRIM. See section IV.I.3 of this NOPR for a description of the key issues manufacturers raised during the interviews. See appendix 12A of the TSD for a copy of the interview guide.

DOE used information obtained during these interviews to prepare a profile of the BVM industry. Drawing on financial analysis performed as part of the 2009 energy conservation standard for BVMs, as well as feedback obtained from manufacturers, DOE derived financial inputs for the GRIM (*e.g.,* sales, general, and administration (SG&A) expenses; research and development (R&D) expenses; and tax rates). DOE also used public sources of information, including company SEC 10–K filings,[45] corporate annual reports, the U.S. Census Bureau's Economic Census,[46] and Hoover's reports,[47] to develop the industry profile.

In Phase 2 of the MIA, DOE prepared an industry cash-flow analysis to quantify the potential impacts of an amended energy conservation standard on manufacturers of BVMs. In general, energy conservation standards can affect manufacturer cash flow in three distinct ways: (1) Create a need for increased investment; (2) raise production costs per unit; and (3) alter revenue due to higher per-unit prices and possible changes in sales volumes. To quantify these impacts, DOE used the GRIM to perform a cash-flow analysis for the BVM industry using financial values derived during Phase 1.

In Phase 3 of the MIA, DOE evaluated subgroups of manufacturers that may be disproportionately impacted by amended energy conservation standards or that may not be represented accurately by the average cost assumptions used to develop the industry cash-flow analysis. For example, small manufacturers, niche players, or manufacturers exhibiting a cost structure that largely differs from the industry average could be more negatively affected. DOE identified one subgroup for a separate impact analysis, small businesses.

DOE initially identified eight companies that sell BVM equipment in the United States. For the small businesses subgroup analysis, DOE applied the small business size standards published by the Small Business Administration (SBA) to determine whether a company is considered a small business. 65 FR 30836, 30848 (May 15, 2000), as amended at 65 FR 53533, 53544 (Sept. 5, 2000) and codified at 13 CFR part 121. To be categorized as a small business under North American Industry Classification System (NAICS) code 333318, *Other Commercial and Service Industry Machinery Manufacturing,* a BVM manufacturer and its affiliates may employ a maximum of 1,000 employees. The 1,000-employee threshold includes all employees in a business's parent company and any other subsidiaries. Based on this classification, of the eight companies selling BVMs in the United States, DOE identified five manufacturers that qualify as small businesses, one of which is a foreign manufacturer. The BVM small manufacturer subgroup is discussed in chapter 12 of the NOPR TSD and in section V.B.2 of this NOPR.

Additionally, in Phase 3 of the MIA, DOE evaluated impacts of amended energy conservation standards on manufacturing capacity and direct employment. DOE also evaluated cumulative regulatory burdens affecting the BVM industry.

2. Government Regulatory Impact Model

DOE uses the GRIM to quantify the changes in cash flow due to new standards that result in a higher or lower industry value. The GRIM analysis uses a standard, annual 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 2015 (the reference year of the analysis) and continuing to 2048. DOE calculated INPVs by summing the stream of annual discounted cash flows during this period. For BVM manufacturers, 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 a 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 collected this information on the critical GRIM inputs from a number of sources, including publicly available data and interviews with a number of manufacturers (described in the next section). The GRIM results are shown in section V.B.2 of this NOPR. Additional details about the GRIM, the discount rate, and other financial parameters can

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

[46] U.S. Census Bureau, Annual Survey of Manufacturers: General Statistics: Statistics for Industry Groups and Industries. <*http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t*>.

[47] Hoovers Inc. Company Profiles. Various Companies. <*http://www.hoovers.com*>.

be found in chapter 12 of the NOPR TSD.

a. Government Regulatory Impact Model Key Inputs

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 the analyzed equipment can affect the revenues, gross margins, and cash flow of the industry, making these equipment cost data key GRIM inputs for DOE's analysis.

In the MIA, DOE used the MPCs for each considered efficiency level calculated in the engineering analysis, as described in section IV.C of this notice and further detailed in chapter 5 of the NOPR TSD. In addition, DOE used information from its teardown analysis, described in chapter 5 of the TSD, to disaggregate the MPCs into material, labor, and overhead costs. To calculate the MPCs for equipment above the baseline, DOE added the incremental material, labor, and overhead costs from the engineering cost-efficiency curves to the baseline MPCs. These cost breakdowns and product markups were validated and revised with manufacturers during manufacturer interviews. DOE notes that, since all BVM equipment would be required to be compliant with EPA's new Rule 20 regulations prohibiting the use of R–134a after January 1, 2019 (80 FR 42870, 42917–42920; July 20, 2015), the MPCs modeled in the GRIM represent equipment that is compliant with Rule 20 (*i.e.,* uses only CO_2 and propane refrigerants), as well as any existing energy conservation standards for such equipment.

Shipments Forecasts

The GRIM estimates manufacturer revenues based on total unit shipment forecasts by equipment class and the distribution of these values 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 forecasts derived from the shipments analysis. See section IV.G of this NOPR and chapter 10 of the NOPR TSD for additional details.

Product and Capital Conversion Costs Associated With Energy Conservation Standards for Beverage Vending Machines

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

Industry investments related to compliance with EPA Rule 20 are detailed in the next section (''One-Time Investments Associated with EPA SNAP Rule 20'') and are separate from the conversion costs manufacturers are estimated to incur to comply with amended energy conservation standards.

To evaluate the level of capital conversion expenditures manufacturers would likely incur to comply with amended energy conservation standards, DOE used manufacturer interview feedback to determine an average per-manufacturer capital conversion cost for each design option and equipment class. DOE scaled the per-manufacturer capital conversion costs to the industry level using a count of manufacturers producing the given equipment class (*i.e.,* Class A, Class B, Combination A, Combination B). DOE validated manufacturer comments related to capital conversion costs related to amended standards compliance through estimates of capital expenditure requirements derived from the product teardown analysis and engineering analysis described in chapter 5 of the TSD.

As detailed in Section IV.G.1 of this notice, shipments of BVM units with HFC refrigerants are forecasted to fall to zero by 2019 as a result of the EPA SNAP Rule 20 compliance date of 2019. Therefore, DOE estimates no conversion costs associated with the remaining shipments of BVM units with HFC refrigerants that are forecasted to occur during the conversion period (the three years leading up to the amended energy conservation standard year of 2019).

Table IV.7 contains the per-manufacturer capital conversion costs associated with key design options for each equipment class. DOE assumes that all Combination A units share a common cabinet and glass pack design with a Class A unit, and would not carry any additional capital conversion costs.

TABLE IV.7—PER-MANUFACTURER CAPITAL CONVERSION COSTS FOR KEY DESIGN OPTIONS

[2014$ millions]

Design option	Capital conversion costs (2014$ millions)			
	Class A	Class B	Combination A	Combination B
Enhanced Glass Pack	0.06	*N/A	0	N/A
1.125″ Thick Insulation	0.13	0.10	0	0.09
Vacuum Insulated Panels	0.27	0.31	0	0.27

*N/A = Not Applicable

DOE used a top-down approach that relied on manufacturer feedback from interviews to assess product conversion costs for the BVM industry. Using the DOE's CCMS [48] and ENERGY STAR [49] databases, along with manufacturer Web sites, DOE determined the number of platforms that are currently available for each equipment type (*i.e.,* Class A, Class B, Combination A, Combination B). DOE used manufacturer feedback to determine an average per platform product conversion cost by design option and equipment type. DOE then used the platform counts to scale the average per platform product conversion to the industry level. DOE received insufficient feedback from industry to estimate representative product conversion costs for Combination A and Combination B equipment. As a result, DOE scaled Class A product conversion costs to estimate Combination A product conversion costs and DOE scaled Class B product conversion costs to scale Combination B product conversion costs. This scaling was based on the ratio of Combination A to Class A platforms in the industry and the ratio of Combination B to Class B platforms, respectively.

Table IV.8 contains the per-platform product conversion costs associated with key design options for each equipment class.

TABLE IV.8—PER-PLATFORM PRODUCT CONVERSION COSTS FOR KEY DESIGN OPTIONS

[2014$ millions]

Design option	Product conversion costs (2014$ millions)			
	Class A	Class B	Combination A	Combination B
Higher Efficiency Compressor	0.03	0.04	0.004	0.04
Enhanced Glass Pack	0.08	* N/A	0.004	N/A
1.125″ Thick Insulation	0.09	0.05	0.004	0.05
Vacuum Insulated Panels	0.14	0.11	0.004	0.10

* N/A = Not Applicable.

DOE assumes that all energy conservation standards-related conversion costs 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 NOPR. For additional information on the estimated product and capital conversion costs, see chapter 12 of the NOPR TSD.

DOE requests manufacturers provide an estimate of the capital and product conversion costs associated compliance with DOE amended energy conservation standards (section VII.E of this NOPR). In addition, DOE specifically requests feedback from industry regarding the product conversion costs associated with standards compliance for Combination A and Combination B equipment (section VII.E of this NOPR).

One-Time Investments Associated With EPA SNAP Rule 20

As a result of EPA Rule 20, the industry will be required to make an upfront investment in order to transition from the use of R–134a to R–744 or R–290. This industry investment (detailed below) is not a result of the amended DOE energy conservation standards. However, DOE reflects the impact of this investment in both the no-new-standards and standards cases.

EPA Rule 20 did not provide an estimate of the upfront investments associated with a R–134a refrigerant phase-out for BVM manufacturers. Based on feedback in interviews, DOE estimated an upfront cost to the industry to comply with Rule 20 using refrigerants R–744 and R–290. DOE estimated that each BVM manufacturer would need to invest $750,000 to update their products to comply with Rule 20 if they have no compliant products today. DOE assumed this one-time investment applied to all eight manufacturers, resulting in an industry cost of $6 million.[50] DOE believes this is a conservative estimate since there are manufacturers that already have SNAP-compliant products on the market today and those manufacturers would not need to make the same level of investment ahead of the 2019 effective date. For integration into the GRIM, DOE assumed that this one-time cost would occur in 2018 because the EPA's Rule 20 requires a phaseout of R–134a by 2019. This cost is independent of conversion costs that industry would need to make as a result of amended energy conservation standards (discussed in the previous section). Unlike product and capital conversion costs necessitated by DOE energy conservation standards, DOE includes this one-time Rule 20 investment in the GRIM in both the no-new-standards case and the standards case. The costs related to complying with EPA Rule 20 have been incorporated into the baseline to which DOE analyzed these proposed standards. As such, all the costs to industry that occur in the standards case relate to the impact of the proposed energy conservations standards.

DOE requests manufacturers provide an estimate of the one-time investments required to transition to alternative refrigerants, such as CO_2 and propane (section VII.E of this NOPR).

DOE requests that manufacturers provide sufficient detail such that DOE could model and verify these one-time costs related to the change in refrigerants, including the specific capital expenditures required and the potential redesign costs on a per-platform basis (section VII.E of this NOPR).

Additionally, DOE requests manufacturers provide information about the ability to coordinate one-time investments related to EPA Rule 20 compliance and conversion costs necessitated by the DOE energy conservation standards (section VII.E of this NOPR).

b. Government Regulatory Impact Model Scenarios

Manufacturer Markup Scenarios

MSPs include direct manufacturing production costs (*i.e.,* labor, materials, and overhead estimated in DOE's MPCs) and all non-production costs (*i.e.,* SG&A, R&D, and interest), along with profit. To calculate the MSPs in the GRIM, DOE applied manufacturer

[48] "CCMS." CCMS. January 19, 2015. Accessed January 19, 2015. *http://www.regulations.doe.gov/certification-data/.*

[49] ENERGY STAR Certified Vending Machines. June 6, 2013. Accessed January 19, 2015. *http://www.energystar.gov/products/certified-products.*

[50] In the GRIM, the $6 million one-time SNAP investment would affect the industry in the no-new-standards case as well as at each TSL.

markups to the MPCs estimated in the engineering analysis for each equipment class and efficiency level. Modifying these manufacturer markups in the standards case yields different sets of impacts on manufacturers. For the MIA, DOE modeled two standards-case manufacturer markup scenarios to represent the 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 manufacturer markup values that, when applied to the inputted 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 (for a given equipment class), which assumes that manufacturers would be able to maintain the same amount of profit as a percentage of revenues at all efficiency levels within an equipment class. As production costs increase with efficiency, this scenario implies that the absolute dollar markup will increase as well. Based on publicly available financial information for manufacturers of beverage vending machines as well as comments from manufacturer interviews, DOE assumed the average manufacturer markups to vary by equipment class as shown in Table IV.9.

TABLE IV.9—BASELINE MANUFACTURER MARKUPS

Equipment class	Markup
Class A	1.22
Class B	1.17
Combination A	1.36
Combination B	1.36

Because this manufacturer markup scenario assumes that manufacturers would be able to maintain their gross margin percentage markups as production costs increase in response to an amended energy conservation standard, it represents a high bound to industry profitability.

In the preservation of per-unit operating profits scenario, manufacturer markups are calibrated such that the per-unit operating profit in the year after the compliance date of the amended energy conservation standard is the same as in the no-new-standards case for each product class. Under this scenario, as the cost of production goes up, manufacturers are generally required to reduce the markups on their minimally compliant products to maintain a cost-competitive offering. The implicit assumption behind this scenario is that the industry can only maintain operating profits after compliance with the amended standard is required. Therefore, gross margin (as a percentage) is reduced between the no-new-standards case and the standards case. This manufacturer markup scenario represents a low bound to industry profitability under an amended energy conservation standard.

3. Manufacturer Interviews

To inform the MIA, DOE interviewed manufacturers with an estimated combined market share of 78 percent. The information gathered during these interviews enabled DOE to tailor the GRIM to reflect the unique financial characteristics of the BVM industry. During the manufacturer interviews, DOE asked manufacturers to describe their major concerns about this rulemaking. Below, DOE summarizes these issues, which were informally raised in manufacturer interviews, in order to obtain public comment and related data.

a. Uncertainty Regarding Potential EPA Phaseout of Hazardous Refrigerants

Manufacturers expressed significant concern relating to the combined effect of amended energy efficiency standards for BVMs and the proposal by the EPA to change the status of certain HFC's, including R–134a, to unacceptable. At the time of the MIA interviews, EPA SNAP Rule 20 had been proposed, containing a proposed compliance date of January 1, 2016. 79 FR 46126, 46135 (August 6, 2014). The rule has since been finalized with a change of status for R–134a to unacceptable in new vending applications beginning in 2019. 80 FR 42870, 42917–42920 (July 20, 2015).

Manufacturers stated that complying with the current DOE efficiency standard for Class A products has been difficult enough without having to switch refrigerants. They stated that alternative refrigerants may be less efficient than HFC–134a and the proposed ban of HFCs coupled with amended standards for Class A products could potentially limit or prevent certain manufacturers' abilities to maintain Class A product offerings. Manufacturers requested that DOE take the change in refrigerant into account in its analysis.

b. Impact on Product Utility

Manufacturers commented that current Class A standards greatly inhibit their ability to provide all the features demanded by their customers, and, by extension, any amended standard for Class A machines would have an even greater detrimental impact on customer utility and product innovation. Because many of the product add-ons oriented towards greater purchaser interaction—a feature valued by some Class A customers—require more energy, more stringent standards would be in direct conflict with customer utility.

c. Availability of Higher Efficiency Components

Due to the low volume nature of the BVM industry overall, manufacturers expressed concern relating to the availability of components that would be required if energy efficiency standards for beverage vending machines are amended.

Historically, because there has been a minimal market for higher efficiency beverage vending machines, there are few suppliers of higher efficiency components to the industry. These suppliers have had the ability to charge high prices for components.

Manufacturers added that this issue becomes even more burdensome when considering the high efficiency components that will be needed for use in beverage vending machines using natural refrigerants (*i.e.,* CO_2 or propane). BVM manufacturers are concerned that, due to the extremely low number of CO_2 and hydrocarbon component manufactures, the limited availability and cost of these components would significantly increase product manufacturing costs.

4. Discussion of Comments

During the public comment period following the preliminary analysis public meeting, NAMA (a trade association) and AMS (a small business manufacturer of beverage vending machines) provided several comments on the potential impact of amended energy conservation standards on manufacturers.

AMS commented that potential EPA regulations to phase out R–134a could create costs totaling at least $100,000 associated with the need for a new engineering laboratory, manufacturing changes, and new safety equipment to handle hydrocarbon refrigerants. Additionally, AMS pointed out that the EPA proposal to phase out R–134a by 2016 will require product redesign, followed by testing and safety certifications in addition to the restructuring of testing and production facilities. (AMS, No. 29 at p. 3) NAMA also commented that the additional cost of manufacturing and safety equipment needed to produce hydrocarbon refrigeration systems for beverage vending machines would exceed $100,000. Both AMS and NAMA raised concerns that the proposed EPA regulations and an amended energy conservation standard would result in significant cumulative regulatory burden. (AMS, No. 29 at p. 3; NAMA, No. 32 at p. 3)

DOE recognizes that EPA regulations that restrict the use of HFC refrigerants will lead to changes in production costs for manufacturers and necessitate investments. DOE accounted for the forthcoming HFC phase out by estimating refrigerant-specific design pathways, cost efficiency curves and the upfront investments needed to adapt products, production lines, and facilities to the use of propane and CO_2. While AMS and NEMA estimated an investment of $100,000 per manufacturer for capital expenditures such as laboratory, production facility, and safety equipment changes, DOE used a higher value of $750,000 per manufacturer to account for capital expenditures as well as non-equipment costs such R&D, testing, and marketing material changes to bring BVM equipment using propane-290 or R–744 to market. DOE integrated this cost into both the no-new-standards and standards case estimates of INPV. See section IV.I.2. for further detail on one-time costs associated with SNAP Rule 20 compliance. Furthermore, DOE includes the EPA's SNAP Rule 20 in its list of cumulative regulatory burdens in section V.B.2.e of this NOPR.

In comments, AMS noted that while they may be the smallest U.S. manufacturer of beverage vending machines, they do not meet the definition of a ''small business.'' (AMS, No. 29 at p. 1)

For the purposes of the Regulatory Flexibility Analysis, DOE is required to use the SBA definition of ''small business'' for manufacturing. The SBA definition sets size thresholds based on classifications by the NAICS. BVM manufacturing is classified under NAICS 333318, ''Other Commercial and Service Industry Machinery Manufacturing.'' For this category, the SBA size threshold is 1,000 employees or less for an entity to be considered as a small business. Under the SBA definition of a small business and for the purposes of the Regulatory Flexibility Analysis, DOE believes AMS is a small manufacturer. The Regulatory Flexibility Analysis uses the SBA thresholds in determining whether small manufacturers as a subgroup may be disproportionately impacted by the proposed standard and in determining whether there are regulatory alternatives to DOE's proposed energy conservation regulation.

Separate from the Regulatory Flexibility Analysis, EPCA also provides compliance flexibility for small companies meeting specific criteria. Under 10 CFR part 430 subpart E, titled ''Small Business Exemptions,'' a manufacturer whose annual gross revenue from all of its operations does not exceed $8,000,000 may apply for an exemption from all or part of an energy conservation standard for a limited period of time. This criterion is used to determine whether individual companies can apply for temporary exemption from the energy conservation standard. Companies with annual revenue greater than $8,000,000 do not meet the ''Small Business Exemption'' criteria under 10 CFR 40 subpart E and do not qualify for exemption requests. However, such companies may still be considered a small manufacturer for the purposes of the Regulatory Flexibility Analysis, as discussed previously.

J. Emissions Analysis

The emissions analysis consists of two components. The first component estimates the effect of potential energy conservation standards on power sector and site (where applicable) combustion emissions of CO_2, NO_X, SO_2, and Hg. The second component estimates the impacts of potential standards on emissions of two additional greenhouse gases, CH_4 and N_2O, as well as the reductions to emissions of all species due to ''upstream'' activities in the fuel production chain. These upstream activities comprise extraction, processing, and transporting fuels to the site of combustion. The associated emissions are referred to as upstream emissions.

The analysis of power sector emissions uses marginal emissions factors calculated using a methodology based on results published for the *AEO2014* reference case and a set of side cases that implement a variety of efficiency-related policies. The methodology is described in chapter 15 of the NOPR TSD.

Combustion emissions of CH_4 and N_2O are estimated using emissions intensity factors published by the EPA, GHG Emissions Factors Hub.[51] The FFC upstream emissions are estimated based on the methodology described in chapter 15 of the NOPR TSD. The upstream emissions include both emissions from fuel combustion during extraction, processing, and transportation of fuel, and ''fugitive'' emissions (direct leakage to the atmosphere) of CH_4 and CO_2.

The emissions intensity factors are expressed in terms of physical units per MWh or MMBtu of site energy savings. Total emissions reductions are estimated using the energy savings calculated in the national impact analysis.

For CH_4 and N_2O, DOE calculated emissions reduction in tons and also in terms of units of carbon dioxide equivalent (CO_2eq). Gases are converted to CO_2eq by multiplying the physical units by the gases' global warming potential (GWP) over a 100-year time horizon. Based on the Fourth Assessment Report of the Intergovernmental Panel on Climate Change,[52] DOE used GWP values of 28 for CH_4 and 265 for N_2O.

The *AEO2014* projections incorporate the projected impacts of existing air quality regulations on emissions. *AEO2014* generally represents current legislation and environmental regulations, including recent government actions, for which implementing regulations were available as of October 31, 2013. DOE's estimation of impacts accounts for the presence of the emissions control programs discussed in the following paragraphs.

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). SO_2 emissions from 28 eastern states and DC were also limited under the Clean Air Interstate Rule (CAIR), which created an allowance-based trading program that operates along with the Title IV program in those states and DC 70 FR 25162 (May 12, 2005). CAIR was remanded to EPA by the U.S. Court of Appeals for the District of Columbia Circuit (D.C. Circuit), but it remained in effect.[53] In 2011 EPA issued

[51] Available at *http://www.epa.gov/climateleadership/inventory/ghg-emissions.html.*

[52] Intergovernmental Panel on Climate Change. Chapter 8 in *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.). 2013. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

[53] See *North Carolina* v. *EPA,* 550 F.3d 1176 (D.C. Cir. 2008); *North Carolina* v. *EPA,* 531 F.3d 896 (D.C. Cir. 2008).

a replacement for CAIR, the Cross-State Air Pollution Rule (CSAPR). 76 FR 48208 (August 8, 2011). On August 21, 2012, the D.C. Circuit issued a decision to vacate CSAPR,[54] and the court ordered EPA to continue administering CAIR. On April 29, 2014, the U.S. Supreme Court reversed the judgment of the D.C. Circuit and remanded the case for further proceedings consistent with the Supreme Court's opinion.[55] On October 23, 2014, the D.C. Circuit lifted the stay of CSAPR.[56] Pursuant to this action, CSAPR went into effect (and CAIR ceased to be in effect) as of January 1, 2015.

Because *AEO2014* was prepared before the Supreme Court's opinion, it assumed that CAIR remains a binding regulation through 2040. Thus, DOE's analysis used emissions factors that assume that CAIR, not CSAPR, is the regulation in force. However, the difference between CAIR and CSAPR is not relevant for the purpose of DOE's analysis of emissions impacts from energy conservation standards.

The attainment of emissions caps is typically flexible among EGUs and is enforced through the use of emissions allowances and tradable permits. 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 any regulated EGU. In past rulemakings, DOE recognized that there was uncertainty about the effects of efficiency standards on SO_2 emissions covered by the existing cap-and-trade system, but it concluded that no reductions in power sector emissions would occur for SO_2 as a result of standards.

Beginning in 2016, however, SO_2 emissions will fall as a result of the Mercury and Air Toxics Standards (MATS) for power plants. 77 FR 9304 (February 16, 2012) In the final MATS rule, EPA established a standard for hydrogen chloride (HCl) as a surrogate for acid gas hazardous air pollutants (HAPs), 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 will be reduced as a result of the control technologies installed on coal-fired power plants to comply with the MATS requirements for acid gas. *AEO2014* assumes that, in order to continue operating, coal plants must have either flue gas desulfurization or dry sorbent injection systems installed by 2016. Both technologies are used to reduce acid gas emissions and also reduce SO_2 emissions. Under the MATS, emissions will be far below the cap that would be established by CAIR, so 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 any regulated EGU. Therefore, DOE believes that efficiency standards will reduce SO_2 emissions in 2016 and beyond.

CAIR established a cap on NO_X emissions in 28 eastern states and the District of Columbia.[57] Energy conservation standards are expected to have little or no physical effect on these emissions in those states covered by CAIR because excess NO_X emissions allowances resulting from the lower electricity demand could be used to permit offsetting increases in NO_X emissions. However, standards would be expected to reduce NO_X emissions in the states not affected by the caps, so DOE estimated NO_X emissions reductions from potential standards considered in this NOPR for these states.

The MATS also limit mercury emissions from power plants, but they do not include emissions caps and, as such, DOE's energy conservation standards would likely reduce mercury emissions. DOE estimated mercury emissions reduction using emissions factors based on *AEO2014*, which incorporates the MATS.

Power plants may emit particulates from the smoke stack, which are known as direct particulate matter (PM) emissions. NEMS does not account for direct PM emissions from power plants. DOE is investigating the possibility of using other methods to estimate reduction in PM emissions due to standards. The great majority of ambient PM associated with power plants is in the form of secondary sulfates and nitrates, which are produced at a significant distance from power plants by complex atmospheric chemical reactions that often involve the gaseous emissions of power plants, mainly SO_2 and NO_X. The monetary benefits that DOE estimates for reductions in SO_2 and NO_X emissions resulting from standards are in fact primarily related to the health benefits of reduced ambient PM.

DOE notes that the Supreme Court recently remanded EPA's 2012 rule regarding national emission standards for hazardous air pollutants from certain electric utility steam generating units. See Michigan v. EPA (Case No. 14–46, 2015). DOE has tentatively determined that the remand of the MATS rule does not change the assumptions regarding the impact of energy efficiency standards on SO_2 emissions (see chapter 13 for further discussion). Further, while the remand of the MATS rule may have an impact on the overall amount of mercury emitted by power plants, it does not change the impact of the energy efficiency standards on mercury emissions. DOE will continue to monitor developments related to this case and respond to them as appropriate.

K. Monetizing Carbon Dioxide and Other Emissions Impacts

As part of the development of this proposed rule, DOE considered the estimated monetary benefits from the reduced emissions of CO_2 and NO_X that are expected to result from each of the TSLs considered. In order to make this calculation similar to the calculation of the NPV of customer benefit, DOE considered the reduced emissions expected to result over the lifetime of equipment shipped in the forecast period for each TSL. This section summarizes the basis for the monetary values used for each of these emissions and presents the values considered in this rulemaking.

For this proposed rule, DOE is relying on a set of values for the SCC that was developed by an interagency process. A summary of the basis for these values is provided below, and a more detailed description of the methodologies used is provided as an appendix to chapter 14 of the TSD.

1. Social Cost of Carbon

The SCC is an estimate of the monetized damages associated with an incremental increase in carbon emissions in a given year. It is intended to include (but is not limited to) climate-change-related changes in net agricultural productivity, human health, property damages from increased flood risk, and the value of ecosystem services. Estimates of the SCC are provided in dollars per metric ton of CO_2. A domestic SCC value is meant to

[54] See *EME Homer City Generation, LP* v. *EPA,* 696 F.3d 7, 38 (D.C. Cir. 2012).

[55] See *EPA* v. *EME Homer City Generation,* 134 S.Ct. 1584, 1610 (U.S. 2014). The Supreme Court held in part that EPA's methodology for quantifying emissions that must be eliminated in certain States due to their impacts in other downwind States was based on a permissible, workable, and equitable interpretation of the Clean Air Act provision that provides statutory authority for CSAPR.

[56] See *Georgia* v. *EPA,* Order (*D.C. Cir. filed October 23, 2014*) (*No. 11–1302*).

[57] CSAPR also applies to NO_X, and it would supersede the regulation of NO_X under CAIR. As stated previously, the current analysis assumes that CAIR, not CSAPR, is the regulation in force. The difference between CAIR and CSAPR with regard to DOE's analysis of NO_X emissions is slight.

reflect the value of damages in the United States resulting from a unit change in CO_2 emissions, while a global SCC value is meant to reflect the value of damages worldwide.

Under section 1(b) of Executive Order 12866, agencies must, to the extent permitted by law, ''assess both the costs and the benefits of the intended regulation and, recognizing that some costs and benefits are difficult to quantify, propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs.'' The purpose of the SCC estimates presented here is to allow agencies to incorporate the monetized social benefits of reducing CO_2 emissions into cost-benefit analyses of regulatory actions. The estimates are presented with an acknowledgement of the many uncertainties involved and with a clear understanding that they should be updated over time to reflect increasing knowledge of the science and economics of climate impacts.

As part of the interagency process that developed these SCC estimates, technical experts from numerous agencies met on a regular basis to consider public comments, explore the technical literature in relevant fields, and discuss key model inputs and assumptions. The main objective of this process was to develop a range of SCC values using a defensible set of input assumptions grounded in the existing scientific and economic literatures. In this way, key uncertainties and model differences transparently and consistently inform the range of SCC estimates used in the rulemaking process.

a. Monetizing Carbon Dioxide Emissions

When attempting to assess the incremental economic impacts of CO_2 emissions, the analyst faces a number of serious challenges. A report from the National Research Council [58] points out that any assessment will suffer from uncertainty, speculation, and lack of information about: (1) Future emissions of greenhouse gases; (2) the effects of past and future emissions on the climate system; (3) the impact of changes in climate on the physical and biological environment; and (4) the translation of these environmental impacts into economic damages. As a result, any effort to quantify and monetize the harms associated with climate change will raise serious questions of science, economics, and ethics and should be viewed as provisional.

Despite the limits of both quantification and monetization, SCC estimates can be useful in estimating the social benefits of reducing CO_2 emissions. The agency can estimate the benefits from reduced (or costs from increased) emissions in any future year by multiplying the change in emissions in that year by the SCC value appropriate for that year. The net present value of the benefits can then be calculated by multiplying each of these future benefits by an appropriate discount factor and summing across all affected years.

It is important to emphasize that the interagency process is committed to updating these estimates as the science and economic understanding of climate change and its impacts on society improves over time. In the meantime, the interagency group will continue to explore the issues raised by this analysis and consider public comments as part of the ongoing interagency process.

b. Development of Social Cost of Carbon Values

In 2009, an interagency process was initiated to offer a preliminary assessment of how best to quantify the benefits from reducing CO_2 emissions. To ensure consistency in how benefits are evaluated across agencies, the Administration sought to develop a transparent and defensible method, specifically designed for the rulemaking process, to quantify avoided climate change damages from reduced CO_2 emissions. The interagency group did not undertake any original analysis. Instead, it combined SCC estimates from the existing literature to use as interim values until a more comprehensive analysis could be conducted. The outcome of the preliminary assessment by the interagency group was a set of five interim values: Global SCC estimates for 2007 (in 2006$) of $55, $33, $19, $10, and $5 per metric ton of CO_2. These interim values represented the first sustained interagency effort within the U.S. government to develop an SCC for use in regulatory analysis. The results of this preliminary effort were presented in several proposed and final rules.

c. Current Approach and Key Assumptions

Since the release of the interim values, the interagency group reconvened on a regular basis to generate improved SCC estimates. Specifically, the group considered public comments and further explored the technical literature in relevant fields. The interagency group relied on three integrated assessment models commonly used to estimate the SCC: The FUND, DICE, and PAGE models. These models are frequently cited in the peer-reviewed literature and were used in the last assessment of the Intergovernmental Panel on Climate Change. Each model was given equal weight in the SCC values that were developed.

Each model takes a slightly different approach to model how changes in emissions result in changes in economic damages. A key objective of the interagency process was to enable a consistent exploration of the three models while respecting the different approaches to quantifying damages taken by the key modelers in the field. An extensive review of the literature was conducted to select three sets of input parameters for these models: Climate sensitivity, socio-economic and emissions trajectories, and discount rates. A probability distribution for climate sensitivity was specified as an input into all three models. In addition, the interagency group used a range of scenarios for the socio-economic parameters and a range of values for the discount rate. All other model features were left unchanged, relying on the model developers' best estimates and judgments.

The interagency group selected four sets of SCC values for use in regulatory analyses. Three sets of values are based on the average SCC from the three integrated assessment models, at discount rates of 2.5, 3, and 5 percent. The fourth set, which represents the 95th percentile SCC estimate across all three models at a 3-percent discount rate, is included to represent higher-than-expected impacts from temperature change further out in the tails of the SCC distribution. The values grow in real terms over time. Additionally, the interagency group determined that a range of values from 7 percent to 23 percent should be used to adjust the global SCC to calculate domestic effects, although preference is given to consideration of the global benefits of reducing CO_2 emissions. Table IV.10 presents the values in the 2010 interagency group report,[59] which is reproduced in appendix 14A of the TSD.

[58] National Research Council. *Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use.* 2009. National Academies Press: Washington, DC.

[59] *Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866.* Interagency Working Group on Social Cost of Carbon, United States Government, February 2010. *www.whitehouse.gov/sites/default/files/omb/inforeg/for-agencies/Social-Cost-of-Carbon-for-RIA.pdf.*

TABLE IV.10—ANNUAL SCC VALUES FROM 2010 INTERAGENCY REPORT, 2010–2050

[2007 dollars per metric ton CO_2]

Year	Discount rate (%)			
	5	3	2.5	3
	Average	Average	Average	95th percentile
2010	4.7	21.4	35.1	64.9
2015	5.7	23.8	38.4	72.8
2020	6.8	26.3	41.7	80.7
2025	8.2	29.6	45.9	90.4
2030	9.7	32.8	50.0	100.0
2035	11.2	36.0	54.2	109.7
2040	12.7	39.2	58.4	119.3
2045	14.2	42.1	61.7	127.8
2050	15.7	44.9	65.0	136.2

The SCC values used for this NOPR were generated using the most recent versions of the three integrated assessment models that have been published in the peer-reviewed literature.[60] (See appendix 14B of the TSD for further information.) Table IV.11 shows the updated sets of SCC estimates in 5-year increments from 2010 through 2050. The full set of annual SCC estimates from 2010 through 2050 is reported in appendix 14B of the TSD. The central value that emerges is the average SCC across models at the 3-percent discount rate. However, for purposes of capturing the uncertainties involved in regulatory impact analysis, the interagency group emphasizes the importance of including all four sets of SCC values.

TABLE IV.11—ANNUAL SCC VALUES FROM 2013 INTERAGENCY UPDATE, 2010–2050

[2007 dollars per metric ton CO_2]

Year	Discount rate (%)			
	5	3	2.5	3
	Average	Average	Average	95th percentile
2010	10	31	50	86
2015	11	36	56	105
2020	12	42	62	123
2025	14	46	68	138
2030	16	50	73	152
2035	18	55	78	168
2040	21	60	84	183
2045	23	64	89	197
2050	26	69	95	212

It is important to recognize that a number of key uncertainties remain and that current SCC estimates should be treated as provisional and revisable because they will evolve with improved scientific and economic understanding. The interagency group also recognizes that the existing models are imperfect and incomplete. The National Research Council report mentioned in section IV.K.1.a of this NOPR points out that there is tension between the goal of producing quantified estimates of the economic damages from an incremental ton of carbon and the limits of existing efforts to model these effects. A number of analytic challenges are being addressed by the research community, including research programs housed in many of the Federal agencies participating in the interagency process to estimate the SCC. The interagency group intends to periodically review and reconsider those estimates to reflect increasing knowledge of the science and economics of climate impacts, as well as improvements in modeling.

In summary, in considering the potential global benefits resulting from reduced CO_2 emissions, DOE used the values from the 2013 interagency report, adjusted to 2014$ using the gross domestic product price deflator. For each of the four cases of SCC values, the values for emissions in 2015 were $12.2, $40.0, $62.3, and $116.8 per metric ton of CO_2 avoided. DOE derived values after 2050 using the relevant growth rates for the 2040–2050 period in the interagency update.

DOE multiplied the CO_2 emissions reduction estimated for each year by the SCC value for that year in each of the four cases. 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 SCC values in each case.

2. Valuation of Other Emissions Reductions

As noted above, DOE has taken into account how the new and amended

[60] *Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866.* Interagency Working Group on Social Cost of Carbon, United States Government. May 2013; revised July 2015. *https://www.whitehouse.gov/sites/default/files/omb/inforeg/scc-tsd-final-july-2015.pdf.*

energy conservation standards would reduce NO_X emissions in those 22 states not affected by emission caps. DOE estimated the monetized value of NO_X emissions reductions resulting from each of the TSLs considered for this rule based on estimates found in the relevant scientific literature. Estimates of monetary value for reducing NO_X from stationary sources range from $483 to $4,963 per ton (2014$).[61] DOE calculated monetary benefits using a medium value for NO_X emissions of $2,723 per short ton (in 2014$), and real discount rates of 3 percent and 7 percent.

DOE is evaluating appropriate monetization of avoided SO_2 and Hg emissions in energy conservation standards rulemakings. DOE has not included such monetization in the current analysis.

L. Utility Impact Analysis

The utility impact analysis estimates several effects on the power generation industry that would result from the adoption of new or amended energy conservation standards proposed in this NOPR. The utility impact analysis estimates the changes in electric installed capacity and generation that result for each TSL. The utility impact analysis uses a variant of NEMS associated with *AEO2014,*[62] which is a public domain, multi-sectored, partial equilibrium model of the U.S. energy sector. DOE uses a variant of this model, referred to as NEMS–BT,[63] to account for selected utility impacts of new or amended energy conservation standards. DOE's analysis consists of a comparison between model results for the most recent *AEO* reference case and for cases in which energy use is decremented to reflect the impact of potential standards. The energy savings inputs associated with each TSL come from the NIA. Chapter 15 of the TSD describes the utility impact analysis.

M. Employment Impact Analysis

DOE considers employment impacts in the domestic economy as one factor in selecting a proposed standard. Employment impacts include both direct and indirect impacts. Direct employment impacts are changes in the number of employees at the plants that produce the covered products, along with affiliated distribution and service companies. DOE evaluated direct employment impacts in the MIA.

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 equipment. Indirect employment impacts from standards consist of the jobs created or eliminated in the national economy due to: (1) Reduced spending by end users on energy; (2) reduced spending on new energy supply by the utility industry; (3) increased customer spending on the purchase of new equipment; 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.[64] 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 customer utility bills. Because reduced customer 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, based on the BLS data alone, DOE believes net national employment may increase because of shifts in economic activity resulting from amended and new BVM energy conservation standards proposed in this NOPR.

For the standard levels proposed in this NOPR, DOE estimated indirect national employment impacts using an input/output model of the U.S. economy called Impact of Sector Energy Technologies version 3.1.1 (ImSET).[65] ImSET is a special-purpose version of the ''U.S. Benchmark National Input-Output'' (I–O) model, which was designed to estimate the national employment and income effects of energy-saving technologies. The ImSET software includes a computer-based I–O model having structural coefficients that characterize economic flows among 187 sectors. ImSET's national economic I–O structure is based on a 2002 U.S. benchmark table, specially aggregated to the 187 sectors most relevant to industrial, commercial, and residential building energy use. DOE notes that ImSET is not a general equilibrium forecasting model and understands the uncertainties involved in projecting employment impacts, especially changes in the later years of the analysis. Because ImSET does not incorporate price changes, the employment effects predicted by ImSET may overestimate actual job impacts over the long run. For this NOPR, DOE used ImSET only to estimate short-term (2020 and 2025) employment impacts.

DOE reiterates that the indirect employment impacts estimated with ImSET for the entire economy differ from the direct employment impacts in the BVM manufacturing sector estimated using the GRIM in the MIA, as described at the beginning of this section. The methodologies used and the sectors analyzed in the ImSET and GRIM models are different.

N. Description of Materials Incorporated by Reference

As discussed in section IV.A.1.a, DOE is proposing in this NOPR to incorporate by reference ASTM Standard E 1084–86 (Reapproved 2009), ''Standard Test Method for Solar Transmittance (Terrestrial) of Sheet Materials Using Sunlight,'' to determine whether a material is transparent when assessing whether a beverage vending machine has a transparent front and meets the proposed Class A definition.

[61] U.S. Office of Management and Budget, Office of Information and Regulatory Affairs. *2006 Report to Congress on the Costs and Benefits of Federal Regulations and Unfunded Mandates on State, Local, and Tribal Entities,* Washington, DC. Available at *www.whitehouse.gov/sites/default/files/omb/assets/omb/inforeg/2006_cb/2006_cb_final_report.pdf.*

[62] For more information on NEMS, refer to the U.S. Department of Energy, Energy Information Administration documentation. A useful summary is *National Energy Modeling System: An Overview 2003,* DOE/EIA–0581 (2003), March 2003.

[63] DOE/EIA approves use of the name ''NEMS'' to describe only an official version of the model without any modification to code or data. Because this analysis entails some minor code modifications and the model is run under various policy scenarios that are variations on DOE/EIA assumptions, DOE refers to it by the name ''NEMS–BT'' (''BT'' is DOE's Building Technologies Program, under whose aegis this work has been performed).

[64] *See* U.S. Department of Commerce—Bureau of Economic Analysis. *Regional Multipliers: A User Handbook for the Regional Input-Output Modeling System (RIMS II).* 1992.

[65] Scott, M.J., O.V. Livingston, P.J. Balducci, J.M. Roop, and R.W. Schultz. *ImSET 3.1: Impact of Sector Energy Technologies.* 2009. Pacific Northwest National Laboratory, Richland, WA. Report No. PNNL–18412. *www.pnl.gov/main/publications/external/technical_reports/PNNL-18412.pdf.*

Copies of ASTM standards may be purchased from ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA, 19428, (877) 909–2786, or at *www.astm.org.*

V. Analytical Results and Conclusions

The following section addresses the results from DOE's analyses with respect to potential energy conservation standards for beverage vending machines in this rulemaking.

A. Trial Standard Levels

DOE analyzed 8 efficiency levels (ELs) for Class A equipment, 12 ELs for Class B equipment, 15 ELs for Combination A equipment, and 14 ELs for Combination B equipment in the LCC and NIA analyses, where each EL represents a 5-percent improvement in efficiency from baseline efficiency (EL 0) to up to max tech. Of the ELs analyzed for each class DOE selected five TSLs based on the following criteria:

(1) TSL 1 is equivalent to the current ENERGY STAR criterion for all equipment that is eligible for ENERGY STAR qualification. This corresponded to EL 2 for Class B equipment and EL 1 for Class A. Combination equipment is currently not eligible for ENERGY STAR qualification and, as such, DOE selected TSL 1 as equivalent to EL 1, since EL 1 was the first EL analyzed above the baseline (EL 0).

(2) TSL 2 was selected to be the EL, which is 10 percent better than TSL 1.

(3) TSL 3 was selected to be an interim analysis point corresponding to the EL halfway between TSL 2 and 4 (rounding up when between ELs).

(4) TSL 4 represents the EL with the maximum NPV at a 7-percent discount rate. This level also corresponds to the maximum LCC savings for most equipment classes. In addition, the EL corresponding to a 3-year payback, zero customers with net cost, and maximum NPV at a 3-percent discount rate were the same or within one EL from the selected EL.

(5) TSL 5 corresponds to the max tech EL.

Table V.1 shows the TSL levels DOE selected for the equipment classes analyzed. Note that DOE performed its analyses for a ''representative size'' beverage vending machine and defined refrigerant-neutral ELs such that the selected ELs could be met by any refrigerant. Similarly, the defined TSLs share this approach and can be met by either refrigerant.

TABLE V.1—TRIAL STANDARD LEVELS FOR A REPRESENTATIVE SIZE BVM MODEL EXPRESSED IN TERMS OF DAILY ENERGY CONSUMPTION

[kWh/day]

Equipment Class	Representative volume $(ft)^3$	TSL	Baseline	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
Class A	30.0	EL	0	1	3	4	5	8
		DEC	4.21	4.00	3.58	3.37	3.16	2.49
Class B	23.4	EL	0	2	4	8	11	12
		DEC	4.86	4.37	3.89	2.92	2.19	1.70
Combination A	10.3	EL	0	1	3	8	13	15
		DEC	5.99	5.69	5.09	3.59	2.10	1.66
Combination B	4.3	EL	0	1	3	8	13	14
		DEC	4.44	4.21	3.77	2.66	1.55	1.19

In this NOPR, DOE elected to maintain the energy conservation standard structure established in the 2009 BVM final rule, which establishes the MDEC of covered BVM models in terms of a linear equation of the following form:

MDEC = A × V + B

Where:

A is expressed in terms of kWh/(day·ft3) of measured refrigerated volume,

V is the measured refrigerated volume (ft3) calculated for the equipment, and

B is an offset factor expressed in kWh/day.

Coefficients A and B are uniquely derived for each equipment class based on a linear equation passing between the daily energy consumption values for equipment of different refrigerated volumes. For the A and B coefficients, DOE used the unique energy consumption values of the small, medium, and large or medium and large size BVM units for Class A and B or Combination A and B beverage vending machines, respectively. Table V.2 depicts the TSL equations for each analyzed TSL and equipment class. The methodology used to establish the TSL equations and more detailed results is described in more detail in appendix 10B of the TSD.

TABLE V.2—TRIAL STANDARD LEVELS MAXIMUM DAILY ENERGY CONSUMPTION (kWh/day) EXPRESSED IN TERMS OF EQUATIONS AND COEFFICIENTS FOR BVM EQUIPMENT

TSL	Class A	Class B	Combination A	Combination B
Baseline	0.055 × V + 2.56	0.073 × V + 3.16	0.126 × V + 4.70	0.126 × V + 3.89
1	0.052 × V + 2.43	0.066 × V + 2.84	0.119 × V + 4.46	0.120 × V + 3.69
2	0.047 × V + 2.18	0.058 × V + 2.53	0.107 × V + 3.99	0.107 × V + 3.31
3	0.044 × V + 2.05	0.044 × V + 1.90	0.075 × V + 2.82	0.076 × V + 2.33
4	0.041 × V + 1.92	0.033 × V + 1.42	0.044 × V + 1.64	0.044 × V + 1.36
5	0.032 × V + 1.51	0.026 × V + 1.10	0.035 × V + 1.31	0.034 × V + 1.04

In Table V.2, ''V'' is the representative value of refrigerated volume (ft^3) of the BVM model, as measured in accordance with the method for determining refrigerated volume adopted in the recently amended DOE test procedure for beverage vending machines and appropriate sampling plan requirements. 80 FR 45758 (July 31, 2015). In this NOPR, DOE is proposing a calculation method at 10 CFR 429.52(a)(3) for determining the representative value of refrigerated volume for each BVM model. DOE is proposing that the representative value of refrigerated volume must be determined as the mean of the measured refrigerated volume of each tested unit and manufacturers must use this calculated value for determining the appropriate standard level for that model.

DOE is also proposing provisions to assess whether the representative value of refrigerated volume, as certified by manufacturers, is valid. Under the proposed provisions, DOE would compare the manufacturer's certified rating with results from the unit or units in DOE's tested sample. If the results of the tested unit or units in DOE's sample are within 5 percent of the representative value of refrigerated volume certified by manufacturers, the certified refrigerated volume value would be considered valid. Based on whether the representative value of refrigerated volume is valid, DOE proposes to do one of the following:

(1) If the representative value of refrigerated volume, as certified by manufacturers, is valid, DOE would use this value to determine the MDEC for that model; or

(2) If the representative value of refrigerated volume is invalid, DOE would use the results of the tested unit or units as the basis for calculating the MDEC for that BVM model.

DOE proposes that these sampling and enforcement provisions would be effective 30 days after publication of any final rule in the **Federal Register** and, as such, applicable to both the existing standards, as well as any new and amended standards adopted as a result of this rulemaking.

DOE requests comment on the proposal to clarify the calculation of the refrigerated volume for each BVM basic model (section VII.E of this NOPR).

B. Economic Justification and Energy Savings

DOE analyzed the economic impacts on customers by looking at the effects potential standards would have on the LCC and PBP. DOE also examined the impacts of potential standards on customer subgroups. These analyses are discussed below.

1. Economic Impacts on Commercial Customers

a. Life-Cycle Cost and Payback Period

Customers affected by new standards usually incur higher purchase prices and lower operating costs. DOE evaluates these impacts on individual customers by calculating changes in LCC and the PBP associated with the TSLs. The results of the LCC analysis for each TSL were obtained by comparing the installed and operating costs of the equipment in the base-case scenario against the standards-case scenarios at each TSL. Inputs used for calculating the LCC include total installed costs (*i.e.,* equipment price plus installation costs), operating expenses (*i.e.,* annual energy savings, energy prices, energy price trends, repair costs, and maintenance costs), equipment lifetime, and discount rates.

The LCC analysis is carried out using Monte Carlo simulations. Consequently, the results of the LCC analysis are distributions covering a range of values, as opposed to a single deterministic value. DOE presents the mean or median values, as appropriate, calculated from the distributions of results. The LCC analysis also provides information on the percentage of customers for whom an increase in the minimum efficiency standard would have a positive impact (net benefit), a negative impact (net cost), or no impact.

DOE also performed a PBP analysis as part of the LCC analysis. The PBP is the number of years it would take for the customer to recover the increased costs of higher-efficiency equipment as a result of operating cost savings. The PBP is an economic benefit-cost measure that uses benefits and costs without discounting. Chapter 8 of the NOPR TSD provides detailed information on the LCC and PBP analysis.

DOE used a ''roll-up'' scenario in this rulemaking. Under the roll-up scenario, DOE assumes that the market shares of the efficiency levels (in the no-new-standards case) that do not meet the standard level under consideration would be ''rolled up'' into (meaning ''added to'') the market share of the efficiency level at the standard level under consideration, and the market shares of efficiency levels that are above the standard level under consideration would remain unaffected. Customers in the no-new-standards scenario who buy the equipment at or above the TSL under consideration would be unaffected if the standard were to be set at that TSL. Customers in the base-case scenario who buy equipment below the TSL under consideration would be affected if the standard were to be set at that TSL. Among these affected customers, some may benefit from lower LCCs of the equipment and some may incur net cost due to higher LCCs, depending on the inputs to the LCC analysis, such as electricity prices, discount rates, and installed costs.

DOE's LCC and PBP analysis provided key outputs for each efficiency level above the baseline. The results for all equipment classes are given in Table V.3 through Table V.18. DOE's results indicate that affected customers typically have a positive LCC savings, with the exception of the TSL 5 Class A CO_2 equipment customers.

TABLE V.3—AVERAGE LCC AND PBP RESULTS FOR CLASS A, CO_2*

TSL	EL	% of Baseline energy use	Average costs (2014$)				Simple payback period (years)	Average lifetime (years)
			Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	0	100	2,898	419	4,226	7,124	....	13.5
1	1	95	2,902	412	4,151	7,053	0.6	13.5
	2	90	2,911	404	4,075	6,986	0.9	13.5
2	3	85	2,921	397	4,000	6,921	1.1	13.5
3	4	80	2,968	389	3,924	6,892	2.4	13.5
4	5	75	3,031	382	3,849	6,880	3.6	13.5
	6	70	3,205	374	3,773	6,978	6.9	13.5
	7	65	3,457	367	3,698	7,155	10.7	13.5
5	8	59	3,759	358	3,607	7,367	14.1	13.5

*The results for each EL are calculated assuming that all customers use equipment at that efficiency level. The PBP is measured relative to the baseline equipment.

TABLE V.4—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE EFFICIENCY DISTRIBUTION FOR CLASS A, CO_2

TSL	EL	% of Baseline energy use	Life-cycle cost savings	
			% of Customers that experience a net cost	Average life-cycle cost savings * (2014$)
	0	100	0	0
1	1	95	0	0
	2	90	0	67
2	3	85	0	132
3	4	80	0	160
4	5	75	1	173
	6	70	31	75
	7	65	78	(102)
5	8	59	93	(314)

* The calculation includes customers with zero LCC savings (no impact). Parentheses indicate negative values.

TABLE V.5—AVERAGE LCC AND PBP RESULTS FOR CLASS A, PROPANE *

TSL	EL	% of Baseline energy use	Average costs (2014$)				Simple payback period (years)	Average lifetime (years)
			Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	0	100	2,874	419	4,226	7,100	....	13.5
1	1	95	2,877	412	4,151	7,028	0.4	13.5
	2	90	2,883	404	4,075	6,958	0.6	13.5
2	3	85	2,892	397	4,000	6,892	0.8	13.5
3	4	80	2,903	389	3,924	6,827	1.0	13.5
4	5	75	2,914	382	3,849	6,763	1.1	13.5
	6	70	3,005	374	3,773	6,778	2.9	13.5
	7	65	3,176	367	3,698	6,874	5.8	13.5
5	8	59	3,381	358	3,607	6,988	8.3	13.5

* The results for each EL are calculated assuming that all customers use equipment at that efficiency level. The PBP is measured relative to the baseline equipment.

TABLE V.6—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE EFFICIENCY DISTRIBUTION FOR CLASS A, PROPANE

TSL	EL	% of Baseline energy use	Life-cycle cost savings	
			% of Customers that experience a net cost	Average life-cycle cost savings * (2014$)
	0	100	0	0
1	1	95	0	0
	2	90	0	70
2	3	85	0	136
3	4	80	0	201
4	5	75	0	265
	6	70	0	250
	7	65	15	154
5	8	59	47	39

* The calculation includes customers with zero LCC savings (no impact). Parentheses indicate negative values.

TABLE V.7—AVERAGE LCC AND PBP RESULTS FOR CLASS B, CO_2*

TSL	EL	% of Baseline energy use	Average costs (2014$)				Simple payback period (years)	Average lifetime (years)
			Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	0	100	2,368	458	4,617	6,985	....	13.5
	1	95	2,372	450	4,532	6,904	0.5	13.5
1	2	90	2,376	441	4,447	6,823	0.5	13.5
	3	85	2,380	433	4,362	6,743	0.5	13.5
2	4	80	2,385	424	4,277	6,663	0.5	13.5

TABLE V.7—AVERAGE LCC AND PBP RESULTS FOR CLASS B, CO_2*—Continued

TSL	EL	% of Baseline energy use	Average costs (2014$) Installed cost	First year's operating cost	Lifetime operating cost	LCC	Simple payback period (years)	Average lifetime (years)
	5	75	2,391	416	4,192	6,584	0.5	13.5
	6	70	2,397	408	4,108	6,505	0.6	13.5
	7	65	2,403	399	4,023	6,426	0.6	13.5
3	8	60	2,411	391	3,938	6,349	0.6	13.5
	9	55	2,425	382	3,853	6,277	0.7	13.5
	10	50	2,450	354	3,567	6,017	0.8	13.5
4	11	45	2,625	346	3,482	6,106	2.3	13.5
5	12	35	3,298	329	3,311	6,609	7.2	13.5

*The results for each EL are calculated assuming that all customers use equipment at that efficiency level. The PBP is measured relative to the baseline equipment.

TABLE V.8—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE EFFICIENCY DISTRIBUTION FOR CLASS B, CO_2

TSL	EL	% of Baseline energy use	Life-cycle cost savings: % of Customers that experience a net cost	Average life-cycle cost savings* (2014$)
	0	100	0	0
	1	95	0	0
1	2	90	0	0
	3	85	0	0
2	4	80	0	34
	5	75	0	80
	6	70	0	147
	7	65	0	215
3	8	60	0	292
	9	55	0	363
	10	50	0	624
4	11	45	0	534
5	12	35	51	31

*The calculation includes customers with zero LCC savings (no impact).

TABLE V.9—AVERAGE LCC AND PBP RESULTS FOR CLASS B, PROPANE*

TSL	EL	% of Baseline energy use	Average costs (2014$) Installed cost	First year's operating cost	Lifetime operating cost	LCC	Simple payback period (years)	Average lifetime (years)
	0	100	2,337	458	4,617	6,954	....	13.5
	1	95	2,339	450	4,532	6,871	0.3	13.5
1	2	90	2,342	441	4,447	6,789	0.3	13.5
	3	85	2,345	433	4,362	6,708	0.3	13.5
2	4	80	2,349	424	4,277	6,626	0.4	13.5
	5	75	2,354	416	4,192	6,547	0.4	13.5
	6	70	2,360	408	4,108	6,468	0.5	13.5
	7	65	2,366	399	4,023	6,388	0.5	13.5
3	8	60	2,372	391	3,938	6,310	0.5	13.5
	9	55	2,381	382	3,853	6,233	0.6	13.5
	10	50	2,392	374	3,768	6,160	0.7	13.5
4	11	45	2,486	346	3,482	5,967	1.3	13.5
5	12	35	2,989	329	3,311	6,300	5.0	13.5

*The results for each EL are calculated assuming that all customers use equipment at that efficiency level. The PBP is measured relative to the baseline equipment.

TABLE V.10—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE EFFICIENCY DISTRIBUTION FOR CLASS B, PROPANE

TSL	EL	% of Baseline energy use	Life-cycle cost savings	
			% of Customers that experience a net cost	Average life-cycle cost savings* (2014$)
	0	100	0	0
	1	95	0	4
1	2	90	0	16
	3	85	0	97
2	4	80	0	179
	5	75	0	258
	6	70	0	338
	7	65	0	417
3	8	60	0	495
	9	55	0	572
	10	50	0	645
4	11	45	0	838
5	12	35	4	505

*The calculation includes customers with zero LCC savings (no impact).

TABLE V.11—AVERAGE LCC AND PBP RESULTS FOR COMBINATION A, CO_2*

TSL	EL	% of Baseline energy use	Average costs (2014$)				Simple payback period (years)	Average lifetime (years)
			Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	0	100	2,877	508	5,117	7,994	....	13.5
1	1	95	2,879	497	5,007	7,886	0.2	13.5
	2	90	2,881	486	4,897	7,778	0.2	13.5
2	3	85	2,883	475	4,787	7,670	0.2	13.5
	4	80	2,886	464	4,677	7,563	0.2	13.5
	5	75	2,889	453	4,567	7,456	0.2	13.5
	6	70	2,894	442	4,457	7,351	0.2	13.5
	7	65	2,900	431	4,347	7,247	0.3	13.5
3	8	60	2,909	420	4,237	7,146	0.4	13.5
	9	55	2,919	410	4,127	7,047	0.4	13.5
	10	50	2,930	399	4,017	6,948	0.5	13.5
	11	45	2,945	388	3,908	6,852	0.6	13.5
	12	40	2,962	357	3,596	6,559	0.6	13.5
4	13	35	3,108	346	3,487	6,595	1.4	13.5
	14	30	3,689	335	3,377	7,066	4.7	13.5
5	15	28	3,995	330	3,328	7,323	6.3	13.5

*The results for each EL are calculated assuming that all customers use equipment at that efficiency level. The PBP is measured relative to the baseline equipment.

TABLE V.12—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE EFFICIENCY DISTRIBUTION FOR COMBINATION A, CO_2

TSL	EL	% of Baseline energy use	Life-cycle cost savings	
			% of Customers that experience a net cost	Average life-cycle cost savings* (2014$)
	0	100	0	0
1	1	95	0	53
	2	90	0	161
2	3	85	0	269
	4	80	0	376
	5	75	0	483
	6	70	0	588
	7	65	0	692
3	8	60	0	793
	9	55	0	892
	10	50	0	991
	11	45	0	1,087
	12	40	0	1,381
4	13	35	0	1,344
	14	30	1	873
5	15	28	10	616

TABLE V.13—AVERAGE LCC AND PBP RESULTS FOR COMBINATION A, PROPANE *

TSL	EL	% of Baseline energy use	Average costs (2014$)				Simple payback period (years)	Average lifetime (years)
			Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	0	100	2,871	508	5,117	7,988	....	13.5
1	1	95	2,873	497	5,007	7,880	0.1	13.5
	2	90	2,874	486	4,897	7,771	0.1	13.5
2	3	85	2,876	475	4,787	7,663	0.1	13.5
	4	80	2,878	464	4,677	7,555	0.2	13.5
	5	75	2,880	453	4,567	7,448	0.2	13.5
	6	70	2,884	442	4,457	7,341	0.2	13.5
	7	65	2,890	431	4,347	7,237	0.2	13.5
3	8	60	2,897	420	4,237	7,134	0.3	13.5
	9	55	2,907	410	4,127	7,034	0.4	13.5
	10	50	2,918	399	4,017	6,935	0.4	13.5
	11	45	2,932	388	3,908	6,840	0.5	13.5
	12	40	2,949	357	3,596	6,545	0.5	13.5
4	13	35	3,043	346	3,487	6,530	1.1	13.5
	14	30	3,535	335	3,377	6,912	3.9	13.5
5	15	28	3,810	330	3,328	7,138	5.3	13.5

* The results for each EL are calculated assuming that all customers use equipment at that efficiency level. The PBP is measured relative to the baseline equipment.

TABLE V.14—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE EFFICIENCY DISTRIBUTION FOR COMBINATION A, PROPANE

TSL	EL	% of Baseline energy use	Life-cycle cost savings	
			% of Customers that experience a net cost	Average life-cycle cost savings * (2014$)
	0	100	0	0
1	1	95	0	55
	2	90	0	164
2	3	85	0	272
	4	80	0	380
	5	75	0	487
	6	70	0	593
	7	65	0	697
3	8	60	0	801
	9	55	0	900
	10	50	0	999
	11	45	0	1,095
	12	40	0	1,390
4	13	35	0	1,405
	14	30	0	1,023
5	15	28	3	797

* The calculation includes customers with zero LCC savings (no impact).

TABLE V.15—AVERAGE LCC AND PBP RESULTS FOR COMBINATION B, CO_2 *

TSL	EL	% of Baseline energy use	Average costs (2014$)				Simple payback period (years)	Average lifetime (years)
			Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	0	100	2,474	458	4,618	7,092	....	13.5
1	1	95	2,475	450	4,533	7,008	0.1	13.5
	2	90	2,476	441	4,448	6,924	0.1	13.5
2	3	85	2,477	433	4,363	6,840	0.1	13.5
	4	80	2,478	425	4,278	6,756	0.1	13.5
	5	75	2,479	416	4,193	6,672	0.1	13.5
	6	70	2,480	408	4,108	6,589	0.1	13.5
	7	65	2,485	399	4,023	6,508	0.2	13.5
3	8	60	2,490	391	3,938	6,428	0.2	13.5
	9	55	2,499	382	3,853	6,352	0.3	13.5
	10	50	2,511	374	3,768	6,279	0.4	13.5
	11	45	2,525	366	3,683	6,208	0.5	13.5

TABLE V.15—AVERAGE LCC AND PBP RESULTS FOR COMBINATION B, CO_2 *—Continued

TSL	EL	% of Baseline energy use	Average costs (2014$)				Simple payback period (years)	Average lifetime (years)
			Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	12	40	2,539	357	3,598	6,138	0.7	13.5
4	13	35	2,556	329	3,312	5,868	0.6	13.5
5	14	27	3,278	315	3,172	6,451	5.6	13.5

* The results for each EL are calculated assuming that all customers use equipment at that efficiency level. The PBP is measured relative to the baseline equipment.

TABLE V.16—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE EFFICIENCY DISTRIBUTION FOR COMBINATION B, CO_2

TSL	EL	% of Baseline energy use	Life-cycle cost savings	
			% of Customers that experience a net cost	Average life-cycle cost savings * (2014$)
	0	100	0	0
1	1	95	0	21
	2	90	0	64
2	3	85	0	127
	4	80	0	211
	5	75	0	295
	6	70	0	378
	7	65	0	459
3	8	60	0	539
	9	55	0	615
	10	50	0	687
	11	45	0	759
	12	40	0	829
4	13	35	0	1,098
5	14	27	7	516

* The calculation includes customers with zero LCC savings (no impact).

TABLE V.17—AVERAGE LCC AND PBP RESULTS FOR COMBINATION B, PROPANE *

TSL	EL	% of Baseline energy use	Average costs (2014$)				Simple payback period (years)	Average lifetime (years)
			Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	0	100	2,461	458	4,618	7,079	....	13.5
1	1	95	2,461	450	4,533	6,995	0.1	13.5
	2	90	2,462	441	4,448	6,911	0.1	13.5
2	3	85	2,463	433	4,363	6,826	0.1	13.5
	4	80	2,464	425	4,278	6,742	0.1	13.5
	5	75	2,465	416	4,193	6,658	0.1	13.5
	6	70	2,466	408	4,108	6,574	0.1	13.5
	7	65	2,467	399	4,023	6,490	0.1	13.5
3	8	60	2,470	391	3,938	6,409	0.1	13.5
	9	55	2,476	382	3,853	6,329	0.2	13.5
	10	50	2,484	374	3,768	6,253	0.3	13.5
	11	45	2,498	366	3,683	6,181	0.4	13.5
	12	40	2,513	337	3,397	5,910	0.4	13.5
4	13	35	2,529	329	3,312	5,841	0.5	13.5
5	14	27	2,869	315	3,172	6,041	2.9	13.5

* The results for each EL are calculated assuming that all customers use equipment at that efficiency level. The PBP is measured relative to the baseline equipment.

TABLE V.18—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE EFFICIENCY DISTRIBUTION FOR COMBINATION B, PROPANE

TSL	EL	% of Baseline energy use	Life-cycle cost savings	
			% of Customers that experience a net cost	Average life-cycle cost savings * (2014$)
	0	100	0	0
1	1	95	0	28
	2	90	0	84
2	3	85	0	168
	4	80	0	252
	5	75	0	336
	6	70	0	421
	7	65	0	504
3	8	60	0	586
	9	55	0	666
	10	50	0	742
	11	45	0	813
	12	40	0	1,084
4	13	35	0	1,153
5	14	27	0	953

* The calculation includes customers with zero LCC savings (no impact).

b. Life-Cycle Cost Subgroup Analysis

Using the LCC spreadsheet model, DOE estimated the impacts of the TSLs on manufacturing and/or industrial facilities that purchase their own beverage vending machines. This subgroup typically has higher discount rates and lower electricity prices relative to the average customer. DOE estimated the average LCC savings and simple PBP for this subgroup as shown in Table V.19 through Table V.26.

The results of the LCC subgroup analysis indicate that the manufacturing/industrial subgroup fares slightly worse than the average customer, with the subgroup showing lower LCC savings and longer payback periods than a typical customer shows. At TSL 4, all equipment classes have positive LCC savings for the subgroup, although not as great in magnitude as for the average customer. Chapter 11 of the NOPR TSD provides a more detailed discussion on the LCC subgroup analysis and results.

TABLE V.19—COMPARISON OF IMPACTS FOR MANUFACTURING/INDUSTRIAL SUBGROUP RELATIVE TO ALL CUSTOMERS, CLASS A, CO_2

TSL	LCC Savings (2014$) *		Simple Payback Period (years)	
	Manufacturing subgroup	All customers	Manufacturing subgroup	All customers
1	0	0	0.8	0.6
2	98	132	1.3	1.1
3	110	160	3.0	2.4
4	106	173	4.5	3.6
5	(433)	(314)	17.7	14.1

* Parentheses indicate negative values.

TABLE V.20—COMPARISON OF IMPACTS FOR MANUFACTURING/INDUSTRIAL SUBGROUP RELATIVE TO ALL CUSTOMERS, CLASS A, PROPANE

TSL	LCC Savings (2014$) *		Simple payback period (years)	
	Manufacturing subgroup	All customers	Manufacturing subgroup	All customers
1	0	0	0.5	0.4
2	103	136	1.0	0.8
3	151	201	1.2	1.0
4	199	265	1.3	1.1
5	(80)	39	10.4	8.3

* Parentheses indicate negative values.

TABLE V.21—COMPARISON OF IMPACTS FOR MANUFACTURING/INDUSTRIAL SUBGROUP RELATIVE TO ALL CUSTOMERS, CLASS B, CO_2

TSL	LCC Savings (2014$) *		Simple payback period (years)	
	Manufacturing subgroup	All customers	Manufacturing subgroup	All customers
1	0	0	0.6	0.5
2	26	34	0.6	0.5
3	222	292	0.8	0.6
4	403	534	2.7	2.3
5	(136)	31	8.7	7.2

* Parentheses indicate negative values.

TABLE V.22—COMPARISON OF IMPACTS FOR MANUFACTURING/INDUSTRIAL SUBGROUP RELATIVE TO ALL CUSTOMERS, CLASS B, PROPANE

TSL	LCC Savings (2014$) *		Simple payback period (years)	
	Manufacturing subgroup	All customers	Manufacturing subgroup	All customers
1	13	16	0.4	0.3
2	138	179	0.5	0.4
3	380	495	0.7	0.5
4	661	838	1.6	1.3
5	292	505	6.1	5.0

* Parentheses indicate negative values.

TABLE V.23—COMPARISON OF IMPACTS FOR MANUFACTURING/INDUSTRIAL SUBGROUP RELATIVE TO ALL CUSTOMERS, COMBINATION A, CO_2

TSL	LCC Savings (2014$)		Simple payback period (years)	
	Manufacturing subgroup	All customers	Manufacturing subgroup	All customers
1	42	53	0.2	0.2
2	209	269	0.2	0.2
3	613	793	0.5	0.4
4	1,038	1,344	1.7	1.4
5	276	616	7.7	6.3

TABLE V.24—COMPARISON OF IMPACTS FOR MANUFACTURING/INDUSTRIAL SUBGROUP RELATIVE TO ALL CUSTOMERS, COMBINATION A, PROPANE

TSL	LCC Savings (2014$)		Simple payback period (years)	
	Manufacturing subgroup	All customers	Manufacturing subgroup	All customers
1	43	55	0.2	0.1
2	211	272	0.2	0.1
3	619	801	0.4	0.3
4	1,097	1,405	1.3	1.1
5	456	797	6.5	5.3

TABLE V.25—COMPARISON OF IMPACTS FOR MANUFACTURING/INDUSTRIAL SUBGROUP RELATIVE TO ALL CUSTOMERS, COMBINATION B, CO_2

TSL	LCC Savings (2014$)		Simple payback period (years)	
	Manufacturing subgroup	All customers	Manufacturing subgroup	All customers
1	16	21	0.2	0.1
2	98	127	0.2	0.1

TABLE V.25—COMPARISON OF IMPACTS FOR MANUFACTURING/INDUSTRIAL SUBGROUP RELATIVE TO ALL CUSTOMERS, COMBINATION B, CO_2—Continued

TSL	LCC Savings (2014$)		Simple payback period (years)	
	Manufacturing subgroup	All customers	Manufacturing subgroup	All customers
3	417	539	0.3	0.2
4	877	1,098	0.8	0.6
5	266	516	6.8	5.6

TABLE V.26—COMPARISON OF IMPACTS FOR MANUFACTURING/INDUSTRIAL SUBGROUP RELATIVE TO ALL CUSTOMERS, COMBINATION B, PROPANE

TSL	LCC Savings (2014$)		Simple payback period (years)	
	Manufacturing subgroup	All customers	Manufacturing subgroup	All customers
1	22	28	0.1	0.1
2	131	168	0.1	0.1
3	455	586	0.2	0.1
4	923	1,153	0.6	0.5
5	693	953	3.5	2.9

c. Rebuttable Presumption Payback

As discussed in section III.F.2 of this NOPR, EPCA provides a rebuttable presumption that an energy conservation standard is economically justified if the additional cost to the customer of the equipment that meets the new or amended standard level is less than three times the value of the first-year energy savings resulting from the standard. (42 U.S.C. 6295(o)(1)(B)(iii)) DOE's LCC and PBP analyses generate values that calculate the PBP for customers of potential new and amended energy conservation standards. These analyses include, but are not limited to, the 3-year PBP contemplated under the rebuttable presumption test. However, DOE routinely conducts a full economic analysis that considers the full range of impacts, including those to the customer, manufacturer, nation, and environment, as required under 42 U.S.C. 6295(o)(2)(B)(i). The results of this 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.27 shows the rebuttable presumption payback periods for TSL 4, for all equipment classes and both CO_2 and propane refrigerants.

TABLE V.27—REBUTTABLE PRESUMPTION PAYBACK PERIODS AT TSL 4 FOR ALL REFRIGERANTS AND EQUIPMENT CLASSES

Refrigerant	Rebuttable presumption payback period (years)			
	Class A	Class B	Combination A	Combination B
CO_2	3.6	2.3	1.4	0.6
Propane	1.1	1.3	1.1	0.5

2. Economic Impact on Manufacturers

DOE performed an MIA to estimate the impact of amended energy conservation standards on manufacturers of beverage vending machines. The section below describes the expected impacts on manufacturers at each TSL. Chapter 12 of the NOPR TSD explains the analysis in further detail.

a. Industry Cash-Flow Analysis Results

The following tables illustrate the estimated financial impacts (represented by changes in industry net present value, or INPV) of amended energy conservation standards on manufacturers of beverage vending machines, as well as the conversion costs that DOE expects manufacturers would incur for all equipment classes at each TSL.

As discussed in sections IV.I and V.B.2.a of this NOPR, DOE modeled two different markup scenarios to evaluate the range of cash flow impacts on the BVM industry: (1) The preservation of gross margin percentage markup scenario; and (2) the preservation of per-unit operating profit markup scenario.

To assess the less severe end of the range of potential impacts, DOE modeled a preservation of gross margin percentage markup scenario, in which a uniform ''gross margin percentage'' markup is applied across all potential efficiency levels. In this scenario, DOE assumed that a manufacturer's absolute dollar markup would increase as production costs increase in the standards case.

To assess the more severe end of the range of potential impacts, DOE modeled the preservation of per unit operating profit markup scenario, which reflects manufacturer concerns surrounding their inability to maintain margins as manufacturing production costs increase to meet more stringent efficiency levels. In this scenario, as manufacturers make the necessary investments required to convert their facilities to produce new standards-compliant products and incur higher costs of goods sold, their percentage markup decreases. Operating profit does not change in absolute dollars but decreases as a percentage of revenue.

Each of the modeled 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 that result from the sum of discounted cash flows from the reference year 2015 through 2048, the end of the analysis period. To provide perspective on the short-run cash flow impact, DOE includes in the discussion of the results a comparison of free cash flow between the no-new-standards case and the standards case at each TSL in the year before amended standards would take effect. This figure provides an understanding of the magnitude of the required conversion costs—relative to the cash flow generated by the industry in the no-new-standards case.

Table V.28 and Table V.29 present a range of results reflecting both the preservation of gross margin percentage markup scenario and the preservation of per-unit operating profit markup scenario. As noted, the preservation of per-unit operating profit scenario accounts for the more severe impacts presented. Estimated conversion costs and free cash flow in the year prior to the effective date of amended standards do not vary with markup scenario.

TABLE V.28—MANUFACTURER IMPACT ANALYSIS UNDER THE PRESERVATION OF GROSS MARGIN PERCENTAGE MARKUP SCENARIO FOR ANALYSIS PERIOD

[2015–2048]

	Units	No-new-standards case	Trial standard level				
			1	2	3	4	5
INPV	*2014$M*	62.7	62.7	62.8	63.1	62.9	73.8
Change in INPV	*2014$M**		(0.01)	0.06	0.33	0.15	11.07
	*% Change**		(0.02)	0.10	0.53	0.24	17.64
Product Conversion Costs	*2014$M*		0.05	0.23	0.79	1.61	3.36
Capital Conversion Costs	*2014$M*				0.18	1.19	3.16
Total Conversion Costs	*2014$M*		0.05	0.23	0.97	2.80	6.52
Free Cash Flow	*2014$M*	(1.6)	(1.6)	(1.7)	(2.0)	(2.7)	(4.1)
	*% Change**		(0.9)	(4.5)	(20.0)	(63.6)	(151.5)

* Parentheses indicate negative values.

TABLE V.29—MANUFACTURER IMPACT ANALYSIS UNDER THE PRESERVATION OF PER-UNIT OPERATING PROFIT MARKUP SCENARIO FOR ANALYSIS PERIOD

[2015–2048]

	Units	No-new-standards case	Trial standard level				
			1	2	3	4	5
INPV	*2014$M*	62.7	62.7	62.5	61.7	59.2	50.7
Change in INPV	*2014$M**		(0.03)	(0.24)	(1.04)	(3.54)	(12.06)
	*% Change**		(0.05)	(0.38)	(1.66)	(5.65)	(19.23)
Product Conversion Costs	*2014$M*		0.05	0.23	0.79	1.61	3.36
Capital Conversion Costs	*2014$M*				0.18	1.19	3.16
Total Conversion Costs	*2014$M*		0.05	0.23	0.97	2.80	6.52
Free Cash Flow	*2014$M*	(1.6)	(1.6)	(1.7)	(2.0)	(2.7)	(4.1)
	*% Change**		(0.9)	(4.5)	(20.0)	(63.6)	(151.5)

* Parentheses indicate negative values.

At TSL 1, DOE estimates the impact on INPV for manufacturers of beverage vending machine to range from −$.03 million to −$.01 million, or a change in INPV of −0.05 percent and −0.02 percent under the preservation of per-unit operating profit markup scenario and preservation of gross margin percentage markup scenario, respectively. At this TSL, industry free cash flow is estimated to decrease by approximately 0.9 percent to $1.6 million, compared to the base-case value of $1.6 million in the year before the compliance date (2018).

At TSL 1, the industry as a whole is expected to incur $0.05 million in product conversion costs and would have no capital conversion costs necessary to manufacture redesigned platforms associated with amended energy conservation standards compliance. DOE's engineering analysis indicates that the most cost-effective design options to reach TSL 1 are component swaps and software modifications such as automatic lighting controls, evaporator fan controls, incorporation of a permanent split capacitor evaporator fan motor, or enhanced evaporator coils. Manufacturer feedback indicated that such component swaps do not incur large product or capital conversion costs.

At TSL 2, DOE estimates the impact on INPV for manufacturers of beverage vending machines to range from −$.24 million to −$.06 million, or a change in INPV of −0.38 to −0.10 percent under the preservation of gross margin percentage markup scenario and the preservation of per-unit operating profit markup scenario, respectively. At this TSL, industry free cash flow is estimated to decrease by approximately 4.5 percent to $1.7 million, compared to the base-case value of $1.6 million in the year before the compliance date (2018).

At TSL 2, the industry as a whole is expected to incur $0.23 million in product conversion costs and no capital conversion costs to manufacturer products requiring platform redesigns. DOE's engineering analysis indicates that the most cost-effective design options to reach TSL 2 are component swaps and software modifications such as incorporating an enhanced evaporator coil, improved single speed reciprocating compressor, or a low power state for CO_2 products, and incorporating a permanent split capacitor condenser fan motor, LED lighting, enhanced evaporator coil, or evaporator fan controls for propane products. Manufacturer feedback indicated that such component swaps do not incur large product or capital conversion costs.

At TSL 3, DOE estimates the impact on INPV for manufacturers of beverage vending machines to range from −$1.04 million to $0.33 million, or a change in INPV of −1.66 percent to 0.53 percent under the preservation of gross margin percentage markup scenario and the preservation of per-unit operating profit markup scenario, respectively. At this TSL, industry free cash flow is estimated to decrease by approximately 20.0 percent to $2.0 million, compared to the base-case value of $1.6 million in the year before the compliance date (2018).

At TSL 3, the industry as a whole is expected to spend $0.79 million in product conversion costs, as well as $0.18 million in capital conversion costs to manufacture redesigned platforms. While conversion costs remain relatively constant for manufacturers of Class B, Combination A and Combination B machines, the conversion costs for Class A equipment increase at TSL 3 (especially for CO_2 products), as a greater portion of these products will require larger investments to achieve the trial efficiency. At this level, manufacturers will most likely be required to integrate enhanced glass packs into Class A CO_2 machines. Because Class A machines represent approximately 54 percent of the market, conversion costs associated with these products have a significant impact on total industry conversion costs.

At TSL 4, DOE estimates the impact on INPV for manufacturers of beverage vending machines to range from −$3.54 million to −$0.15 million, or a change in INPV of −5.65 percent to −0.24 percent under the preservation of gross margin percentage markup scenario and the preservation of per-unit operating profit markup scenario, respectively. At this TSL, industry free cash flow is estimated to decrease by approximately 63.6 percent to −$2.7 million, compared to the base-case value of $1.6 million in the year before the compliance date (2018).

At TSL 4, the industry as a whole is expected to spend $1.61 million in product conversion costs, as well as $1.19 million in capital conversion costs for platform redesigns. At TSL 4, some manufacturers will likely be required to increase the thickness of their products' insulation and incorporate vacuum insulated panels (VIPs). Additionally, many manufacturers of Combination A machines will most likely be required to integrate enhanced glass packs in order to achieve the required efficiency.

At TSL 4, there is a slight decrease of less than 1 percent in total industry shipments in 2019 relative to the no-new-standards case. Under the preservation of gross margin percentage markup scenario, the decrease in shipments and increased conversion costs are outweighed by a relatively larger increase in industry revenue, resulting in a positive change in INPV. Under the preservation of per-unit operating profit markup scenario, the increase in MPCs at TSL 4 is outweighed by the decrease in shipments and the increase in industry conversion costs, resulting in a decrease in INPV.

At TSL 5, DOE estimates the impact on INPV for manufacturers of beverage vending machines to range from −$12.06 million to $11.07 million, or a change in INPV of −19.23 percent to 17.64 percent under the preservation of gross margin percentage markup scenario and the preservation of per-unit operating profit markup scenario, respectively. At this TSL, industry free cash flow is estimated to decrease by approximately 151.5 percent to $4.1 million, compared to the base-case value of $1.6 million in the year before the compliance date (2018).

At TSL 5, the industry as a whole is expected to spend $3.36 million in product conversion costs associated with the research and development and testing and certification, as well as $3.16 million in one-time investments in PP&E for platform redesigns. The conversion cost burden for manufacturers of all products increases substantially at TSL 5. At this level, manufacturers will likely be required to integrate VIPs to achieve the required efficiency. VIPs are an unproven technology in the BVM industry and would likely require substantial effort and cost to incorporate.

At TSL 5, there is an 6-percent decrease in total industry shipments in 2019 relative to the no-new-standards case. Under the preservation of gross margin percentage markup scenario, this decrease in shipments and increased conversion costs are outweighed by a relatively larger increase in industry MPCs, resulting in a positive change in INPV. Under the preservation of per-unit operating profit markup scenario, the increase in MPCs at TSL 5 is outweighed by the decrease in shipments and the increase in industry conversion costs. This results in a decrease in INPV.

b. Impacts on Direct Employment

To quantitatively assess the potential impacts of amended energy conservation standards on direct employment, DOE used the GRIM to estimate the domestic labor expenditures and number of direct employees in the no-new-standards case and at each TSL from 2014 through 2048. DOE used data from the U.S. Census Bureau's 2011 Annual Survey of Manufacturers,[66] the results of the engineering analysis, and interviews with manufacturers to determine the inputs necessary to calculate industry-wide labor expenditures and domestic direct employment levels. Labor expenditures related to manufacturing of beverage vending machines are a function of labor intensity, 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 MPCs by the labor percentage of MPCs. DOE estimates that 90 percent of BVM units are produced domestically.

The total labor expenditures in the GRIM were then converted to domestic production employment levels by dividing production labor expenditures by the annual payment per production worker (production worker hours times the labor rate found in the U.S. Census Bureau's 2011 Annual Survey of Manufacturers). The production worker estimates in this section only cover workers up to the line-supervisor level who are directly involved in fabricating and assembling a product within an original equipment manufacturer (OEM) facility. Workers performing services that are closely associated with production operations, such as materials handling tasks using forklifts, are also included as production labor. DOE's estimates only account for production workers who manufacture the specific products covered by this rulemaking.

Because production employment expenditures are assumed to be a fixed

[66] U.S. Census Bureau, Annual Survey of Manufacturers: General Statistics: Statistics for Industry Groups and Industries (2011) (Available at *http://www.census.gov/manufacturing/asm/index.html*).

percentage of cost of goods sold and the MPCs typically increase with more efficient products, labor tracks the increased prices in the GRIM. As efficiency of BVMs increase, so does the complexity of the products, generally requiring more labor to produce. Based on industry feedback, DOE believes that manufacturers that use domestic production currently will continue to produce the same scope of covered products in domestic production facilities. DOE does not expect production to shift to lower labor cost countries. To estimate a lower bound to employment, DOE assumed that employment tracks closely with industry shipments, and any percentage decrease in shipments will result in a commensurate percentage decrease in employment. A complete description of the assumptions used to generate these upper and lower bounds can be found in chapter 12 of the NOPR TSD.

Using the GRIM, DOE estimates that in the absence of amended energy conservation standards, there would be 414 domestic production workers in the BVM industry. As noted previously, DOE estimates that 90 percent of BVM units sold in the United States are manufactured domestically. Table V.30 shows the range of the impacts of potential amended energy conservation standards on U.S. production workers of beverage vending machines.

TABLE V.30—POTENTIAL CHANGES IN THE TOTAL NUMBER OF BEVERAGE VENDING MACHINE PRODUCTION WORKERS IN 2019

	No-new-standards case *	Trial standard level				
		1	2	3	4	5
Potential Changes in Domestic Production Workers in 2019. **	....	....	0 to 2	0 to 11	(1) to 40	(26) to 133

* No-new-standards case estimates 414 domestic production workers in the BVM industry in 2019.
** Parentheses indicate negative values.

The upper end of the range estimates the maximum increase in the number of production workers in the BVM industry after implementation of an emended energy conservation standard. It assumes that manufacturers would continue to produce the same scope of covered products within the United States and would require some additional labor to produce more efficient products.

The lower end of the range represents the maximum decrease in total number of U.S. production workers that could result from an amended energy conservation standard. During interviews, manufacturers noted that, due to the high shipping costs associated with beverage vending machines, they would be hesitant to move any major production operations outside the U.S. Therefore, the lower bound of direct employment impacts assumes domestic production of beverage vending machines would decrease by the same relative percentage decrease in industry shipments as a result of an amended energy conservation standard.

This conclusion is independent of any conclusions regarding indirect employment impacts in the broader United States economy, which are documented in chapter 16 of the TSD.

DOE requests comments on the total annual direct employment levels in the industry for BVM production (section VII.E of this NOPR).

c. Impacts on Manufacturing Capacity

According to interview feedback from BVM manufacturers, amended energy conservations standards will not significantly constrain manufacturing production capacity. Manufacturers stated that they would use normally-scheduled factory downtime to make any facility modifications that are necessary as a result of amended standards. DOE believes that manufactures will be able to maintain production capacity levels sufficient to meet market demand under these proposed levels. However, manufacturers did express concern regarding the potential strain on technical resources if the amended standard's effective date did not provide ample time for the industry to first fully comply with the EPA's proposed HFC phaseout. At the time of manufacturer interviews, EPA SNAP Proposed Rule 20 (Docket No. EPA–HQ–OAR–2013–0748) proposed to change the status of certain refrigerants to be unacceptable for certain applications, including HFC–134a for BVM applications, with a proposed phaseout on January 1, 2016. 79 FR 46126, 46135 (August 6, 2014). Although Rule 20 has subsequently been finalized with a mandated phaseout date of January 1, 2019 (80 FR 42870, 42917–42920; July 20, 2015), few manufacturers have experience with CO_2 designs, and no beverage vending machines in the domestic market currently use propane. The switch to CO_2 and propane will require all manufacturers to redesign the majority of their products. Manufacturers are concerned they do not have the technical capacity to redesign for new refrigerants and amended energy conservation standards. DOE accounted for the forthcoming HFC phaseout in its analysis by estimating CO_2- and propane-specific cost-efficiency curves and industry conversion costs related to energy conservation standards compliance, as well as a one-time investment required for the industry to switch all BVM production to CO_2- and propane. Cost-efficiency curves are presented in chapter 5 of the NOPR TSD, and information regarding conversion costs is contained in chapter 12.

d. Impacts on Subgroups of Manufacturers

Small manufacturers, niche equipment manufacturers, and manufacturers exhibiting a cost structure substantially different from the industry average could be affected disproportionately. As discussed in sections IV.I.3 and V.B.2.a of this NOPR, using average cost assumptions to develop an industry cash-flow estimate is inadequate to assess differential impacts among manufacturer subgroups.

For BVM equipment, DOE identified and evaluated the impact of amended energy conservation standards on one subgroup: Small manufacturers. The SBA defines a ''small business'' as having 1,000 employees or less for NAICS 333318, ''Other Commercial and Service Industry Machinery Manufacturing.'' Based on this definition, DOE identified 5 manufacturers in the BVM equipment industry that are small businesses.

For a discussion of the impacts on the small manufacturer subgroup, see the Regulatory Flexibility Analysis in section V.B.2.d of this NOPR and chapter 12 of the NOPR TSD.

e. Cumulative Regulatory Burden

While any one regulation may not impose a significant burden on manufacturers, the combined effects of several 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. Multiple regulations affecting the same manufacturer can strain profits and can lead companies to abandon product lines or markets with lower expected future returns than competing products. For these reasons, DOE conducts an analysis of cumulative regulatory burden as part of its rulemakings pertaining to appliance efficiency.

For the cumulative regulatory burden analysis, DOE considers other DOE regulations that could affect BVM manufacturers that will take effect approximately three years before or after the 2019 compliance date of amended energy conservation standards. The compliance years and expected industry conversion costs of energy conservation standards that may also impact BVM manufacturers are indicated in Table V.31.

TABLE V.31—COMPLIANCE DATES AND EXPECTED CONVERSION EXPENSES OF FEDERAL ENERGY CONSERVATION STANDARDS AFFECTING BVM MANUFACTURERS

Regulation	Compliance date(s)	Expected expenses/impacts
Commercial Refrigeration Equipment 79 FR 17725 (March 28, 2014)	3/27/2017	$43.1 million.

Manufacturers cited ENERGY STAR standards for beverage vending machines as a source of regulatory burden. In response, DOE does not consider the ENERGY STAR program in its analysis of cumulative regulatory burden because ENERGY STAR is a voluntary program and is not federally mandated.

In interviews, manufactures cited the proposed phaseout of HFCs (including the common BVM refrigerant, HFC–134a) which could happen as early as January 2016 (subsequently finalized for January 2019), as a major source of additional burden accompanying potential amended efficiency standards. As detailed in section IV.I, based on feedback in interviews, DOE assumed that each manufacturer would need to invest $750,000 to update their products to comply with Rule 20. DOE assumed this one-time SNAP investment would apply to all eight manufacturers in the year leading up to the phaseout (*i.e.,* 2018), resulting in an additional burden to the industry of $6 million. This one-time cost occurs in both the no-new-standards case and in the standards case.

3. National Impact Analysis

a. Significance of Energy Savings

DOE estimated the NES by calculating the difference in annual energy consumption for the base-case scenario and standards-case scenario at each TSL for each equipment class and summing up the annual energy savings for the beverage vending machines purchased during the 30-year 2019 through 2048 analysis period. Energy impacts include the 30-year period, plus the life of equipment purchased in the last year of the analysis, or roughly 2019 through 2078. The energy consumption calculated in the NIA is full-fuel-cycle (FFC) energy, which quantifies savings beginning at the source of energy production. DOE also reports primary or source energy that takes into account losses in the generation and transmission of electricity. FFC and primary energy are discussed in section IV.G.3 of this NOPR.

Table V.32 presents the source NES for all equipment classes at each TSL and the sum total of NES for each TSL.

TABLE V.32—CUMULATIVE NATIONAL PRIMARY ENERGY SAVINGS FOR EQUIPMENT PURCHASED IN 2019–2048

[Quads]

Equipment class	Standard level				
	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
Class A	* 0.000	0.031	0.046	0.062	0.108
CO_2	0.000	0.018	0.028	0.037	0.065
Propane	0.000	0.012	0.018	0.025	0.044
Class B	0.004	0.013	0.045	0.071	0.087
CO_2	0.000	0.002	0.020	0.036	0.045
Propane	0.004	0.011	0.025	0.035	0.042
Combination A	0.002	0.010	0.029	0.048	0.052
CO_2	0.001	0.006	0.017	0.029	0.031
Propane	0.001	0.004	0.012	0.019	0.021
Combination B	0.001	0.005	0.019	0.033	0.037
CO_2	0.000	0.003	0.011	0.019	0.022
Propane	0.000	0.002	0.008	0.013	0.015
Total †	0.006	0.058	0.138	0.213	0.284

* The value equal to 0.000 means the NES rounds to less than 0.001 quads.
† Numbers may not add to totals, due to rounding.

Table V.33 presents FFC energy savings at each TSL for each equipment class. The NES increases from 0.007 quads at TSL 1 to 0.297 quads at TSL 5.

TABLE V.33—CUMULATIVE NATIONAL ENERGY SAVINGS INCLUDING FULL-FUEL-CYCLE FOR EQUIPMENT PURCHASED IN 2019–2048 (QUADS)

Equipment class	Standard level				
	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
Class A	* 0.000	0.032	0.048	0.064	0.114
CO_2	0.000	0.019	0.029	0.039	0.068
Propane	0.000	0.013	0.019	0.026	0.046
Class B	0.004	0.014	0.047	0.074	0.091
CO_2	0.000	0.002	0.021	0.037	0.047
Propane	0.004	0.011	0.026	0.037	0.044
Combination A	0.002	0.010	0.030	0.050	0.055
CO_2	0.001	0.006	0.018	0.030	0.033
Propane	0.001	0.004	0.012	0.020	0.022
Combination B	0.001	0.005	0.020	0.034	0.038
CO_2	0.000	0.003	0.011	0.020	0.023
Propane	0.000	0.002	0.008	0.014	0.016
Total **	0.007	0.061	0.145	0.223	0.297

* A value equal to 0.000 means the NES rounds to less than 0.001 quads.
** Numbers may not add to totals, due to rounding.

OMB Circular A–4 [67] requires agencies to present analytical results, including separate schedules of the monetized benefits and costs that show the type and timing of benefits and costs. Circular A–4 also directs agencies to consider the variability of key elements underlying the estimates of benefits and costs. For this rulemaking, DOE undertook a sensitivity analysis using 9 rather than 30 years of product shipments. The choice of a 9-year period is a proxy for the timeline in EPCA for the review of certain energy conservation standards and potential revision of and compliance with such revised standards.[68] DOE notes that the review timeframe established in EPCA generally does not overlap with the product lifetime, product manufacturing cycles or other factors specific to beverage vending machines. Thus, this information is presented for informational purposes only and is not indicative of any change in DOE's analytical methodology. The NES results based on a 9-year analysis period are presented in Table V.34. The impacts are counted over the lifetime of equipment purchased in 2019 through 2027.

TABLE V.34—NATIONAL FULL-FUEL-CYCLE ENERGY SAVINGS FOR 9 YEARS OF SHIPMENTS (2019–2027)

[Quads]

Equipment class	Standard level				
	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
Class A	* 0.000	0.006	0.010	0.013	0.023
CO_2	0.000	0.004	0.006	0.008	0.013
Propane	0.000	0.003	0.004	0.005	0.009
Class B	0.001	0.003	0.009	0.015	0.018
CO_2	0.000	0.000	0.004	0.007	0.009
Propane	0.001	0.002	0.005	0.007	0.009
Combination A	0.000	0.002	0.006	0.010	0.011
CO_2	0.000	0.001	0.004	0.006	0.007
Propane	0.000	0.001	0.002	0.004	0.004
Combination B	0.000	0.001	0.004	0.007	0.008
CO_2	0.000	0.001	0.002	0.004	0.004
Propane	0.000	0.000	0.002	0.003	0.003
Total **	0.001	0.012	0.029	0.045	0.059

* A value equal to 0.000 means the NES rounds to less than 0.001 quads.
** Numbers may not add to totals, due to rounding.

[67] U.S. Office of Management and Budget, ''Circular A–4: Regulatory Analysis'' (Sept. 17, 2003) (Available at: *http://www.whitehouse.gov/omb/circulars_a004_a-4/*).

[68] EPCA requires DOE to review its standards at least once every 6 years, and requires, for certain products, a 3-year period after any new standard is promulgated before compliance is required, except that in no case may any new standards be required within 6 years of the compliance date of the previous standards. (42 U.S.C. 6295(m)) While adding a 6-year review to the 3-year compliance period adds up to 9 years, DOE notes that it may undertake reviews at any time within the 6 year period and that the 3-year compliance date may yield to the 6-year backstop. A 9-year analysis period may not be appropriate given the variability that occurs in the timing of standards reviews and the fact that for some consumer products, the compliance period is 5 years rather than 3 years.

b. Net Present Value of Customer Costs and Benefits

DOE estimated the cumulative NPV to the nation of the total savings for the customers that would result from potential standards at each TSL. In accordance with OMB guidelines on regulatory analysis (OMB Circular A–4, section E, September 17, 2003), DOE calculated NPV using both a 7-percent and a 3-percent real discount rate. The 7-percent rate is an estimate of the average before-tax rate of return on private capital in the U.S. economy, and reflects the returns on real estate and small business capital, including corporate capital. DOE used this discount rate to approximate the opportunity cost of capital in the private sector, because recent OMB analysis has found the average rate of return on capital to be near this rate. In addition, DOE used the 3-percent rate to capture the potential effects of amended standards on private consumption. This rate represents the rate at which society discounts future consumption flows to their present value. It can be approximated by the real rate of return on long-term government debt (*i.e.,* yield on Treasury notes minus annual rate of change in the CPI), which has averaged about 3 percent on a pre-tax basis for the last 30 years.

Table V.35 and Table V.36 show the customer NPV results for each of the TSLs DOE considered for beverage vending machines at both 7-percent and 3-percent discount rates. In each case, the impacts cover the expected lifetime of equipment purchased from 2019 through 2048. Detailed NPV results are presented in chapter 10 of the NOPR TSD.

The NPV results at a 7-percent discount rate for TSL 5 were negative for Class A. In all cases the TSL 5 NPV was significantly lower than the TSL 4 results. This is consistent with the results of LCC analysis results for TSL 5, which showed significant increase in LCC and significantly higher PBPs. Efficiency levels for TSL 4 were chosen to correspond to the highest NPV at a 7-percent discount rate for all classes. Consequently, the total NPV for beverage vending machines was highest for TSL 4, with a value of $0.417 billion (2014$) at a 7-percent discount rate. TSL 3 showed the second highest total NPV, with a value of $0.261 billion (2014$) at a 7-percent discount rate. TSL 1, TSL 2 and TSL 5 have a total NPV lower than TSL 3 or 4.

TABLE V.35—NET PRESENT VALUE AT A 7-PERCENT DISCOUNT RATE FOR EQUIPMENT PURCHASED IN 2019–2048

[billion 2014$]

Equipment class	Standard level				
	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
Class A	0.000	0.058	0.076	0.090	* (0.069)
CO_2	0.000	0.034	0.042	0.045	(0.077)
Propane	0.000	0.023	0.035	0.046	0.007
Class B	0.007	0.026	0.088	0.149	0.053
CO_2	0.000	0.005	0.038	0.070	0.004
Propane	0.007	0.022	0.049	0.079	0.049
Combination A	0.004	0.020	0.059	0.101	0.050
CO_2	0.002	0.012	0.035	0.059	0.027
Propane	0.002	0.008	0.024	0.041	0.023
Combination B	0.002	0.010	0.039	0.077	0.047
CO_2	0.001	0.005	0.022	0.045	0.021
Propane	0.001	0.005	0.016	0.032	0.026
Total	0.013	0.113	0.261	0.417	0.081

* Values in parentheses are negative numbers.

TABLE V.36—NET PRESENT VALUE AT A 3-PERCENT DISCOUNT RATE FOR EQUIPMENT PURCHASED IN 2019–2048

[billion 2014$]

Equipment class	Standard level				
	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
Class A	0.000	0.149	0.203	0.249	*(0.005)
CO_2	0.000	0.088	0.114	0.131	(0.072)
Propane	0.000	0.060	0.089	0.118	0.067
Class B	0.018	0.066	0.224	0.395	0.229
CO_2	0.000	0.012	0.098	0.191	0.074
Propane	0.018	0.054	0.125	0.205	0.154
Combination A	0.010	0.050	0.149	0.260	0.166
CO_2	0.006	0.030	0.089	0.154	0.094
Propane	0.004	0.020	0.060	0.106	0.073
Combination B	0.004	0.025	0.097	0.196	0.142
CO_2	0.002	0.013	0.056	0.115	0.070
Propane	0.002	0.012	0.041	0.080	0.072
Total	0.032	0.290	0.673	1.100	0.532

* Values in parentheses are negative numbers.

The NPV results based on the aforementioned 9-year analysis period are presented in Table V.37 and Table V.38. The impacts are counted over the lifetime of equipment purchased in 2019–2027. As mentioned previously in section V.B.3.a of this NOPR, this information is presented for informational purposes only and is not indicative of any change in DOE's analytical methodology or decision criteria.

TABLE V.37—NET PRESENT VALUE AT A 7-PERCENT DISCOUNT RATE FOR 9 YEARS OF SHIPMENTS (2019–2027)
[billion 2014$]

Equipment class	Standard level				
	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
Class A	* 0.000	0.022	0.028	0.033	** (0.035)
CO_2	0.000	0.013	0.015	0.016	(0.035)
Propane	0.000	0.009	0.013	0.017	0.000
Class B	0.003	0.010	0.033	0.056	0.016
CO_2	0.000	0.002	0.015	0.026	(0.001)
Propane	0.003	0.008	0.019	0.030	0.017
Combination A	0.002	0.008	0.022	0.038	0.017
CO_2	0.001	0.005	0.013	0.022	0.009
Propane	0.001	0.003	0.009	0.016	0.008
Combination B	0.001	0.004	0.015	0.030	0.017
CO_2	0.000	0.002	0.008	0.017	0.007
Propane	0.000	0.002	0.006	0.012	0.010
Total	0.005	0.043	0.099	0.157	0.015

* A value equal to 0.000 means the NPV rounds to less than $0.001 (2014$).
** Values in parentheses are negative numbers.

TABLE V.38—NET PRESENT VALUE AT A 3-PERCENT DISCOUNT RATE FOR 9 YEARS OF SHIPMENTS (2019–2027)
[billion 2014$]

Equipment class	Standard level				
	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
Class A	* 0.000	0.038	0.051	0.062	** (0.017)
CO_2	0.000	0.023	0.029	0.032	(0.030)
Propane	0.000	0.015	0.023	0.030	0.013
Class B	0.005	0.017	0.058	0.102	0.051
CO_2	0.000	0.003	0.025	0.049	0.014
Propane	0.005	0.014	0.032	0.053	0.037
Combination A	0.003	0.013	0.038	0.067	0.039
CO_2	0.002	0.008	0.023	0.040	0.022
Propane	0.001	0.005	0.015	0.027	0.018
Combination B	0.001	0.006	0.025	0.051	0.035
CO_2	0.001	0.003	0.015	0.030	0.017
Propane	0.001	0.003	0.011	0.021	0.018
Total	0.008	0.075	0.173	0.283	0.109

* A value equal to 0.000 means the NPV rounds to less than $0.001 (2014$).
** Values in parentheses are negative numbers.

c. Indirect Impacts on Employment

DOE expects energy conservation standards for beverage vending machines to reduce energy costs for equipment owners, with the resulting net savings being redirected to other forms of economic activity. Those shifts in spending and economic activity could affect the demand for labor. Thus, indirect employment impacts may result from expenditures shifting between goods (the substitution effect) and changes in income and overall expenditure levels (the income effect) that occur due to the imposition of new and amended standards. These impacts may affect a variety of businesses not directly involved in the decision to make, operate, or pay the utility bills for beverage vending machines. As described in section IV.M of this NOPR, DOE used an input/output model of the U.S. economy to estimate indirect employment impacts of the TSLs that DOE considered in this rulemaking (see chapter 16 of the NOPR TSD for more details). DOE understands that there are uncertainties involved in projecting employment impacts, especially changes in the later years of the analysis. Therefore, DOE generated results for near-term time frames (2020–2025), where these uncertainties are reduced.

The results suggest that these proposed standards would be likely to have negligible impact on the net demand for labor in the economy. All TSLs increase net demand for labor by fewer than 1000 jobs. 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 more detailed results about anticipated indirect employment impacts. As shown in Table V.39, DOE estimates that net indirect employment impacts from a BVM amended standard are small relative to the national economy.

TABLE V.39—NET SHORT-TERM CHANGE IN EMPLOYMENT

[Jobs]

Trial standard level	2020	2025
1	1	4
2	9	35
3	21	82
4	32	129
5	334	190

4. Impact on Utility or Performance of Equipment

In its analyses, DOE has considered potential impacts of amended standards, including the use of design options considered in the engineering analysis, on the performance and utility of BVM equipment. This includes the ability to achieve and maintain the necessary vending temperatures, the ability to display and vend product upon receipt of payment, and other factors core to the utility of vending machine operation. DOE has tentatively concluded that the amended standards it is proposing in this NOPR would not lessen the utility or performance of beverage vending machines.

DOE requests comment on its preliminary conclusion that the proposed standard levels will not have any negative impact on the performance or utility of equipment available in the market (section VII.E of this NOPR).

5. Impact of Any Lessening of Competition

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. (42 U.S.C. 6295(o)(2)(B)(i)(V) and (o)(2)(B)(ii))

To assist the Attorney General in making such a determination, DOE provided DOJ with copies of this NOPR and the TSD for review. DOE will consider DOJ's comments on the proposed rule in preparing the final rule, and DOE will publish and respond to DOJ's comments in that document.

6. Need of the Nation To Conserve Energy

An improvement in the energy efficiency of the products subject to this rule is likely to improve the security of the nation's energy system by reducing overall demand for energy. Reduced electricity demand may also improve the reliability of the electricity system. Reductions in national electric generating capacity estimated for each considered TSL are reported in chapter 15 of the NOPR TSD.

Energy conservation savings from new and amended standards for the BVM equipment classes covered in this NOPR could also produce environmental benefits in the form of reduced emissions of air pollutants and greenhouse gases associated with electricity production. Table V.40 provides DOE's estimate of cumulative emissions reductions projected to result from the TSLs considered in this rulemaking. The table includes both power sector emissions and upstream emissions. The upstream emissions were calculated using the multipliers discussed in section IV.G of this NOPR. DOE reports annual CO_2, NO_X, and Hg emissions reductions for each TSL in chapter 13 of the NOPR TSD.

TABLE V.40—CUMULATIVE EMISSIONS REDUCTION FOR POTENTIAL STANDARDS FOR BEVERAGE VENDING MACHINES

	TSL				
	1	2	3	4	5
Power Sector and Site Emissions					
CO_2 *(million metric tons)*	0.36	3.36	7.99	12.33	16.42
NO_X *(thousand tons)*	0.28	2.61	6.21	9.57	12.76
Hg (*tons*)	0.00	0.01	0.02	0.03	0.04
N_2O (*thousand tons*)	0.01	0.05	0.11	0.17	0.23
CH_4 (*thousand tons*)	0.04	0.33	0.78	1.20	1.60
SO_2 (*thousand tons*)	0.31	2.83	6.75	10.40	13.86
Upstream Emissions					
CO_2 *(million metric tons)*	0.02	0.19	0.46	0.71	0.95
NO_X *(thousand tons)*	0.30	2.77	6.59	10.16	13.54
Hg (*tons*)	0.00001	0.0001	0.0002	0.0003	0.0004
N_2O (*thousand tons*)	0.00	0.00	0.00	0.01	0.01
CH_4 (*thousand tons*)	1.74	16.11	38.37	59.17	78.89
SO_2 (*thousand tons*)	0.00	0.03	0.08	0.12	0.17
Total Emissions					
CO_2 *(million metric tons)*	0.38	3.55	8.45	13.04	17.37
NO_X *(thousand tons)*	0.58	5.37	12.80	19.73	26.30
Hg (*tons*)	0.001	0.01	0.02	0.03	0.04
N_2O (*thousand tons*)	0.01	0.05	0.12	0.18	0.24
CH_4 (*thousand tons*)	1.77	16.44	39.15	60.37	80.49
SO_2 (*thousand tons*)	0.31	2.87	6.83	10.53	14.02

As part of the analysis for this NOPR, DOE estimated monetary benefits likely to result from the reduced emissions of CO_2 and NO_X estimated for each of the TSLs considered for beverage vending machines. As discussed in section IV.K of this NOPR, for CO_2, DOE used values for the SCC developed by an interagency process. The interagency group selected four sets of SCC values for use in regulatory analyses. Three sets are based on the average SCC from three integrated assessment models, at discount rates of 2.5 percent, 3 percent, and 5 percent. The fourth set, which represents the 95th-percentile SCC estimate across all three models at a 3-percent discount rate, is included to represent higher-than-expected impacts from temperature change further out in the tails of the SCC distribution. The four SCC values for CO_2 emissions reductions in 2015, expressed in 2014$, are $12.2 per metric ton, $40.0 per metric ton, $62.3 per metric ton, and $116.8 per metric ton for discount rates of 2.5 percent, 3 percent, 5 percent, and 3 percent respectively. The values for later years are higher due to increasing emissions-related costs as the magnitude of projected climate change increases.

Table V.41 presents the global value of CO_2 emissions reductions at each TSL. DOE calculated domestic values as a range from 7 percent to 23 percent of the global values, and these results are presented in chapter 14 of the NOPR TSD.

TABLE V.41—GLOBAL PRESENT VALUE OF CO_2 EMISSIONS REDUCTION FOR POTENTIAL STANDARDS FOR BEVERAGE VENDING MACHINES

TSL	SCC Case * (*million 2014$*)			
	5% Discount rate, average *	3% Discount rate, average *	2.5% Discount rate, average *	3% Discount rate, 95th percentile *
Primary Energy Emissions				
1	2.4	11.1	17.7	33.8
2	21.9	102.9	164.4	314.2
3	52.1	245.1	391.5	748.1
4	80.3	378.0	603.7	1,153.6
5	106.9	503.3	804.1	1,536.2
Upstream Emissions				
1	0.1	0.6	1.0	1.9
2	1.2	5.9	9.4	18.0
3	3.0	14.0	22.4	42.8
4	4.5	21.6	34.6	66.0
5	6.1	28.8	46.1	87.9
Total Emissions				
1	2.5	11.7	18.7	35.8
2	23.1	108.8	173.8	332.1
3	55.0	259.1	413.9	790.9
4	84.9	399.6	638.3	1,219.6
5	113.0	532.1	850.1	1,624.1

* For each of the four cases, the corresponding SCC value for emissions in 2015 is $12.2, $40.0, $62.3, and $116.8 per metric ton (2014$), respectively.

DOE is aware that scientific and economic knowledge about the contribution of CO_2 and other greenhouse gas (GHG) emissions to changes in the future global climate and the potential resulting damages to the world economy continues to evolve rapidly. Thus, any value placed in this rulemaking on reducing CO_2 emissions is subject to change. DOE, together with other Federal agencies, will continue to review various methodologies for estimating the monetary value of reductions in CO_2 and other GHG emissions. This ongoing review will consider 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. However, consistent with DOE's legal obligations, and taking into account the uncertainty involved with this particular issue, DOE included in this NOPR the most recent values and analyses resulting from the interagency review process.

DOE also estimated a range for the cumulative monetary value of the economic benefits associated with NO_X emissions reductions anticipated to result from amended standards for the BVM equipment that is the subject of this NOPR. The dollar-per-ton values that DOE used are discussed in section IV.K of this NOPR. Table V.42 presents the present value of cumulative NO_X emissions reductions for each TSL calculated using the average dollar-per-ton values and 7-percent and 3-percent discount rates.

TABLE V.42—PRESENT VALUE OF NO_X EMISSIONS REDUCTION FOR POTENTIAL STANDARDS FOR BEVERAGE VENDING MACHINES

TSL	(*million 2014$*)	
	3% Discount rate	7% Discount rate
Power Sector Emissions		
1	0.4	0.2
2	3.3	1.4
3	7.9	3.4
4	12.2	5.2
5	16.3	6.9
Upstream Emissions		
1	0.4	0.1
2	3.4	1.4
3	8.1	3.3
4	12.5	5.1
5	16.7	6.8
Total Emissions		
1	0.7	0.3
2	6.7	2.8
3	16.1	6.7
4	24.8	10.3
5	33.0	13.7

The NPV of the monetized benefits associated with emissions reductions can be viewed as a complement to the NPV of the customer savings calculated for each TSL considered in this rulemaking. Table V.43 presents the NPV values that result from adding the estimates of the potential economic benefits resulting from reduced CO_2 and NO_X emissions in each of four valuation scenarios to the NPV of customer savings calculated for each TSL considered in this rulemaking, at both a 7-percent and a 3-percent discount rate. The CO_2 values used in the columns of each table correspond to the four scenarios for the valuation of CO_2 emission reductions discussed above.

TABLE V.43—NET PRESENT VALUE OF CUSTOMER SAVINGS COMBINED WITH NET PRESENT VALUE OF MONETIZED BENEFITS FROM CO_2 AND NO_X EMISSIONS REDUCTIONS

TSL	Customer NPV at 3% discount rate added with:			
	SCC Value of $12.2/metric ton CO_2* and med value for NO_X**	SCC Value of $40.0/metric ton CO_2* and medium value for NO_X**	SCC Value of $62.3/metric ton CO_2* and medium value for NO_X**	SCC Value of $116.8/metric ton CO_2* and med value for NO_X**
	(billion 2014$)			
1	0.036	0.045	0.052	0.069
2	0.320	0.405	0.470	0.629
3	0.744	0.948	1.103	1.480
4	1.210	1.524	1.763	2.344
5	0.678	1.097	1.415	2.189
TSL	Customer NPV at 7% discount rate added with:			
	SCC Value of $12.2/metric ton CO_2* and med value for NO_X**	SCC Value of $40.0/metric ton CO_2* and medium value for NO_X**	SCC Value of $62.3/metric ton CO_2* and medium value for NO_X**	SCC Value of $116.8/metric ton CO_2* and med value for NO_X**
	(billion 2014$)			
1	0.016	0.025	0.032	0.049
2	0.139	0.225	0.290	0.448
3	0.323	0.527	0.682	1.059
4	0.512	0.827	1.065	1.647
5	0.207	0.627	0.945	1.719

* These label values represent the global SCC in 2015, in 2014$. The present values have been calculated with scenario-consistent discount rates.

** Medium Value corresponds to $2,723 per ton of NO_X emissions.

In considering the previous results, two issues are relevant. First, the national operating cost savings are domestic U.S. customer monetary savings that occur as a result of market transactions, while the value of CO_2 reductions is based on a global value. Second, the assessments of operating cost savings and the SCC are performed with different methods that use quite different time frames for analysis. The national operating cost savings is measured for the lifetime of products shipped in 2019–2048. The SCC values, on the other hand, reflect the present value of future climate-related impacts resulting from the emission of one metric ton of CO_2 in each year. These impacts continue well beyond 2100.

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.

C. Proposed Standards

When considering proposed standards, the new or amended energy conservation standards for any type (or class) of covered product must be designed to achieve the maximum improvement in energy efficiency that the Secretary determines is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A)) In determining whether a proposed standard is economically justified, the Secretary must determine whether the benefits of the standard exceed its burdens to the greatest extent practicable, in light of the seven statutory factors discussed previously. (42 U.S.C. 6295(o)(2)(B)(i)) The new or amended standard must also result in a significant conservation of energy. (42 U.S.C. 6295(o)(3)(B))

DOE considered the impacts of the standards for beverage vending machines at each TSL, beginning with the maximum technologically feasible level, to determine whether that level was economically justified. Where the max-tech level was not justified, DOE then considered the next-most-efficient level and undertook the same evaluation until it reached the highest efficiency level that is both technologically feasible and economically justified and saves a significant amount of energy.

To aid the reader in understanding the benefits and/or burdens of each TSL, tables in this section summarize the quantitative analytical results for each TSL, based on the assumptions and methodology discussed herein. The efficiency levels contained in each TSL are described in section V.A of this NOPR. 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 customers who may be disproportionately affected by a national standard, impacts on employment, technological feasibility, manufacturer costs, and impacts on competition may affect the economic results presented. Section V.B.1.b of this NOPR presents the estimated impacts of each TSL for these subgroups. DOE discusses the impacts on direct employment in BVM manufacturing in section V.B.2.b of this NOPR, and discusses the indirect employment impacts in section V.B.3.c of this NOPR.

1. Benefits and Burdens of Trial Standard Levels Considered for Beverage Vending Machines

Table V.44, Table V.45, and Table V.46 summarize the quantitative impacts estimated for each TSL for beverage vending machines. The national impacts are measured over the lifetime of beverage vending machines purchased in the 30-year period that begins in the year of compliance with amended standards (2019–2048). The energy savings, emissions reductions, and value of emissions reductions refer to full-fuel-cycle results.

TABLE V.44—SUMMARY OF ANALYTICAL RESULTS FOR BEVERAGE VENDING MACHINES: NATIONAL IMPACTS

Category	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
National FFC Energy Savings (*quads*).	0.01	0.06	0.14	0.22	0.30
NPV of Customer Benefits (2014$ billion)					
3% Discount Rate	0.03	0.29	0.67	1.10	0.53
7% Discount Rate	0.01	0.11	0.26	0.42	0.08
Cumulative Emissions Reduction (Total FFC Emissions)*					
CO_2 (*MMt*)	0.38	3.55	8.45	13.04	17.37
NO_X (*kt*)	0.58	5.37	12.80	19.73	26.30
Hg (*t*)	0.00	0.01	0.02	0.03	0.04
N_2O (*kt*)	0.01	0.05	0.12	0.18	0.24
N_2O(*kt* CO_{2eq})	1.38	12.85	30.61	47.20	62.92
CH_4 (*kt*)	1.77	16.44	39.15	60.37	80.49
CH_4 (*kt* CO_2)*eq*	49.59	460.33	1,096.12	1,690.37	2,253.81
SO_2 (*kt*)	0.31	2.87	6.83	10.53	14.02
Value of Cumulative Emissions Reduction (Total FFC Emissions)					
CO_2 (2014$ million)**	2.5 to 35.8	23.1 to 332.1	55.0 to 790.9	84.9 to 1,219.6	113.0 to 1,624.1
NO_X—3% Discount Rate (*2014$ million*).	0.7	6.7	16.1	24.8	33.0
NO_X—7% Discount Rate (*2014$ million*).	0.3	2.8	6.7	10.3	13.7

* MMT is million metric ton. kt is thousand tons. t is ton. CO_2eq is the quantity of CO_2 that would have the same global warming potential (GWP).

** Range of the economic value of CO_2 reductions is based on estimates of the global benefit of reduced CO_2 emissions.

TABLE V.45—NPV OF CUSTOMER BENEFITS BY EQUIPMENT CLASS

Equipment class	Discount rate (%)	Trial standard level (billion 2014$)				
		1	2	3	4	5
Class A	3	0.000	0.149	0.203	0.249	*(0.005)
	7	0.000	0.058	0.076	0.090	(0.069)
Class B	3	0.018	0.066	0.224	0.395	0.229
	7	0.007	0.026	0.088	0.149	0.053
Combination A	3	0.010	0.050	0.149	0.260	0.166
	7	0.004	0.020	0.059	0.101	0.050
Combination B	3	0.004	0.025	0.097	0.196	0.142
	7	0.002	0.010	0.039	0.077	0.047
Total—All Classes	3	0.032	0.290	0.673	1.100	0.532
	7	0.013	0.113	0.261	0.417	0.081

* Parentheses indicate negative values.

TABLE V.46—SUMMARY OF ANALYTICAL RESULTS FOR BEVERAGE VENDING MACHINES: MANUFACTURER AND CUSTOMER IMPACTS

	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
Manufacturer Impacts					
Industry NPV relative to a case without standards value of 62.7 (*million 2014$*).	62.7 to 62.7	62.5 to 62.8	61.7 to 63.1	59.2 to 62.9	50.7 to 73.8.

TABLE V.46—SUMMARY OF ANALYTICAL RESULTS FOR BEVERAGE VENDING MACHINES: MANUFACTURER AND CUSTOMER IMPACTS—Continued

	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
Industry NPV (*% Change*)	−0.05% to −0.02%.	−0.38% to 0.10%	−1.66% to 0.53%	−5.65% to 0.24%	−19.23% to 17.64%.
Customer Mean LCC Savings (2014$)					
Class A CO_2	0	132	160	173	(314)*.
Class A Propane	0	136	201	265	39.
Class B CO_2	0	34	292	534	31.
Class B Propane	16	179	495	838	505.
Combination A CO_2	53	269	793	1,344	616.
Combination A Propane	55	272	801	1,405	797.
Combination B CO_2	21	127	539	1,098	516.
Combination B Propane	28	168	586	1,153	953.
Customer Simple PBP (years)					
Class A CO_2	0.6	1.1	2.4	3.6	14.1.
Class A Propane	0.4	0.8	1.0	1.1	8.3.
Class B CO_2	0.5	0.5	0.6	2.3	7.2.
Class B Propane	0.3	0.4	0.5	1.3	5.0.
Combination A CO_2	0.2	0.2	0.4	1.4	6.3.
Combination A Propane	0.1	0.1	0.3	1.1	5.3.
Combination B CO_2	0.1	0.1	0.2	0.6	5.6.
Combination B Propane	0.1	0.1	0.1	0.5	2.9.
Distribution of Customer LCC Impacts					
Class A CO_2:					
Net Cost (%)	0	0	0	1	93.
Class A Propane:					
Net Cost (%)	0	0	0	0	47.
Class B CO_2:					
Net Cost (%)	0	0	0	0	51.
Class B Propane:					
Net Cost (%)	0	0	0	0	51.
Combination A CO_2:					
Net Cost (%)	0	0	0	0	10.
Combination A Propane:					
Net Cost (%)	0	0	0	0	3.
Combination B CO_2:					
Net Cost (%)	0	0	0	0	7.
Combination B Propane:					
Net Cost (%)	0	0	0	0	0.

* Parentheses indicate negative values.

DOE also notes that the economics literature provides a wide-ranging discussion of how customers trade-off upfront costs and energy savings in the absence of government intervention. Much of this literature attempts to explain why customers appear to undervalue energy efficiency improvements. There is evidence that customers undervalue future energy savings as a result of: (1) A lack of information; (2) a lack of sufficient salience of the long-term or aggregate benefits; (3) a lack of sufficient savings to warrant delaying or altering purchases (*e.g.,* an inefficient ventilation fan in a new building or the delayed replacement of a water pump); (4) excessive focus on the short term, in the form of inconsistent weighting of future energy cost savings relative to available returns on other investments; (5) computational or other difficulties associated with the evaluation of relevant tradeoffs; and (6) a divergence in incentives (*e.g.,* renter versus building owner, builder versus home buyer). Other literature indicates that with less than perfect foresight and a high degree of uncertainty about the future, customers may trade off these types of investments at a higher-than-expected rate between current consumption and uncertain future energy cost savings. This undervaluation suggests that regulation that promotes energy efficiency can produce significant net private gains (as well as producing social gains by, for example, reducing pollution).

While DOE is not prepared at present to provide a fuller quantifiable framework for estimating the benefits and costs of changes in customer purchase decisions due to an amended energy conservation standard, DOE is committed to developing a framework that can support empirical quantitative tools for improved assessment of the customer welfare impacts of appliance standards. DOE posted a paper that discusses the issue of customer welfare impacts of appliance energy efficiency standards, and potential enhancements to the methodology by which these impacts are defined and estimated in the regulatory process.[69] DOE welcomes comments on how to more fully assess

[69] Sanstad, A. *Notes on the Economics of Household Energy Consumption and Technology Choice.* 2010. Lawrence Berkeley National Laboratory, Berkeley, CA. *www1.eere.energy.gov/buildings/appliance_standards/pdfs/consumer_ee_theory.pdf.*

the potential impact of energy conservation standards on customer choice and methods to quantify

TSL 5 corresponds to the max-tech level for all the equipment classes and offers the potential for the highest cumulative energy savings through the analysis period from 2019 to 2048. The estimated energy savings from TSL 5 are 0.30 quads of energy. TSL 5 has an estimated NPV of customer benefit of $0.081 billion using a 7-percent discount rate, and $0.53 billion using a 3-percent discount rate.

The cumulative emissions reductions at TSL 5 are 17.4 million metric tons of CO_2, 14.0 thousand tons of SO_2, 26.3 thousand tons of NO_X, 0.04 tons of Hg, 80.5 thousand tons of CH_4, and 0.2 thousand tons of N_2O. The estimated monetary value of the CO_2 emissions reductions at TSL 5 ranges from $113 million to $1,624 million.

At TSL 5, the average LCC savings range from a negative $314 to a positive $797, depending on equipment class. The fraction of customers incurring a net cost range from 0 percent for Combination B machines with propane refrigerant to 93 percent for Class A machines with CO_2 refrigerant.

At TSL 5, the projected change in INPV ranges from a decrease of $12.1 million to an increase of $11.1 million. If the lower bound of the range of impacts is reached, TSL 5 could result in a net loss of up to 19.2 percent in INPV for manufacturers.

Accordingly, the Secretary tentatively concludes that at TSL 5 for beverage vending machines, the benefits of energy savings, emission reductions, and the estimated monetary value of the CO_2 emissions reductions would be outweighed by the negative LCC savings and the negative INPV on manufacturers. Consequently, DOE has tentatively concluded that TSL 5 is not economically justified.

Next DOE considered TSL 4, which saves an estimated total of 0.22 quads of energy, an amount DOE considers significant. TSL 4 has an estimated NPV of customer benefit of $0.42 billion using a 7-percent discount rate, and $1.1 billion using a 3-percent discount rate.

The cumulative emissions reductions at TSL 4 are 13.0 million metric tons of CO_2, 10.5 thousand tons of SO_2, 19.7 thousand tons of NO_X, 0.03 tons of Hg, 60.3 thousand tons of CH_4, and 0.2 thousand tons of N_2O. The estimated monetary value of the CO_2 emissions reductions at TSL 5 ranges from $85 million to $1,220 million.

At TSL 4, the average LCC savings ranges from $173 to $1,405, depending on equipment class. The fraction of customers incurring a net cost range from 0 percent for all equipment classes except 1 percent for Class A equipment with CO_2 refrigerant.

At TSL 4, the projected change in INPV ranges from a decrease of $3.5 million to an increase of $0.2 million. At TSL 4, DOE recognizes the risk of negative impacts if manufacturers' expectations concerning reduced profit margins are realized. If the lower bound of the range of impacts is reached, as DOE expects, TSL 4 could result in a net loss of up to 5.7 percent in INPV for manufacturers.

After carefully considering the analysis results and weighing the benefits and burdens of TSL 4, DOE believes that setting the standards for beverage vending machines at TSL 4 represents the maximum improvement in energy efficiency that is technologically feasible and economically justified. TSL 4 is technologically feasible because the technologies required to achieve these levels already exist in the current market and are available from multiple manufacturers. TSL 4 is economically justified because the benefits to the nation in the form of energy savings, customer NPV at 3 percent and at 7 percent, and emissions reductions outweigh the costs associated with reduced INPV and potential effects of reduced manufacturing capacity.

Therefore, DOE proposes the adoption of amended energy conservation standards for beverage vending machines at TSL 4 as indicated in Table V.47.

TABLE V.47—PROPOSED ENERGY CONSERVATION STANDARDS FOR BEVERAGE VENDING MACHINES

Equipment class *	Proposed energy conservation standards ** maximum daily energy consumption (MDEC) kWh/day †
A	0.041 × V + 1.920 ‡
B	0.033 × V + 1.422 ‡
Combination A	0.044 × V + 1.645 ‡
Combination B	0.044 × V + 1.361 ‡

* See section IV.A.1 of the NOPR for a discussion of equipment classes.

** "V" is the representative value of refrigerated volume (ft³) of the BVM model, as measured in accordance with the method for determining refrigerated volume adopted in the recently amended DOE test procedure for beverage vending machines and appropriate sampling plan requirements. 80 FR 45758 (July 31, 2015). See section III.B and V.A for more details.

† kilowatt hours per day.

‡ Trial Standard Level (TSL) 4.

VI. Procedural Issues and Regulatory Review

A. Review Under Executive Orders 12866 and 13563

Section 1(b)(1) of Executive Order 12866, ''Regulatory Planning and Review,'' 58 FR 51735 (October 4, 1993), requires each agency to identify the problem that it intends to address, including, where applicable, the failures of private markets or public institutions that warrant new agency action, as well as to assess the significance of that problem. The problems that these proposed standards address are as follows:

(1) Insufficient information and the high costs of gathering and analyzing relevant information lead some customers to miss opportunities to make cost-effective investments in energy efficiency.

(2) In some cases the benefits of more efficient equipment are not realized due to misaligned incentives between purchasers and users. An example of such a case is when the equipment purchase decision is made by a building contractor or building owner who does not pay the energy costs.

(3) There are external benefits resulting from improved energy efficiency of beverage vending machines that are not captured by the users of such equipment. These benefits include externalities related to public health, environmental protection, and national security that are not reflected in energy prices, such as reduced emissions of air pollutants and greenhouse gases that impact human health and global warming. DOE attempts to quantify some of the external benefits through use of social cost of carbon values.

In addition, DOE determined that this regulatory action is a ''significant regulatory action'' under Executive Order 12866. DOE presented to the Office of Information and Regulatory Affairs (OIRA) in the OMB for review the draft rule and other documents prepared for this rulemaking, including a regulatory impact analysis (RIA), and has included these documents in the rulemaking record. The assessments prepared pursuant to Executive Order 12866 can be found in the technical support document for this rulemaking.

DOE also reviewed this regulation pursuant to Executive Order 13563, issued on January 18, 2011. 76 FR 3281 (January 21, 2011). Executive Order 13563 is supplemental to and explicitly reaffirms the principles, structures, and definitions governing regulatory review established in Executive Order 12866. To the extent permitted by law, agencies are required by Executive Order 13563 to: (1) Propose or adopt a regulation only upon a reasoned determination that its benefits justify its costs (recognizing that some benefits and costs are difficult to quantify); (2) tailor regulations to impose the least burden on society, consistent with obtaining regulatory objectives, taking into account, among other things, and to the extent practicable, the costs of cumulative regulations; (3) select, in choosing among alternative regulatory approaches, those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity); (4) to the extent feasible, specify performance objectives, rather than specifying the behavior or manner of compliance that regulated entities must adopt; and (5) identify and assess available alternatives to direct regulation, including providing economic incentives to encourage the desired behavior, such as user fees or marketable permits, or providing information upon which choices can be made by the public.

DOE emphasizes as well that Executive Order 13563 requires agencies to use the best available techniques to quantify anticipated present and future benefits and costs as accurately as possible. In its guidance, the Office of Information and Regulatory Affairs has emphasized that such techniques may include identifying changing future compliance costs that might result from technological innovation or anticipated behavioral changes. For the reasons stated in the preamble, DOE believes that this NOPR is consistent with these principles, including the requirement that, to the extent permitted by law, benefits justify costs and that net benefits are maximized.

B. Review Under the Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) requires preparation of an initial regulatory flexibility analysis (IRFA) for any rule that by law must be proposed for public comment, unless the agency certifies that the rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. As required by Executive Order 13272, ''Proper Consideration of Small Entities in Agency Rulemaking,'' 67 FR 53461 (August 16, 2002), DOE published procedures and policies on February 19, 2003, to ensure that the potential impacts of its rules on small entities are properly considered during the rulemaking process. 68 FR 7990. DOE has made its procedures and policies available on the Office of the General Counsel's Web site (*www.energy.gov/gc/office-general-counsel*). DOE has prepared the following IRFA for the products that are the subject of this rulemaking.

For the manufacturers of BVM equipment, the SBA set a size threshold, which defines those entities classified as ''small businesses'' for the purposes of the statute. DOE used the SBA's small business size standards to determine whether any small entities would be subject to the requirements of the rule. 65 FR 30836, 30848 (May 15, 2000), as amended at 65 FR 53533, 53544 (September 5, 2000) and codified at 13 CFR part 121. The size standards are listed by NAICS code and industry description and are available at *http://www.sba.gov/content/table-small-business-size-standards.* BVM equipment manufacturing is classified under NAICS 333318, ''Other Commercial and Service Industry Machinery Manufacturing.'' The SBA sets a threshold of 1,000 employees or less for an entity to be considered as a small business for this category.

1. Description and Estimated Number of Small Entities Regulated

During its market survey, DOE used available public information to identify potential small manufacturers. DOE's research involved public databases (*e.g.,* DOE's Compliance Certification Management System (CCMS),[70] and ENERGY STAR[71] databases), individual company Web sites, and market research tools (*e.g.,* Hoovers reports[72]) to create a list of companies that manufacture or sell products covered by this rulemaking. DOE also asked stakeholders and industry representatives during manufacturer interviews and at DOE public meetings if they were aware of any other small manufacturers. DOE reviewed publicly available data and contacted select companies on its list, as necessary, to determine whether they met the SBA's definition of a small business manufacturer of covered BVM equipment. DOE screened out companies that do not offer products covered by this rulemaking, do not meet the definition of a ''small business,'' or are foreign-owned.

DOE identified eight companies selling BVM equipment products in the United States. Four are small domestic manufacturers and one is a small foreign manufacturer with domestic-sited subsidiary that serves as its marketing arm in the United States. DOE contacted all identified BVM manufacturers for interviews. Ultimately, DOE interviewed manufacturers representing approximately 78 percent of BVM equipment industry shipments and approximately 50 percent of the small business shipments.

2. Description and Estimate of Compliance Requirements

The four small domestic BVM manufacturers account for approximately 15–20 percent of BVM equipment shipments. The small domestic manufacturers are Automated Merchandising Systems, Multi-Max Systems, Seaga Manufacturing, and Wittern.

In general, the small manufacturers focus on the Combination A and Combination B market segments. Together, the four domestic and one foreign small manufacturer account for 74 percent of Combination A and Combination B sales. Based on the shipments analysis, Combination A and Combination B shipments account for roughly 18 percent of the total BVM market.

The remaining 82 percent of BVM shipments are Class A and Class B units. Small business manufacturers (including the one foreign small manufacturer) account for approximately 5 percent of the market for each of the Class A and Class B market segments. The remaining 95 percent of both Class A and Class B market segments are held by the three large manufacturers: Crane, Royal, and SVA.

DOE derived industry conversion using a top-down approach described in methodology section IV.I.2.a. Using product platform counts by equipment type (*i.e.,* Class A, Class B, Combo A, Combo B) and manufacturer, DOE estimated the distribution of industry conversion costs between small manufacturers and large manufacturers. Using its count of manufacturers, DOE calculated capital conversion costs (Table VI.1) and product conversion costs (Table VI.2) for an average small manufacturer versus an average large manufacturer. To provide context on the size of the conversion costs relative to the size of the businesses, DOE presents the conversion costs relative to annual revenue and annual operating profit under the proposed standard level, as shown in Table VI.3. The current annual revenue and annual operating profit estimates are derived from the GRIM's industry revenue calculations and the

[70] ''CCMS.'' CCMS. *http://www.regulations.doe.gov/certification-data/.*

[71] ENERGY STAR Certified Vending Machines. June 6, 2013. *http://www.energystar.gov/products/certified-products.*

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

market share breakdowns of small versus large manufacturers.

TABLE VI.1—COMPARISON OF TYPICAL SMALL AND LARGE MANUFACTURER'S CAPITAL CONVERSION COSTS *

Trial standard level	Capital conversion costs for typical small manufacturer (2014$ millions)	Capital conversion costs for typical large manufacturer (2014$ millions)
TSL 1	0.00	0.00
TSL 2	0.00	0.00
TSL 3	0.02	0.02
TSL 4	0.07	0.27
TSL 5	0.32	0.52

* Capital conversion costs are the capital investments made during the 3-year period between the publication of the final rule and the compliance year of the proposed standard.

TABLE VI.2—COMPARISON OF TYPICAL SMALL AND LARGE MANUFACTURER'S PRODUCT CONVERSION COSTS *

Trial standard level	Product conversion costs for typical small manufacturer (2014$ millions)	Product conversion costs for typical large manufacturer (2014$ millions)
TSL 1	0.00	0.01
TSL 2	0.02	0.04
TSL 3	0.10	0.10
TSL 4	0.14	0.30
TSL 5	0.35	0.53

* Product conversion costs are the R&D and other product development investments made during the 3-year period between the publication of the final rule and the compliance year of the proposed standard.

TABLE VI.3—COMPARISON OF CONVERSION COSTS FOR AN AVERAGE SMALL AND AN AVERAGE LARGE MANUFACTURER AT TSL 4

	Capital conversion cost (2014$ millions)	Product conversion cost (2014$ millions)	Conversion costs/ annual revenue (%)	Conversion costs/ annual operating profit (%)	Conversion costs/ conversion period revenue * (%)	Conversion costs/ conversion period operating profit * (%)
Small Manufacturer	0.07	0.14	7	119	2	40
Large Manufacturer	0.27	0.30	2	40	1	13

* The conversion period, the time between the final rule publication year and the compliance year for this rulemaking, is 3 years.

At the proposed level, DOE estimates total conversion costs associated with new and amended energy conservation standards for an average small manufacturer to be $217,000, which is approximately 7 percent of annual revenue and 119 percent of annual operating profit. This suggests that an average small manufacturer would need to reinvest roughly 40 percent of its operating profit per year over the conversion period to comply with standards.

The total conversion costs associated with new and amended energy conservation standards for an average large manufacturer is $571,000, which is approximately 2 percent of annual revenue and 40 percent of annual operating profit. This suggests that an average large manufacturer would need to reinvest roughly 13 percent of its operating profit per year over the 3-year conversion period.

Product conversion costs, which include one-time investments such as product redesigns and industry certification, are a key driver of conversion investments to comply with standards. Product conversion costs tend to be fixed and do not scale with sales volume. For each equipment platform, small businesses must make redesign investments that are similar to their large competitors. However, because small manufacturers' costs are spread over a lower volume of units, it takes longer for small manufacturers to recover their investments. Similarly, capital conversion costs are spread across a lower volume of shipments for small business manufacturers.

DOE requests comment regarding any potential impacts on small business manufacturers from the proposed standards. In particular, DOE seeks further information and data regarding the sales volume and annual revenues for small businesses so the agency can be better informed about the potential impacts to small business manufacturers of the proposed energy conservation standards. DOE will consider any such additional information when formulating and selecting TSLs for the final rule (section VII.E of this NOPR).

3. Significant Alternatives to the Rule

The preceding discussion analyzes impacts on small businesses that would result from DOE's proposed rule. In addition to the other TSLs being considered, the proposed rulemaking TSD includes a regulatory impact analysis (RIA). For beverage vending machines, the RIA discusses the following policy alternatives: (1) No change in standard; (2) customer rebates; (3) customer tax credits; (4) manufacturer tax credits; (5) voluntary energy efficiency targets; (6) early replacement; and (7) bulk government purchases. While these alternatives may mitigate to some varying extent the economic impacts on small entities compared to the standards, DOE did not consider these alternatives further because they are either not feasible to implement without authority and funding from Congress, or they are expected to result in energy savings that are much smaller than those that will be achieved by the new and amended standard levels. Voluntary programs at these levels achieve only a fraction of the savings achieved by standards and would provide even lower savings benefits which would be inconsistent with DOE's statutory mandate to maximize the improvement in energy efficiency that the Secretary determines is technologically feasible and economically justified.

DOE also examined standards at lower efficiency levels, TSL 3, TSL 2 and TSL 1. TSL 3 achieves approximately 40 percent lower savings than TSL 4, TSL 2 achieves 80 percent lower savings than TSL 4 and TSL 1 achieves 99 percent less savings of TSL 4. Additionally, DOE considered standards at higher efficiency levels, corresponding to TSL 5. TSL 5 achieves approximately 44 percent higher savings than TSL 4. However. DOE rejected this TSL due to the negative NPV results. Furthermore, the estimated conversion costs for small business manufacturers are higher at TSL 5 than at TSL 4. To comply with TSL 5, the average small manufacturer must make $570,000 in conversion cost investments, which $370,000 more than at TSL 4. (See chapter 17 of the NOPR TSD for further detail on the policy alternatives DOE considered.)

Additional compliance flexibilities may be available through other means. For example, individual manufacturers may petition for a waiver of the applicable test procedure. Further, EPCA provides that a manufacturer whose annual gross revenue from all of its operations does not exceed $8,000,000 may apply for an exemption from all or part of an energy conservation standard for a period not longer than 24 months after the compliance date of a final rule establishing the standard. (42 U.S.C. 6295(t)) Additionally, Section 504 of the Department of Energy Organization Act, 42 U.S.C. 7194, provides authority for the Secretary to adjust a rule issued under EPCA in order to prevent ''special hardship, inequity, or unfair distribution of burdens'' that may be imposed on that manufacturer as a result of such rule. Manufacturers should refer to 10 CFR part 430, subpart E, and part 1003 for additional details.

C. Review Under the Paperwork Reduction Act of 1995

Manufacturers of beverage vending machines must certify to DOE that their products comply with any applicable energy conservation standards. In certifying compliance, manufacturers must test their equipment according to the applicable DOE test procedures for beverage vending machines, including any amendments adopted for those test procedures on the date that compliance is required. DOE has established regulations for the certification and recordkeeping requirements for all covered customer products and commercial equipment, including beverage vending machines. 76 FR 12422 (March 7, 2011). 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. 80 FR 5099 (January 30, 2015). The public reporting burden for the certification is estimated to average 30 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

Pursuant to the National Environmental Policy Act (NEPA) of 1969, DOE has determined that the proposed rule fits within the category of actions included in Categorical Exclusion (CX) B5.1 and otherwise meets the requirements for application of a CX. See 10 CFR part 1021, appendix B, B5.1(b); 1021.410(b) and appendix B, B(1)–(5). The proposed rule fits within the category of actions because it is a rulemaking that establishes energy conservation standards for customer products or industrial equipment, and for which none of the exceptions identified in CX B5.1(b) apply. Therefore, DOE has made a CX determination for this rulemaking, and DOE does not need to prepare an Environmental Assessment or Environmental Impact Statement for this proposed rule. DOE's CX determination for this proposed rule is available at *http://cxnepa.energy.gov/.*

E. Review Under Executive Order 13132

Executive Order 13132, ''Federalism,'' imposes certain requirements on Federal agencies formulating and implementing policies or regulations that preempt State law or that have Federalism implications. 64 FR 43255 (August 10, 1999). 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 that 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 products that are the subject of this proposed rule. States can petition DOE for exemption from such preemption to the extent, and based on criteria, set forth in EPCA (42 U.S.C. 6297(d)). Therefore, Executive Order 13132 requires no further action.

F. Review Under Executive Order 12988

With respect to the review of existing regulations and the promulgation of new regulations, section 3(a) of Executive Order 12988, ''Civil Justice Reform,'' 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 (February 7, 1996). Section 3(b) of Executive Order 12988 specifically requires that Executive agencies make every reasonable effort to ensure that the regulation: (1) Clearly specifies the preemptive effect, if any; (2) clearly specifies any effect on existing Federal law or regulation; (3) provides a clear legal standard for affected conduct while promoting simplification and burden reduction; (4) specifies the retroactive effect, if any; (5) adequately defines key terms; and (6) addresses other important issues affecting clarity and general draftsmanship under any guidelines issued by the Attorney General. Section 3(c) of Executive Order 12988 requires Executive agencies to review regulations in light of applicable standards in 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 tentatively determined that, to the extent permitted by law, this proposed rule meets the relevant standards of Executive Order 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, sec. 201 (codified at 2 U.S.C. 1531). For a proposed regulatory action likely to result in a rule that may cause the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector, of $100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish a written statement that estimates the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a), (b)) The UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal governments on a proposed ''significant intergovernmental mandate,'' and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect them. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. 62 FR 12820. DOE's policy statement is also available at *www.energy.gov/gc/office-general-counsel.*

Although this proposed rule, which proposes new and amended energy conservation standards for beverage vending machines, does not contain a Federal intergovernmental mandate, it may require annual expenditures of $100 million or more by the private sector. Specifically, the proposed rule would likely result in a final rule that could require expenditures of $100 million or more, including: (1) Investment in research and development and in capital expenditures by BVM manufacturers in the years between the final rule and the compliance date for the amended standards; and (2) incremental additional expenditures by customers to purchase higher-efficiency beverage vending machines, starting at the compliance date for the applicable standard.

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

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

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

Section 654 of the Treasury and General Government Appropriations Act, 1999 (Pub. L. 105–277) requires Federal agencies to issue a Family Policymaking Assessment for any rule that may affect family well-being. This proposed 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 Executive Order 12630, ''Governmental Actions and Interference with Constitutionally Protected Property Rights,'' 53 FR 8859 (March 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 (February 22, 2002), and DOE's guidelines were published at 67 FR 62446 (October 7, 2002). 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

Executive Order 13211, ''Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use,'' 66 FR 28355 (May 22, 2001), requires Federal agencies to prepare and submit to OIRA at OMB, a Statement of Energy Effects for any proposed significant energy action. A ''significant energy action'' is defined as any action by an agency that promulgates or is expected to lead to promulgation of a final rule, and that: (1) Is a significant regulatory action under Executive Order 12866, or any successor order; and (2) is likely to have a significant adverse effect on the supply, distribution, or use of energy; or (3) is designated by the Administrator of OIRA as a significant energy action. For any proposed significant energy action, the agency must give a detailed statement of any adverse effects on energy supply, distribution, or use should the proposal be implemented, and of reasonable alternatives to the action and their expected benefits on energy supply, distribution, and use.

DOE has tentatively concluded that this regulatory action, which sets forth proposed energy conservation standards for beverage vending machines, 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. Review Under the Information Quality Bulletin for Peer Review

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 (January 14, 2005). The Bulletin establishes that certain scientific information shall be peer reviewed by qualified specialists before it is disseminated by the Federal Government, including influential scientific information related to agency regulatory actions. The purpose of the bulletin is to enhance the quality and credibility of the Government's scientific information. Under the Bulletin, the energy conservation standards rulemaking analyses are ''influential scientific information,'' which the Bulletin defines as ''scientific information the agency reasonably can determine will have or does have a clear and substantial impact on important public policies or private sector decisions.'' *Id.* at 2667.

In response to OMB's Bulletin, DOE conducted formal in-progress peer reviews of the energy conservation standards development process and analyses and has prepared a Peer Review Report pertaining to the energy conservation standards rulemaking analyses. Generation of this report involved a rigorous, formal, and documented evaluation using objective criteria and qualified and independent reviewers to make a judgment as to the technical/scientific/business merit, the actual or anticipated results, and the productivity and management effectiveness of programs and/or projects. The ''Energy Conservation Standards Rulemaking Peer Review Report'' dated February 2007 has been disseminated and is available at the following Web site: *www1.eere.energy.gov/buildings/appliance_standards/peer_review.html.*

VII. Public Participation

A. Attendance at the Public Meeting

The time, date, and location of the public meeting are listed in the **DATES** and **ADDRESSES** sections at the beginning of this NOPR. If you plan to attend the public meeting, please notify Ms. Brenda Edwards at (202) 586–2945 or *Brenda.Edwards@ee.doe.gov.*

Please note that foreign nationals visiting DOE Headquarters are subject to advance security screening procedures that require advance notice prior to attendance at the public meeting. Any foreign national wishing to participate in the meeting should advise DOE as soon as possible by contacting *regina.washington@ee.doe.gov* to initiate the necessary procedures.

DOE requires visitors to have laptops and other devices, such as tablets, checked upon entry into the building. Any person wishing to bring these devices into the Forrestal Building will be required to obtain a property pass. Visitors should avoid bringing these devices, or allow an extra 45 minutes to check in. Please report to the visitor's desk to have devices checked before proceeding through security.

Due to the REAL ID Act implemented by the Department of Homeland Security (DHS), there have been recent changes regarding ID requirements for individuals wishing to enter Federal buildings from specific states and U.S. territories. Driver's licenses from the following states or territory will not be accepted for building entry and one of the alternate forms of ID listed below will be required. DHS has determined that regular driver's licenses (and ID cards) from the following jurisdictions are not acceptable for entry into DOE facilities: Alaska, American Samoa, Arizona, Louisiana, Maine, Massachusetts, Minnesota, New York, Oklahoma, and Washington. Acceptable alternate forms of Photo-ID include: U.S. Passport or Passport Card; an Enhanced Driver's License or Enhanced ID-Card issued by the states of Minnesota, New York or Washington (Enhanced licenses issued by these states are clearly marked Enhanced or Enhanced Driver's License); a military ID or other Federal government issued Photo-ID card.

In addition, you can attend the public meeting via webinar. Webinar registration information, participant instructions, and information about the capabilities available to webinar participants will be published on DOE's Web site at: *http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/24.* Participants are responsible for ensuring their systems are compatible with the webinar software.

B. Procedure for Submitting Requests To Speak and Prepared General Statements for Distribution

Any person who has an interest in the topics addressed in this NOPR, or who is a 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 public meeting. Such persons may hand-deliver requests to speak to the address shown in the **ADDRESSES** section at the beginning of this NOPR between 9:00 a.m. and 4:00 p.m., Monday through Friday, except Federal holidays. Requests may also be sent by mail or email to: Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Program, Mailstop EE–2J, 1000 Independence Avenue SW., Washington, DC 20585–0121, or *Brenda.Edwards@ee.doe.gov.* Persons who wish to speak should include with their request a computer diskette or CD–ROM in WordPerfect, Microsoft Word, PDF, or text (ASCII) file format that briefly describes the nature of their interest in this rulemaking and the topics they wish to discuss. Such persons should also provide a daytime telephone number where they can be reached.

DOE requests persons scheduled to make an oral presentation to submit an advance copy of their statements at least one week before the public meeting. DOE may permit persons who cannot supply an advance copy of their statement to participate, if those persons have made advance alternative arrangements with the Building Technologies Program. As necessary, requests to give an oral presentation should ask for such alternative arrangements.

C. Conduct of the Public Meeting

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

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

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

A transcript of the public meeting will be included in the docket, which can be viewed as described in the *Docket* section at the beginning of this NOPR and will be accessible on the DOE Web site. 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 NOPR. Interested parties may submit comments, data, and other information using any of the methods described in the **ADDRESSES** section at the beginning of this NOPR.

Submitting comments via 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 Web site will waive any CBI claims for the information submitted. For information on submitting CBI, see the Confidential Business Information section below.

DOE processes submissions made through *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 mail. Comments and documents submitted via email, hand delivery, or mail also will be posted to *www.regulations.gov*. If you do not want your personal contact information to be publicly viewable, do not include it in your comment or any accompanying documents. Instead, provide your contact information in a cover letter. Include your first and last names, email address, telephone number, and optional mailing address. The cover letter will not be publicly viewable as long as it does not include any comments.

Include contact information each time you submit comments, data, documents, and other information to DOE. If you submit via mail or hand delivery/courier, please provide all items on a CD, if feasible, in which case it is not necessary to submit printed copies. No telefacsimiles (faxes) will be accepted.

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

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

Confidential Business Information. Pursuant to 10 CFR 1004.11, any person submitting information that he or she believes to be confidential and exempt by law from public disclosure should submit via email, postal mail, or hand delivery/courier two well-marked copies: One copy of the document marked ''confidential'' including all the information believed to be confidential, and one copy of the document marked ''non-confidential'' with the information believed to be confidential deleted. Submit these documents via email or on a CD, if feasible. DOE will make its own determination about the confidential status of the information and treat it according to its determination.

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

It is DOE's policy that all comments may be included in the public docket, without change and as received, including any personal information provided in the comments (except information deemed to be exempt from public disclosure).

E. Issues on Which DOE Seeks Comment

Although DOE welcomes comments on any aspect of this proposal, DOE is particularly interested in receiving comments and views of interested parties concerning the following issues:

1. DOE requests comment on the proposed amendment to the Class A equipment class definition. Specifically, DOE requests comment on whether the

presence of a transparent front is always correlated with fully cooled equipment.

2. DOE requests comment on the proposed optional test protocol to determine transparent and non-transparent surface areas and whether Class A equipment typically has at least 25 percent of the surface area on the front side of the unit that is transparent or if another quantitative threshold would be more appropriate.

3. DOE requests comment on the proposed definition of transparent. Specifically, whether 45 percent light transmittance is an acceptable value for the glass or other transparent materials that are typically used to construct the front panel on Class A equipment.

4. DOE requests comment on the proposed amendment to the definition of ''combination vending machine.''

5. DOE requests comment on the proposed definition for Combination A and Combination B.

6. DOE also requests comment on DOE's proposal to apply the optional test protocol for determining the surface area and transparency of materials to combination vending machines, except that the surface areas surrounding the refrigerated compartments that are not designed to be refrigerated would be excluded.

7. DOE requests comment on its updated estimate of market share for combination vending machines.

8. DOE requests comment on its position that machines capable of vending perishable goods do not warrant separate classes due to their physical similarity to refrigerated beverage vending machines used to vend non-perishable products.

9. DOE requests feedback on the manufacturer markup values used to convert MPC to MSP.

10. DOE requests comment on whether equipment is tested with all lighting and accessories on for the duration of the test and no low power modes or energy management systems enabled.

11. DOE requests information on whether the current standard level for Class A and Class B machines is achievable without the use of any energy management systems.

12. To refine its engineering analysis for beverage vending machines further, DOE requests comment and data from interested parties on several topics related to the refrigerants analyzed in the engineering analysis and their relative performance characteristics. Specifically, DOE requests information on the efficiency of CO_2 and propane compressors in BVM applications.

13. DOE requests comment on the conclusion that both the current standard level and all of the efficiency levels analyzed could be met by equipment using any refrigerant.

14. DOE requests information on the additional costs associated with CO_2 and propane refrigeration systems, respectively, including but not limited to additional costs for the compressor, evaporator, condenser, and refrigerant tubing.

15. DOE requests comment and information on the use of propane, isobutane, and other hydrocarbon refrigerants in current commercially available BVM models or on significant research and development efforts on the part of domestic BVM manufacturers to commercialize this technology in the near future.

16. DOE requests comment on the likelihood of manufacturers using propane versus isobutane refrigerant since both have been added to the list of acceptable substitutes for use in BVM applications by EPA SNAP. If it is likely that isobutane would also be implemented in BVM applications, DOE requests similar information on the efficiency of isobutane compressors and additional costs associated with isobutane refrigeration systems, including but not limited to additional costs for the compressor, evaporator, condenser, and refrigerant tubing.

17. DOE requests comment on whether the conversion to use of any alternative refrigerant may impact the availability or relevance of any design options currently observed in equipment on the market.

18. DOE requests data on the use of variable speed compressors in beverage vending machines.

19. DOE requests comment on distribution channels for beverage vending machines.

20. DOE requests comment on the conclusion that data from college campuses are reasonably representative of BVM locations nationally and on their use in estimating the proportion of Class B and Combination B beverage vending machines installed outdoors.

21. DOE requests comment on its decision to disregard the adjustment factors calculated in the preliminary analysis thereby simplifying the energy use analysis by using the national average AEC values.

22. DOE requests comment regarding whether the analysis should account for the impact of any incremental energy use associated with cold weather heaters on the national average energy consumption of Class B and Combination B equipment.

23. DOE also requests data on the incidence and control methodology of cold weather heaters in BVM equipment installed in cold climates.

24. DOE requests comment on the energy use analysis methodology used to estimate the AEC of Class A, Class B, Combination A, and Combination B beverage vending machines located indoors and outdoors, as applicable.

25. DOE requests comment on any other variables DOE should account for in its estimate of national average energy use for beverage vending machines.

26. DOE requests comment on the maintenance and repair costs modeled in the LCC analysis and especially appreciates additional data regarding differences in maintenance or repair costs that vary as a function of refrigerant, equipment class, or efficiency level.

27. DOE requests comment on the assumed lifetime of beverage vending machines and if the lifetime of beverage vending machines is likely to be longer or shorter in the future.

28. DOE requests comment on its assumption that a beverage vending machine will typically undergo two refurbishments during the course of its life and if refurbishments are likely to increase or decrease in the future.

29. DOE also requests comment on the applicability of this assumption to all equipment classes.

30. DOE requests further input or evidence regarding any technology options considered that would be expected to reduce overall equipment lifetimes and if so, by how much.

31. DOE requests comment on its assumption that all baseline Class A and Class B propane and Class A CO_2 equipment would be EL 1.

32. DOE requests comment on its assumption that Combination A and Combination B beverage vending machines have efficiency distributions similar to Class A and Class B equipment because manufacturers will use the same cabinet and similar components in the combination machines as the conventional Class A and Class B equipment.

33. DOE requests comment on its assumptions regarding historical shipments between 1998 and 2014.

34. DOE also requests data from manufacturers on historical shipments, by equipment class, size, and efficiency level, for as many years as possible, ideally beginning in 1998 until the present.

35. DOE requests comment on its assumptions regarding future shipments. Specifically, DOE requests comment on the stock of BVM units likely to be available in the United

States or in particular commercial and industrial building sectors over time.

36. DOE also requests comment on the number of beverage vending machines that are typically installed in each location or building in each industry and if this is likely to increase or decrease over time.

37. DOE requests comment on its assumptions regarding likely reduction in stock in different commercial and industrial building sectors in which beverage vending machines are typically installed.

38. DOE also requests comment on other factors that might be influencing an overall reduction in BVM stock and if this trend is likely to continue over time.

39. DOE requests comment on the impact of the EPA SNAP rules on future shipments of beverage vending machines, by equipment class, refrigerant, and efficiency level.

40. DOE requests comment on its assumptions regarding the relative market share of each refrigerant by equipment class.

41. DOE requests comment on the high and low shipments scenarios.

42. DOE requests comment on the impact of the recent EPA SNAP rulemakings changing the availability of certain refrigerants for the BVM application on future efficiency distributions.

43. DOE requests comment on the identification and analysis of beverage vending machine customer subgroups.

44. DOE requests manufacturers provide an estimate of the capital and product conversion costs associated compliance with DOE amended energy conservation standards.

45. DOE specifically requests feedback from industry regarding the product conversion costs associated with standards compliance for Combination A and Combination B equipment.

46. DOE requests manufacturers provide an estimate of the one-time investments required to transition to alternative refrigerants, such as CO_2 and propane.

47. DOE requests that manufacturers provide sufficient detail such that DOE could model and verify these one-time costs related to the change in refrigerants, including the specific capital expenditures required and the potential redesign costs on a per-platform basis.

48. DOE requests manufacturers provide information about the ability to coordinate one-time investments related to EPA Rule 20 compliance and conversion costs necessitated by the DOE energy conservation standards.

49. DOE requests comment on the proposal to clarify the calculation of the refrigerated volume for each BVM basic model.

50. DOE requests comments on the total annual direct employment levels in the industry for BVM production.

51. DOE requests comment on its preliminary conclusion that the proposed standard levels will not have any negative impact on the performance or utility of equipment available in the market.

52. DOE requests comment regarding any potential impacts on small business manufacturers from the proposed standards. In particular, DOE seeks further information and data regarding the sales volume and annual revenues for small businesses so the agency can be better informed about the potential impacts to small business manufacturers of the proposed energy conservation standards. DOE will consider any such additional information when formulating and selecting TSLs for the final rule.

VIII. Approval of the Office of the Secretary

The Secretary of Energy has approved publication of this proposed rule.

List of Subjects

10 CFR Part 429

Confidential business information, Energy conservation, Household appliances, Imports, Reporting and recordkeeping requirements.

10 CFR Part 431

Administrative practice and procedure, Confidential business information, Energy conservation, Incorporation by reference, Reporting and recordkeeping requirements.

Issued in Washington, DC, on July 30, 2015.

David T. Danielson,

Assistant Secretary of Energy, Energy Efficiency and Renewable Energy.

For the reasons set forth in the preamble, DOE is proposing to amend parts 429 and 431 of chapter II of title 10 of the Code of Federal Regulations as set forth below:

PART 429—CERTIFICATION, COMPLIANCE, AND ENFORCEMENT FOR CONSUMER PRODUCTS AND COMMERCIAL AND INDUSTRIAL EQUIPMENT

■ 1. The authority citation for part 429 continues to read as follows:

Authority: 42 U.S.C. 6291–6317.

■ 2. Section 429.52 is amended by adding paragraph (a)(3) to read as follows:

§ 429.52 Refrigerated bottled or canned beverage vending machines.

(a) * * *

(3) The representative value of refrigerated volume of a basic model reported in accordance with paragraph (b)(2) of this section shall be the mean of the refrigerated volumes measured for each tested unit of the basic model and determined in accordance with the test procedure in § 431.296.

* * * * *

■ 3. Section 429.134 is amended by adding paragraph (g) to read as follows:

§ 429.134 Product-specific enforcement provisions.

* * * * *

(g) *Refrigerated bottled or canned beverage vending machines*—(1) *Verification of refrigerated volume.* The refrigerated volume (V) of each tested unit of the basic model will be measured pursuant to the test requirements of 10 CFR 431.296. The results of the measurement(s) will be compared to the representative value of refrigerated volume certified by the manufacturer. The certified refrigerated volume will be considered valid only if the measurement(s) (either the measured refrigerated volume for a single unit sample or the average of the measured refrigerated volumes for a multiple unit sample) is within five percent of the certified refrigerated volume.

(i) If the representative value of refrigerated volume is found to be valid, the certified refrigerated volume will be used as the basis for calculation of maximum daily energy consumption for the basic model.

(ii) If the representative value of refrigerated volume is found to be invalid, the average measured refrigerated volume determined from the tested unit(s) will serve as the basis for calculation of maximum daily energy consumption for the tested basic model.

(2) *Verification of surface area, transparent, and non-transparent areas.* The percent transparent surface area on the front side of the basic model will be measured pursuant to these requirements for the purposes of determining whether a given basic model meets the definition of Class A or Combination A as presented at 10 CFR 431.292. The transparent and non-transparent surface areas shall be determined on the front side of the beverage vending machine at the outermost surfaces of the beverage

vending machine cabinet, from edge to edge, excluding any legs or other protrusions that extend beyond the dimensions of the primary cabinet. Determine the transparent and non-transparent areas on each side of a beverage vending machine as described in paragraphs (g)(2)(i) and (ii) of this section. For combination vending machines, disregard the surface area surrounding any refrigerated compartments that are not designed to be refrigerated (as demonstrated by the presence of temperature controls), whether or not it is transparent. Determine the percent transparent surface area on the front side of the beverage vending machine as a ratio of the measured transparent area on that side over the sum of the measured transparent and non-transparent areas, multiplying the result by 100.

(i) *Determination of transparent area.* Determine the total surface area that is transparent as the sum of all surface areas on the front side of a beverage vending machine that meet the definition of transparent at 10 CFR 431.292. When determining whether or not a particular wall segment is transparent, transparency should be determined for the aggregate performance of all the materials between the refrigerated volume and the ambient environment; the composite performance of all those materials in a particular wall segment must meet the definition of transparent for that area be treated as transparent.

(ii) *Determination of non-transparent area.* Determine the total surface area that is not transparent as the sum of all surface areas on the front side of a beverage vending machine that are not considered part of the transparent area, as determined in accordance with paragraph (g)(2)(i) of this section.

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

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

Authority: 42 U.S.C. 6291–6317.

■ 5. Section 431.292 is amended by:

■ a. Revising the definitions for ‘‘Class A’’ and ‘‘Class B’’;

■ b. Adding, in alphabetical order, definitions for ‘‘Combination A’’ and ‘‘Combination B’’;

■ c. Revising the definition of ‘‘Combination vending machine’’; and

■ d. Adding a definition for ‘‘transparent’’.

The revisions and additions read as follows:

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

* * * * *

Class A means a refrigerated bottled or canned beverage vending machine that is not a combination beverage 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.

Combination vending machine means a bottled or canned beverage vending machine containing two or more compartments 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.

* * * * *

Transparent means greater than or equal to 45 percent light transmittance, as determined in accordance with the ASTM Standard E 1084–86 (Reapproved 2009), (incorporated by reference, see § 431.293) at normal incidence and in the intended direction of viewing.

* * * * *

■ 6. Section 431.293 is amended by adding a new paragraph (c) to read as follows:

§ 431.293 Materials incorporated by reference.

* * * * *

(c) *ASTM.* ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428, (877) 909–2786, or go to *http://www.astm.org/.*

(1) ASTM E 1084 (Reapproved 2009), ‘‘Standard Test Method for Solar Transmittance (Terrestrial) of Sheet Materials Using Sunlight,’’ approved April 1, 2009, IBR approved for § 431.292.

(2) [Reserved]

■ 7. Section 431.296 is revised 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 August 31, 2012 and before [DATE 3 YEARS AFTER PUBLICATION OF THE FINAL RULE ESTABLISHING NEW AND AMENDED ENERGY CONSERVATION STANDARDS FOR REFRIGERATED BOTTLED OR CANNED BEVERAGE VENDING MACHINES 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	$0.055 \times V^* + 2.56$
Class B	$0.073 \times V^* + 3.16$
Combination Vending Machines	[RESERVED]

* ‘‘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 PUBLICATION OF THE FINAL RULE ESTABLISHING NEW AND AMENDED ENERGY CONSERVATION STANDARDS FOR REFRIGERATED BOTTLED OR CANNED BEVERAGE VENDING MACHINES 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	$0.041 \times V^* + 1.92$
Class B	$0.033 \times V^* + 1.42$
Combination A	$0.044 \times V^* + 1.64$
Combination B	$0.044 \times V^* + 1.36$

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

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