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Office of Energy Efficiency and Renewable Energy

10 CFR Part 431

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

DEPARTMENT OF ENERGY

Office of Energy Efficiency and Renewable Energy

10 CFR Part 431

[Docket No. EERE–2006–STD–0125]

RIN 1904–AB58

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: Advance notice of proposed rulemaking and notice of public meeting.

SUMMARY: The Energy Policy and Conservation Act (EPCA) directs the Department of Energy (DOE) to establish energy conservation standards for various consumer products and commercial and industrial equipment, including refrigerated bottled or canned beverage vending machines (beverage vending machines), for which DOE determines that energy conservation standards would be technologically feasible and economically justified, and would result in significant energy savings. DOE is publishing this Advance Notice of Proposed Rulemaking (ANOPR) to: (1) Announce that it is considering establishment of energy conservation standards for beverage vending machines; and (2) announce a public meeting to receive comments on a variety of related issues.

DATES: DOE will hold a public meeting on Thursday, June 26, 2008, from 9 a.m. to 5 p.m. in Washington, DC. DOE must receive requests to speak at the public meeting no later than 4 p.m., Thursday, June 19, 2008. DOE must receive a signed original and an electronic copy of statements to be given at the public meeting no later than 4 p.m., Thursday, June 19, 2008.

DOE will accept comments, data, and information regarding this ANOPR before or after the public meeting, but no later than July 16, 2008. See Section IV, ''Public Participation,'' of this ANOPR for details.

ADDRESSES: The public meeting will be held at the U.S. Department of Energy, Forrestal Building, Room 1E–245, 1000 Independence Avenue, SW., Washington, DC 20585. (Please note that foreign nationals visiting DOE Headquarters are subject to advance security screening procedures. If you are a foreign national and wish to participate in the public meeting, please inform DOE as soon as possible by contacting Ms. Brenda Edwards at (202) 586–2945 so that the necessary procedures can be completed.)

Any comments submitted must identify the ANOPR for Beverage Vending Machines, and provide the docket number EERE–2006–STD–0125 and/or Regulatory Information Number (RIN) 1904–AB58. Comments may be submitted using any of the following methods:

- *Federal eRulemaking Portal: http://www.regulations.gov.* Follow the instructions for submitting comments.
- *E-mail: beveragevending.rulemaking@ee.doe.gov.* Include docket number EERE–2006–STD–0125 and/or RIN number 1904–AB58 in the subject line of the message.
- *Postal Mail*: Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Program, Mailstop EE–2J, 1000 Independence Avenue, SW., Washington, DC 20585–0121. Please submit one signed paper original.
- *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. Please submit one signed paper original.

For detailed instructions on submitting comments and additional information on the rulemaking process, see Section IV, ''Public Participation,'' of this document.

Docket: For access to the docket to read background documents or comments received, go to the U.S. Department of Energy, Resource Room of the Building Technologies Program, 950 L'Enfant Plaza, SW., Suite 600, Washington, DC, 20024, (202) 586–2945, between 9 a.m. and 4 p.m., Monday through Friday, except Federal holidays. Please call Ms. Brenda Edwards at the above telephone number for additional information regarding visiting the Resource Room.

FOR FURTHER INFORMATION CONTACT: Mr. Charles Llenza, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Program, EE–2J, 1000 Independence Avenue, SW., Washington, DC 20585–0121. Telephone: (202) 586–2192. E-mail: *Charles.Llenza@ee.doe.gov.*

Mr. Eric Stas or Ms. Francine Pinto, U.S. Department of Energy, Office of the General Counsel, GC–72, 1000 Independence Avenue, SW., Washington, DC 20585–0121. Telephone: (202) 586–9507. E-mail: *Eric.Stas@hq.doe.gov* or *Francine.Pinto@hq.doe.gov*.

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

SUPPLEMENTARY INFORMATION:

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I. Introduction

A. Purpose of the Advance Notice of Proposed Rulemaking

Through this Advance Notice of Proposed Rulemaking, the U.S. Department of Energy is initiating rulemaking to consider establishing energy conservation standards for beverage vending machines. The purpose of this ANOPR is to provide interested persons with an opportunity to comment on:

1. The equipment classes that DOE plans to analyze in this rulemaking;
2. The analytical framework, methodology, inputs, models, and tools (*e.g.*, life-cycle cost (LCC) and national energy savings (NES) spreadsheets) that DOE has been using to perform analyses of the impacts of energy conservation standards for refrigerated bottled or canned beverage vending machines (collectively referred to in this ANOPR as ''beverage vending machines'');
3. The analyses conducted for the ANOPR, including the preliminary results of the engineering analysis, the markups analysis to determine equipment price, the energy use characterization, the LCC and payback period (PBP) analyses, the NES and national impact analyses, and preliminary manufacturer impact analysis. These analyses are summarized in the ANOPR Technical Support Document (TSD), *Energy Efficiency Standards for Commercial and Industrial Equipment: Refrigerated Beverage Vending Machines* [1], published in tandem with this ANOPR; and
4. The candidate standard levels (CSLs) that DOE has developed for the ANOPR from these analyses.

Interested persons are welcome to comment on any relevant issue related to this ANOPR. However, throughout this **Federal Register** notice, DOE identifies areas and issues on which it specifically invites public comment. These critical issues are summarized in Section IV.E of this notice.

B. Overview of the Analyses Performed

As noted above, EPCA, as amended, authorizes DOE to consider establishing or amending energy conservation standards for various consumer products and commercial and industrial equipment, including the beverage vending machines that are the subject of this ANOPR. (42 U.S.C. 6291 *et seq.*) DOE conducted in-depth technical analyses for this ANOPR in the following areas: (1) Engineering; (2) markups to determine equipment price; (3) energy use characterization; (4) LCC and PBP; and (5) NES and net present value (NPV). The ANOPR discusses the methodologies, assumptions, and preliminary results for each analysis.

For each type of analysis, Table I.1 identifies the sections in this document that contain the results of the analyses, and summarizes their methodologies, key inputs, and assumptions. In addition, DOE conducted several other analyses that either support the five analyses discussed above or are preliminary analyses that will be expanded during the notice of proposed rulemaking (NOPR) stage of this rulemaking. These analyses include the market and technology assessment, a screening analysis which contributes to the engineering analysis, and the shipments analysis which contributes to the national impacts analysis. In addition to these analyses, DOE has begun preliminary work on the life-cycle cost subgroup analysis, manufacturer impact analysis, utility impact analysis, employment impact analysis, environmental impact analysis, and the regulatory impact analysis for the ANOPR. These analyses will be expanded upon during the NOPR stage of this rulemaking.

DOE consulted with stakeholders as part of its process in developing all of these analyses for the ANOPR and invites further public input on these topics which it will incorporate, as appropriate, into any revised analyses. While obtaining such input is the primary purpose at this ANOPR stage of the rulemaking, this notice also contains a synopsis of the preliminary analytical results. (The TSD contains a complete set of results.) The purpose of publishing these preliminary results in this notice is to: (1) Facilitate public comment on DOE's analytical methodology; (2) illustrate the level of detail interested persons (stakeholders [2]) will find in the TSD; and (3) invite stakeholders to comment on the structure and the presentation of those results. The preliminary analytical results presented in the ANOPR are subject to revision following review and input from stakeholders.

[1] To view the technical support document for this rulemaking, visit DOE's Web site at: *http://www.eere.energy.gov/buildings/appliance_standards/commercial/beverage_machines.html*.

[2] The terms ''stakeholders'' and ''interested persons'' are used interchangeably throughout this ANOPR to refer to any member of the public seeking to provide input on this rulemaking.

TABLE I.1.—IN-DEPTH TECHNICAL ANALYSES CONDUCTED FOR THE ANOPR

Analysis area	Methodology	Key inputs	Key assumptions	ANOPR section for results	TSD section for results
Engineering	Design option analysis.	Component cost data and performance values.	Component performance improvements are estimated using ANSI/ASHRAE Standard 32.1–2004.	Section II.C.6	Chapter 5, section 5.10, and Appendix B.
Markups to Determine Equipment Price.	Assessment of company financial reports to develop markups that transform manufacturer prices into customer prices.	Distribution channels, market shares across the different channels, State sales taxes, and shipments to different States.	Markups for baseline and more-efficient equipment are different.	Section II.D	Chapter 6, section 6.7.
Energy Use Characterization.	Energy use estimates from the energy performance model based on the engineering analysis spreadsheet.	Annual energy consumption based on hourly weather data for 237 U.S. locations.	Vending machines certified for indoor/outdoor use are assumed to be split 25% outdoors and 75% indoors.	Section II.E	Chapter 7, section 7.4.4, and Appendix D.
LCC and Payback Period.	Analysis of a representative sample of commercial customers by business type and location.	Manufacturer selling prices, markups (including sales taxes), installation price, energy consumption, electricity prices and future trends, maintenance costs, repair costs, equipment lifetime, and discount rate.	Baseline efficiency is Level 1. Average electricity prices are listed by customer type and State. The *Annual Energy Outlook 2007 (AEO2007)*[3] is used as the reference case for future trends. Equipment lifetime is 14 years. Discount rate is estimated using the weighted average cost of capital by customer type.	Section II.G.5	Chapter 8, section 8.4, and Appendix G.
Shipments	Projection of total sales by business type, State and by equipment class.	Wholesaler markups from company balance-sheet data, current shipments data by equipment class, and average equipment lifetime.	Market shares by equipment class are constant. Market saturation by business type is constant. Shipments do not change in response to standards.	Section II.H	Chapter 9, section 9.4.

TABLE I.1.—IN-DEPTH TECHNICAL ANALYSES CONDUCTED FOR THE ANOPR—Continued

Analysis area	Methodology	Key inputs	Key assumptions	ANOPR section for results	TSD section for results
National Impact	Forecasts of equipment costs, annual energy consumption, and operating costs to 2042.	Shipments; effective date of standard; base-case efficiencies; shipment-weighted market shares; annual energy consumption, total installed cost, and repair and maintenance costs (all on a per-unit basis); escalation of electricity prices; electricity site-to-source conversion; discount rate; and present year.	Annual shipments are from the shipments model. The annual weighted-average energy efficiency, installed cost, and annual-weighted average repair costs are a function of the energy efficiency level. Annual weighted-average maintenance costs are constant with the energy consumption level. *AEO2007* is used for electricity price escalation, and the National Energy Modeling System (NEMS) is used for site-to-source conversion. Discount rates are 3% and 7% real. Future costs are discounted to 2007.	Section II.I.4	Chapter 10, section 10.4, and Appendix I.

[3] DOE will conduct the NOPR analysis using the latest available version of the AEO. Updated analytical spreadsheets using AEO2008 will be made available on DOE's Web site by late Spring/early Summer 2008: *http://www.eere.energy. gov/buildings/appliance_standards/commercial/beverage_machines.html.*

1. Engineering Analysis

DOE uses the engineering analysis, along with the equipment price determination, to establish the relationship between the costs (i.e., end-user/customer prices) and efficiencies of equipment which DOE evaluates for standards, including beverage vending machines. This relationship serves as the basis for cost and benefit calculations for individual commercial customers, manufacturers, and the Nation. The engineering analysis identifies representative baseline equipment, which is the starting point for analyzing technologies expected to provide energy efficiency improvements. ''Baseline equipment'' here refers to model(s) having features and technologies typically found in equipment currently offered for sale. The baseline model in each equipment class represents the characteristics of equipment in that class; for equipment which is already subject to an energy efficiency standard, the baseline unit is typically one which just meets the current regulatory requirement. After identifying baseline models, DOE estimates manufacturer selling prices (MSPs) through an analysis of manufacturer costs and manufacturer markups. Manufacturer markups are the multipliers used to determine MSPs based on manufacturing cost.

The engineering analysis uses cost-efficiency curves based on a design-options approach [4] derived from DOE analysis. In the engineering analysis, DOE also discusses the equipment classes analyzed, sensitivity to material prices, and the use of alternative refrigerants. For additional detail on the engineering analysis, see Section II.C.1.

2. Markups to Determine Equipment Price

DOE determines customer prices for beverage vending machines from MSP [5] and equipment price markups using industry balance sheet and U.S. Census Bureau data. To determine price markups, DOE identifies distribution channels for equipment sales and determines the existence and amount of markups within each distribution channel. For each distribution channel, DOE distinguishes between ''baseline markups'' applied to the MSP for baseline equipment and ''incremental markups'' applied to the incremental increase in MSP for more-efficient equipment. Overall baseline and overall incremental markups are calculated separately based on the product of all baseline and incremental markups at each step in a distribution channel. Together, the overall baseline markup applied to the baseline equipment MSP and the incremental markups applied to the incremental increase in MSP for more-efficient equipment, including sales tax, determine the final customer price. For additional detail on the markups used to determine equipment price, see Section II.D.

3. Energy Use Characterization

The energy use characterization provides estimates of annual energy consumption for beverage vending machines. DOE uses these estimates in the subsequent LCC and PBP analyses and the national impact analysis (NIA). DOE developed daily energy consumption estimates for the different equipment classes analyzed in the

[4] A design-options approach uses individual or combinations of design options to identify increases in efficiency. Under this approach, estimates are based on manufacturer or component supplier data, or through the use of engineering computer simulation models. Individual design options, or combinations of design options, are added to the baseline model in ascending order of cost-effectiveness.

[5] Manufacturer selling prices are derived from the manufacturer production costs by applying the manufacturer markup. The MSP is the selling price of the equipment directly from the manufacturing facility. If this equipment is then routed through a wholesaler and/or a distributor, additional markups are applied before reaching the customer.

engineering analysis.[6] DOE then validated these estimates with simulation modeling of energy consumption on an annual basis for all the equipment classes and efficiency levels. The simulation modeling took into account the percentage of vending machines that would be placed indoors and outdoors and therefore, exposed to varying ambient temperatures. For additional detail on the energy use characterization, see Section II.E.

4. Life-Cycle Cost and Payback Period Analyses

The LCC and PBP analyses determine the economic impact of potential standards on individual commercial customers. The LCC is the total customer expense for a piece of equipment over the life of the equipment (i.e., purchase price plus maintenance and operating costs). The LCC analysis compares the life-cycle costs of equipment designed to meet new or amended energy conservation standards with the life-cycle cost of the equipment likely to be installed in the absence of such standards. DOE determines these costs by considering: (1) Total installed cost to the purchaser (including MSP, sales taxes, distribution channel markups, and installation cost); (2) the operating expenses of the equipment (energy cost and maintenance and repair cost); (3) equipment lifetime; and (4) a discount rate that reflects the real cost of capital and puts the LCC in present value terms. For additional detail on the LCC analysis, see Section II.G.1.

The PBP represents the number of years needed to recover the increase in purchase price (including installation cost) of more-efficient equipment through savings in the operating cost. The PBP is the increase in total installed cost due to increased efficiency divided by the (undiscounted) decrease in annual operating cost from increased efficiency. For additional detail on the PBP analysis, see Section II.G.1.

5. National Impact Analysis

The NIA estimates the NES, as well as the NPV, of total national customer costs and savings expected to result from new standards at specific efficiency levels. Stated another way, DOE calculated the NES and NPV for each standard level for beverage vending machines as the difference between a base-case forecast (i.e., without new standards) and the standards-case forecast (i.e., with new standards). For each year of the analysis, the beverage vending machine stock is composed of units of different types shipped in previous years (or vintages) which remain available for sale at present. Each vintage has a characteristic distribution of efficiency levels. DOE first determined the average energy consumption of each vintage in the stock accounting for all efficiency levels in that vintage. The national annual energy consumption is then the product of the annual average energy consumption per beverage vending machine at a given vintage and the number of beverage vending machines of that vintage in the stock for the particular year. This approach accounts for differences in unit energy consumption from year to year. Annual energy savings are calculated for each standard level by subtracting national energy consumption for that standard level from that calculated for the baseline. Cumulative energy savings are the sum of the annual NES determined from 2012 to 2042.

In a similar fashion, DOE tracks the first costs for all equipment installed at each efficiency level for each vintage. It also tracks the annual operating cost (sum of the energy, maintenance, and repair costs) by vintage for all equipment remaining in the stock for each year of the analysis. DOE then calculates the net economic savings each year as the difference between total operating cost savings and increases in the total installed costs. The NPV is the annual net cost savings calculated for each year, discounted to the year 2012, and expressed in 2007$. Cumulative NPV savings reported are the sum of the annual NPV savings over the analysis period (2012–2042).[7] Critical inputs to the NIA include shipment projections, rates at which users retire equipment (based on estimated equipment lifetimes), and estimates of changes in shipments and retirement rates in response to changes in equipment costs due to new standards. For additional detail on the NIA, see Section II.I.1.

C. Authority

Title III of EPCA sets forth a variety of provisions concerning energy efficiency. Part A[8] of Title III provides for the ''Energy Conservation Program for Consumer Products Other Than Automobiles.'' (42 U.S.C. 6291–6309)

The amendments to EPCA contained in the Energy Policy Act of 2005 (EPACT 2005), Pub. L. 109–58, include new or amended energy conservation standards and test procedures for some of these products, and direct DOE to undertake rulemakings to promulgate such requirements. In particular, section 135(c)(4) of EPACT 2005 amends EPCA to direct DOE to prescribe energy conservation standards for beverage vending machines. (42 U.S.C. 6295(v))

Because of its placement in Part A of Title III of EPCA, the rulemaking for beverage vending machine energy conservation standards is bound by the requirements of 42 U.S.C. 6295. However, since beverage vending machines are commercial equipment and consistent with DOE's previous action to incorporate the EPACT 2005 requirements for commercial equipment into Title 10 of the Code of Federal Regulations (CFR), Part 431 (''Energy Efficiency Program for Certain Commercial and Industrial Equipment''), DOE intends to place the new requirements for beverage vending machines in 10 CFR part 431. The location of the provisions within the CFR does not affect either their substance or applicable procedure, so DOE is placing them in the appropriate CFR part based on their nature or type.[9]

Before DOE prescribes any such standards, however, it must first solicit comments on proposed standards. Moreover, DOE must design each new standard for beverage vending machines to achieve the maximum improvement in energy efficiency that is technologically feasible and economically justified, and will result in significant conservation of energy. (42 U.S.C. 6295(o)(2)(A), (o)(3), (v)) To determine whether a standard is economically justified, DOE must, after receiving comments on the proposed standard, determine whether the benefits of the standard exceed its burdens to the greatest extent practicable, considering the following seven factors:

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

(2) The savings in operating costs throughout the estimated average life of the covered product in the type (or class) compared with any increase in the price, initial charges, or

[6] The daily energy consumption estimates were calculated in the engineering analysis based on procedures and conditions specified in ANSI/ASHRAE Standard 32.1–2004, *Methods of Testing for Bottled, Canned, and Other Sealed Beverages*.

[7] DOE uses 31 years as the time period of analysis for its NES calculations in many of its rulemakings, in order to enable interested persons to understand the relative magnitude of energy savings potentials of the various equipment at the standard levels being considered.

[8] This part was originally titled Part B; however, it was redesignated Part A, after Part B of Title III was repealed by Pub. L. 109–58. Similarly, Part C, *Certain Industrial Equipment*, was redesignated Part A–1.

[9] Because of their placement into 10 CFR 431, beverage vending machines will be referred to as ''equipment'' throughout this notice.

maintenance expenses for the covered product likely to result from imposition of the standard;

(3) The total projected amount of energy savings likely to result directly from imposition of the standard;

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

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

(6) The need for national energy conservation; and

(7) Other factors the Secretary of Energy (the Secretary) considers relevant.

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

D. Background

1. History of Standards Rulemaking for Beverage Vending Machines

As noted above, section 135(c)(4) of EPACT 2005 amended section 325 of EPCA in part by adding new subsections 325(v)(2), (3), and (4). (42 U.S.C. 6295(v)(1), (2) and (3)).[10] These provisions direct the Secretary to prescribe, by rule, energy conservation standards for beverage vending machines no later than August 8, 2009, and state that any such standards shall apply to beverage vending machines manufactured three years after the date of publication of the final rule that establishes those standards. The energy use of this equipment has never before been regulated at the Federal level.

Section 135(a)(3) of EPACT 2005 amended section 321 of EPCA in part by adding new subsection 321(40) (42 U.S.C. 6291(40)), which establishes the definitions for ''refrigerated bottled or canned beverage vending machine'' as ''a commercial refrigerator that cools bottled or canned beverages and dispenses the bottled or canned beverages on payment.'' In addition, section 136(a)(3) of EPACT 2005 amended section 340 of EPCA in part by adding a definition for ''commercial refrigerator, freezer, and refrigerator-freezer.''[11]

On June 28, 2006, DOE published in the **Federal Register** a notice announcing a public meeting and the availability of a Framework Document titled, *Rulemaking Framework for Refrigerated Bottled or Canned Beverage Vending Machines*,[12] that describes the procedural and analytical approaches that DOE anticipates using to evaluate energy conservation standards for beverage vending machines. 71 FR 36715. DOE invited written comments on this analytical framework.

DOE held a Framework public meeting on July 11, 2006, whose purpose was to discuss the procedural and analytical approaches for use in the rulemaking, and to inform and facilitate stakeholder involvement in the rulemaking process. The analytical framework presented at the public meeting described different analyses, such as LCC and PBP, the planned methods for conducting them, and the relationships among the various analyses.[13] Manufacturers, trade associations, environmental advocates, and other interested parties attended the public meeting.

Comments received after publication of the Framework Document and at the July 11 public meeting helped identify and elaborated upon issues involved in this rulemaking and provided information that has contributed to DOE's efforts to resolve these issues. Many of the statements provided by stakeholders are quoted or summarized in this ANOPR. A parenthetical reference at the end of a quotation or passage provides the location of such item in the public record (*i.e.*, the docket for this rulemaking). The ANOPR TSD describes the analytical framework in detail.

During the course of this rulemaking, Congress passed the Energy Independence Security Act of 2007 (EISA 2007), which the President signed on December 19, 2007 (Pub. L. 110–140). Of relevance to the beverage vending machine rulemaking, section 310(3) of EISA 2007 amended section 325 of EPCA in part by adding subsection 325(gg) (42 U.S.C. 6295(gg)). This subsection requires any new or amended energy conservation standard adopted after July 1, 2010 to incorporate ''standby mode and off mode energy use.'' (42 U.S.C. 6295(gg)(3)(A)) Since any standard associated with this rulemaking is required by August 2009, the energy use calculations will not include ''standby mode and off mode energy use.'' To include standby mode and off mode energy use requirements for this rulemaking would take a considerable degree of analytical effort and would likely require changes to the test procedure. Given the statutory deadline, DOE has decided to address this requirement when the standards for beverage vending machines are reviewed in August 2015 to consider the need for possible amendment in accordance with 42 U.S.C. 6295(m).

2. Rulemaking Process

Table I.2 sets forth a list of the analyses DOE has conducted and intends to conduct in its evaluation of potential energy conservation standards for beverage vending machines. Historically, DOE performed the manufacturer impact analysis (MIA) in its entirety between the ANOPR and NOPR stages of energy conservation standards rulemakings. However, more recently, DOE has refined its process and has begun to publish a preliminary MIA in the ANOPR for public comment. DOE believes this change will improve the rulemaking process. Accordingly, as noted in the table below, DOE has performed a preliminary MIA for this ANOPR.

TABLE I.2.—BEVERAGE VENDING MACHINE ANALYSIS

ANOPR	NOPR	Final Rule*
• Market and technology assessment	• Revised ANOPR analyses	• Revised NOPR analyses
• Screening analysis	• Life-cycle cost sub-group analysis	

[10] It is noted that the relevant statutory provisions were renumbered pursuant to section 316 of the Energy Independence and Security Act of 2007, Pub. L. 110–140.

[11] This definition reads as follows:

''(9)(A) The term 'commercial refrigerator, freezer, and refrigerator-freezer' means refrigeration equipment that—

(i) is not a consumer product (as defined in section 321 [of EPCA; 42 U.S.C. 6291(1)]);

(ii) is not designed and marketed exclusively for medical, scientific, or research purposes;

(iii) operates at a chilled, frozen, combination chilled and frozen, or variable temperature;

(iv) displays or stores merchandise and other perishable materials horizontally, semivertically, or vertically;

(v) has transparent or solid doors, sliding or hinged doors, a combination of hinged, sliding, transparent, or solid doors, or no doors;

(vi) is designed for pull-down temperature applications or holding temperature applications; and

(vii) is connected to a self-contained condensing unit or to a remote condensing unit.''

(42 U.S.C. 6311(9)(A))

[12] The Framework Document is available at: *http://www.eere.energy.gov/buildings/appliance_standards/commercial/beverage_machines.html.*

[13] PDF copies of the slides and other materials associated with the public meeting are available at: *http://www.eere.energy.gov/buildings/appliance_standards/commercial/beverage_machines.html.*

TABLE I.2.—BEVERAGE VENDING MACHINE ANALYSIS—Continued

ANOPR	NOPR	Final Rule*
• Engineering analysis	• Manufacturer impact analysis	
• Energy use characterization	• Utility impact analysis	
• Markups to determine equipment price	• Employment impact analysis	
• Life-cycle cost and payback period analyses	• Environmental assessment	
• Shipments analysis	• Regulatory impact analysis	
• National impact analysis		
• Preliminary manufacturer impact analysis		

* During the final rule phase, DOE considers the comments submitted by the U.S. Department of Justice in the NOPR phase concerning the impact of any lessening of competition likely to result from the imposition of the standard. (42 U.S.C. 6295(o)(2)(B)(v))

The analyses listed in Table I.2 also include the development of related economic models and analytical tools, as necessary. If timely new data, models, or tools that enhance the development of standards become available, DOE will incorporate them into this rulemaking.

3. Miscellaneous Rulemaking Issues

a. Consensus Agreement

In response to the Framework Document, USA Technologies stated that there appears to be considerable consensus regarding potential energy conservation standards for beverage vending machines and that DOE could provide a valuable and meaningful service by coordinating the efforts of industry, manufacturers, beverage vending machine owners, and utilities by fostering an agreement on standards. USA Technologies stated that this approach could help the industry achieve significant energy savings in a very short time, instead of waiting until 2012. (USA Tech, No. 9 at p. 1) [14] Edison Electric Institute (EEI) suggested that, given DOE's workload on Federal standards over the next several years, DOE should try to arrange a negotiated rulemaking of interested parties to help streamline the process. EEI noted that such a process was very successful with the fluorescent lamp ballast rulemaking.[15] (EEI, No. 12 at p. 1)

DOE supports efforts by interested parties to work together to develop and present to DOE recommendations on equipment categories and standard levels. Such recommendations are welcome throughout the standards development process, especially following issuance of the ANOPR. Any consensus recommendation must satisfy the statutory criteria provided by EPCA in determining whether an energy conservation standard is technologically feasible and economically justified, and will result in significant conservation of energy. (42 U.S.C. 6295(o)(2)(A), (o)(3), (v)) Any consensus recommendation should also include information that DOE can use to assess the seven statutory factors that determine whether the benefits of the standard exceed its burdens to the greatest extent practicable. (42 U.S.C. 6925(o)(2)(B)(i))

b. Type of Standard

Crane Merchandising Systems asked whether the technology options listed would become mandatory as part of the rulemaking. (Public Meeting Transcript, No. 8 at p. 150) USA Technologies stated that, in terms of technology options for compliance with energy conservation standards, the more opportunity manufacturers have to be creative, the better, particularly since this is a very creative industry. It stated that restricting manufacturers to particular design options would not be in the manufacturers'—or the buyers'—best interest. (Public Meeting Transcript, No. 8 at p. 173) Dixie-Narco likewise stated that the choice of technologies used to achieve standards should be left to the discretion of the manufacturer. (Public Meeting Transcript, No. 14 at p. 3) Dixie-Narco further suggested that the DOE standard should not recommend any particular design packages or endorse any specific third-party technologies developed for use in vending machines that original equipment manufacturers have not endorsed as being compatible with their equipment. It stated that these technologies may work against other energy-saving components such as variable-capacity compressors. (Public Meeting Transcript, No. 14 at p. 3) In contrast, the Naval Facilities Engineering Service Center (NFESC) recommended that DOE should pursue cost-effective standards for beverage vending machines, which would include both overall efficiency standards, as well as prescriptive standards that address more focused topics such as a low-power-mode requirement for low-use periods and lighting efficiency within the unit. (NFESC, No. 15 at p. 2)

In response, DOE notes that EPCA provides that an ''energy conservation standard'' must be either (A) ''a * * * level of energy efficiency'' or ''a * * * quantity of energy use,'' or (B), for certain specified equipment, ''a design requirement.'' (42 U.S.C. 6291(6)) Thus, an ''energy conservation standard'' cannot consist of both a design requirement and a level of efficiency or energy use.[16] Moreover, item (A) above indicates that, under EPCA, a single energy conservation standard cannot have measures of both energy efficiency and energy use. Furthermore, EPCA specifically requires DOE to base its test procedure for this equipment on American National Standards Institute (ANSI)/American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 32.1–2004, *Methods of Testing for Rating Vending Machines for Bottled, Canned or Other Sealed Beverages.* (42 U.S.C. 6293(b)(15)) The test methods in ANSI/ASHRAE Standard 32.1–2004 consist of means to measure energy consumption, not energy efficiency.

For these reasons, DOE does not intend to develop efficiency standards or design requirements for this equipment. Instead, DOE intends to develop standards such that each beverage vending machine would be subject to a maximum level of energy

[14] A notation in the form ''USA Tech, No. 9 at p. 1'' identifies a written comment that DOE received and included in the docket for this rulemaking (Docket No. EERE–2006-STD–0125), maintained in the Resource Room of the Building Technologies Program. Specifically, this footnote refers to a comment made USA Technologies, and recorded on page 1 of document number 9. Likewise, a notation in the form ''Public Meeting Transcript, No. 8 at p. 150'' identifies an oral comment that DOE received during the July 11, 2006, Framework public meeting and which was recorded in the public meeting transcript in the docket for this rulemaking. Likewise, a notation in the form ''Joint Comment,'' No. 13 at p. 3'' identifies a written comment that DOE has received and has included in the docket of this rulemaking.

[15] DOE notes that in the florescent lamp ballasts rulemaking, a consensus process was used. 65 FR 56740, 56744 (Sept. 19, 2000).

[16] Beverage vending machines are not one of the specified equipment for which EPCA allows a standard to consist of a design requirement. (42 U.S.C. 6291(6)(B), 6292(a)).

use, and manufacturers could meet these standards with their own choice of design methods.

c. Split Incentive Issue

DOE mentioned the ''split incentive issue'' (explained below) at the Framework public meeting when discussing distribution channels for beverage vending machines sold to the bottler or a vending machine operator. The bottler or the vending machine operator installs these machines at different sites through location contracts, maintains and stocks the machines, and retains a certain percentage of the coin-box revenue. The site owner, in this case, allows the machine to be placed on-site, receives a percentage of the coin-box revenue and/or other remuneration, and most relevant to this rulemaking, pays the electricity bill and enjoys any electricity cost savings associated with more-efficient machines. The equipment purchaser (bottler or vending machine operator) does not pay the electricity bill and, therefore, does not receive any cost savings. In principle, the business site owner would be willing to accept a lower percentage of revenue for a machine that uses less electricity. However, where it is costly to renegotiate contracts, the incentive to purchase more-efficient machines may be lessened or eliminated. Nonetheless, there may be a growing market for energy-efficient beverage vending machines because environmentally-conscious beverage companies and bottlers are pushing to install energy-efficient machines on-site, and certain site owners are demanding that energy-efficient machines be installed to reduce their electricity costs.

At the Framework public meeting, Coca-Cola indicated that the vending machine operator may or may not pay some or all of the energy costs, depending on its contract with the site owner. (Public Meeting Transcript, No. 8 at p. 190) Meanwhile, EEI asserted that information about distribution channels and beverage vending machine contracts would be important for the LCC analysis. EEI claimed that unless there is a provision in the contract for energy costs, there will be a split incentive for machine owners and site owners. (EEI, No. 12 at p. 5)

DOE agrees with EEI that there may be a split incentive in the beverage vending machine market; however, it disagrees with EEI's contention that the split incentive is relevant to the LCC analysis. DOE recognizes that when a standard results in overall operating cost savings that are greater than increases in the installed cost for the equipment, there will be a life-cycle cost benefit from the standard, a key piece of regulatory information independent of who receives such benefit. How the benefits and burdens are shared between the equipment purchaser and the site owner is a function of the nature of the contract, and this allocation may in fact change as the expenses of either party change as a result of subsequent events, such as changes in electricity prices or standards requiring more-efficient machines. DOE has limited data on existing beverage vending machine contracts, but knows that these can vary widely. DOE has no data on how these contracts may change as the relative expenses of either party shift. In summary, for the purposes of the LCC analysis and as is required by EPCA, DOE is evaluating the benefits and burdens of the standards from the standpoint of a ''customer'' who is assumed to bear the burden of purchasing the equipment and the benefits of any energy savings, which in this case, is the equipment purchaser. (42 U.S.C. 6295(o)(2)(B)(i)) DOE requests further comment and information on this issue.

4. Test Procedure

A test procedure outlines the method by which manufacturers will determine the energy consumption of their beverage vending machines, and thereby assess the results used to certify compliance with an energy conservation standard.

Section 135(b) of EPACT 2005 amended section 323 of EPCA in part by adding new subsections 323(b)(15) (42 U.S.C. 6293(b)(15)) and 323(f) (42 U.S.C. 6293(f)). Respectively, these subsections provide that the test procedure for refrigerated bottled or canned beverage vending machines shall be based on ANSI/ASHRAE Standard 32.1–2004, and that the Secretary had until August 8, 2007 to prescribe that new test procedure.

On December 8, 2006, DOE published a final rule in the **Federal Register** that incorporated by reference ANSI/ASHRAE Standard 32.1–2004, with two modifications, as the DOE test procedure for this equipment. 71 FR 71340, 71375; 10 CFR 431.294. The first modification DOE made was to specify that in Section 6.2, ''Voltage and Frequency,'' equipment with dual nameplate voltages must be tested at the lower of the two voltages only. 71 FR 71340, 71355 (Dec. 8, 2006). The second modification was to specify that (1) any measurement of ''vendible capacity'' of refrigerated bottled or canned beverage vending machines must be in accordance with the second paragraph of Section 5, ''Vending Machine Capacity,'' of ANSI/ASHRAE Standard 32.1–2004, and (2) any measurement of ''refrigerated volume'' of refrigerated bottled or canned beverage vending machines must be in accordance with the methodology specified in Section 5.2, ''Total Refrigerated Volume,'' (excluding subsections 5.2.2.2 through 5.2.2.4) of the ANSI/Association of Home Appliance Manufacturers (AHAM) HRF–1–2004, *Energy, Performance and Capacity of Household Refrigerators, Refrigerator-Freezers and Freezers. Id.*

5. Rating Conditions

In the Framework Document, DOE requested feedback on what rating conditions it should use for setting standards and determining compliance with them. DOE's test procedure included two rating conditions (i.e., 75 degrees Fahrenheit (°F)/45 percent relative humidity (RH) and 90°F/65 percent RH). EEI stated that the 75°F/45 percent RH ambient conditions specified in the ANSI/ASHRAE Standard 32.1–2004 should provide adequate daily energy-usage information for most machines located solely indoors. EEI added that for certain indoor conditions (i.e., machines located in rooms with limited ventilation), the 90°F/65 percent RH test conditions may be better. (EEI, No. 12 at p. 2)

Dixie-Narco stated that for the majority of indoor equipment, the rating 75°F/45 percent RH temperature is accurate and reflects actual conditions. (Public Meeting Transcript, No. 8 at p. 95) Dixie-Narco stated that the 90°F/65 percent RH rating condition is highly overstated, arguing that no location in the United States is at 90°F/65 percent RH condition 24 hours a day, 365 days a year. Royal Vendors and UVA Technologies agreed with Dixie-Narco, stating that the actual energy use of outdoor machines is likely to be overstated, in most cases, when determined under those conditions. (Public Meeting Transcript, No. 8 at pp. 96–97)

Pacific Gas and Electric (PG&E) indicated, however, that DOE need not distinguish between indoor and outdoor temperature conditions in setting rating conditions because machines located indoors sometimes operate in warmer conditions, similar to the ambient conditions that the machine might operate in if it was located outdoors. (Public Meeting Transcript, No. 8 at p. 94) Coca-Cola stated energy consumption depends not only on ambient temperature, but also on ambient humidity and the heat load (heat output by components) within the machine. (Coca-Cola, No. 8 at p. 220) EEI noted that one EEI member company suggested that if DOE could determine a way to require outdoor-rated machines to be used exclusively outdoors and indoor-rated machines to be used exclusively indoors, there could be considerable energy savings. (EEI, No. 12 at p. 2)

During the Framework public meeting, EEI stated that if glass-front machines are placed outside, DOE might need to consider a different test procedure to account for the difference in radiation heat loads between glass-front and closed-front machines. EEI also suggested separate tests for winter and summer conditions for machines used outdoors. (Public Meeting Transcript, No. 8 at p. 66) In addition, EEI argued that energy usage of beverage vending machines varies dramatically based on ambient conditions. It suggested that DOE should adopt a test procedure for outdoor machines that would account for high ambient temperatures and/or solar loads, which would improve the efficiency of the equipment throughout the year, but especially on peak summer days. (EEI, No. 12 at p. 3) EEI added that if DOE decides to establish standards in terms of total daily energy consumption, then extreme outdoor temperature conditions must be accounted for. (EEI, No. 12 at p. 5)

In response to these comments, DOE understands the concerns about the variability in energy consumption resulting from different ambient conditions. However, outdoor-only beverage machines are currently nonexistent. Currently, all machines placed outdoors are designed for both indoor and outdoor use and are not designed exclusively for outdoor use only. If, as suggested by several manufacturers, a 90 °F/65 percent RH rating condition for a machine used outdoors would result in overstatement of its energy use due to changing daily and seasonal ambient conditions, that rating condition applied to the same machine used indoors would then be expected to result in an even greater overstatement of energy use. For example, the average annual temperature in Miami, FL (one of the southernmost and warmest cities in the United States) is approximately 75 °F.[17] Therefore, throughout the United States, almost all average annual outdoor temperatures are close to or below 75 °F. DOE chooses to evaluate an average temperature because it believes that the increase in the energy consumption of a machine operating in temperatures above the average is offset by the decrease in energy consumption of a machine operating in temperatures below the average. In addition, beverage vending machines have closed refrigeration systems. The relative humidity that a beverage vending machine operates in has a much less significant impact than ambient temperature on the energy consumption of a beverage vending machine. After careful consideration of public comments on this issue, DOE plans to use a 75 °F/45 percent RH rating condition for all refrigerated beverage vending machines covered by this rulemaking. DOE will include this rating condition requirement as part of any energy conservation standards developed in this rulemaking.

II. Energy Conservation Standards Analyses for Beverage Vending Machines

This section addresses the analyses DOE has performed and intends to perform for this rulemaking. A separate subsection addresses each analysis and the underlying assumptions applied to that analysis. Specifically, DOE will perform a set of analyses, including: (1) A market and technology assessment; (2) a screening analysis; (3) an engineering analysis; (4) an analysis to determine equipment price; (5) an energy use characterization; (6) an LCC and PBP analysis; (7) a shipments analysis; (8) a national impact analysis; and (9) a manufacturer impact analysis. Additional analyses consider the impact of a potential rule on utilities, LCC sub-groups, employment, and the environment. A full description of how these analyses are performed is contained in the TSD.[18] However, this section of the ANOPR provides an overview of these analyses, while focusing on how these analyses are being tailored to this rulemaking and on their underlying assumptions. It also discusses comments received from interested parties since DOE published the beverage vending machines Framework Document.

A. Market and Technology Assessment

When DOE begins a standards rulemaking, it develops market assessment information that provides an overall picture of the market for the equipment concerned, including the nature of the equipment, the industry structure, and market characteristics for the equipment. The technology assessment identifies available, energy-saving technologies, which will be considered in the screening analysis. These activities consist of both quantitative and qualitative efforts based primarily on publicly available information. The subjects addressed in the market and technology assessment for this rulemaking include manufacturer characteristics and market shares, existing regulatory and non-regulatory efficiency improvement initiatives, equipment classes, and trends in equipment markets and characteristics. This information serves as resource material for use throughout the rulemaking.

1. Definition of ''Beverage Vending Machine''

As mentioned above, EPCA defines the term ''refrigerated bottled or canned beverage vending machine'' as ''a commercial refrigerator that cools bottled or canned beverages and dispenses the bottled or canned beverages on payment.'' (42 U.S.C. 6291(40)) Thus, whether equipment is a beverage vending machine covered under EPCA depends on whether it cools and dispenses ''bottled beverages'' and/or ''canned beverages,'' and, in the Framework Document, DOE requested feedback on the meaning of these terms. The following summarizes public comments on this issue.

PepsiCo stated that there are many types of packaging for beverages that cannot be categorized as a can or bottle. (Public Meeting Transcript, No. 8 at p. 36) Dixie-Narco questioned how DOE's packaging definition will take into account evolving package types over time. (Public Meeting Transcript, No. 8 at p. 37) PepsiCo elaborated, asking how DOE will treat other types of packaging (e.g., pouch-type packaging and packaging that is a combination of plastic and paperboard). (Public Meeting Transcript, No. 8 at pp. 40–41) The National Automated Merchandising Association (NAMA) then asked whether DOE will include aseptic packaging as a bottle or can.[19] (Public Meeting Transcript, No. 8 at p. 41)

Dixie-Narco suggested that DOE should use the term ''beverage containers'' to describe the items refrigerated beverage vending machines dispense. (Public Meeting Transcript, No. 8 at p. 46) EEI stated that DOE

[17] Typical Meterorological Year 2 (TMY2) Data (from the 1961–1990 National Solar Radiation Data Base). Available at: *http://rredc.nrel.gov/solar/old_data/nsrdb/tmy2/.*

[18] Available on DOE's Web site at *http://www.eere.energy.gov/buildings/appliance_standards/commercial/beverage_machines.html.*

[19] An aseptic package is a package that is intended to prevent spoilage and is used for long-term storage of its contents.

should expand the list of vended items to more than just bottles and cans. (Public Meeting Transcript, No. 8 at p. 42) It suggested that DOE should add ''other beverage container'' to the list of vended items that delineate what constitutes a beverage vending machine, and that DOE should define that term, so as to include other combinations (e.g., plastic and paperboard, metal and plastic, metal and glass) or other materials that may contain a beverage that will be housed in a refrigerated beverage vending machine. EEI noted that another option would be to add the phrase ''packaged beverage-refrigerated'' to the list of vended products that define what equipment is a beverage vending machine. (EEI, No. 12 at p. 3)

The Alliance to Save Energy, the American Council for an Energy Efficient Economy (ACEEE), the Appliance Standards Awareness Project (ASAP), the Natural Resources Defense Council (NRDC), the Northeast Energy Efficiency Partnerships (NEEP), and the Northwest Power and Conservation Council, in comments they jointly filed (hereafter ''Joint Comment''), stated that the definitions suggested by DOE for the terms ''bottle'' and ''can'' seem workable, except that the term ''can'' should be broadened to include plastic. The Joint Comment also noted the distinction between what is a ''can'' and what is a ''bottle'' is not important, as long as all types of containers are included. (Joint Comment, No. 13 at p. 3) Dixie-Narco agreed with this comment. The Joint Comment suggested using the ASHRAE standard package (i.e., a 12-ounce, 355-milliliter can) as a thermal load in the test procedure. (Dixie-Narco, No. 14 at p. 1)

After carefully reviewing these comments, DOE has tentatively decided to consider broader definitions for the terms ''bottled'' and ''canned'' as they apply to beverage vending machines. DOE believes a bottle or can in this context refers to ''a sealed container for beverages,'' so a bottled or canned beverage is ''a beverage in a sealed container.'' Such definition would avoid unnecessary complications regarding the material composition of the container. Furthermore, a single, encompassing definition will eliminate the need to determine whether a particular container is a bottle or a can. DOE seeks comment on this broader definition, both as to the definition itself and whether it is consistent with the intent of the Act.

Combination vending machines are vending machines that dispense cooled beverages as well as other beverages and food items. These types of vending machines are discussed in Section 5.a below.

2. Equipment Classes

In general, when evaluating and establishing energy conservation standards, DOE divides covered equipment into equipment classes by the type of energy used, capacity, or other performance-related features that affect efficiency and factors such as the utility of such feature(s) to users. (42 U.S.C. 6295(q)) DOE routinely establishes different energy conservation standards for different equipment classes based on these criteria.

A number of characteristics of beverage vending machines have the potential to affect their energy use and efficiency, and accordingly, to be the basis for separate equipment classes for these machines. In the Framework Document, DOE suggested and sought feedback on two issues that could affect equipment class designations: (1) Indoor-only and indoor/outdoor machines; and (2) glass-front and solid-front machines.

With regard to glass-front and solid-front machines, ACEEE stated it may be better to distinguish equipment classes as ''zone-cooled'' and ''fully-cooled'' rather than ''solid-front'' and ''glass-front'', respectively. It asserted that the latter two demarcations overlap to some extent, and some important distinctions make zone-cooled and fully-cooled better classifications. (Public Meeting Transcript, No. 8 at p. 85) NAMA stated that during vending machine efficiency meetings with the Canadian Standards Association (CSA), the CSA's standards committee recommended ''zone-cooled'' and ''fully-cooled'' as the two classes of refrigerated beverage vending machines. (Public Meeting Transcript, No. 8 at p. 58) Dixie-Narco and Coca-Cola agreed that using these designations to define equipment classes has merit. (Public Meeting Transcript, No. 8 at pp. 63–64)

As stated earlier, DOE categorizes equipment classes based on different performance-related or utility-related factors that affect efficiency. PG&E stated that the efficiency of a machine depends on whether it is zone-cooled or fully-cooled. (Public Meeting Transcript, No. 8 at p. 62) Dixie-Narco stated that, all other things being equal, zone-cooled machines use less energy than fully-cooled machines because their refrigeration system is smaller. (Public Meeting Transcript, No. 8 at p. 103) PepsiCo expressed a similar opinion, adding that it would like to see standards based on energy use, rather than trying to define what the design of the machine should be. (Public Meeting Transcript, No. 8 at p. 103)

Based on public comments, DOE agrees that ''zone-cooled'' and ''fully-cooled'' are more appropriate descriptors for beverage vending machines that are solid-front and glass-front, respectively, and intends to use this terminology in this rulemaking.

In addition to whether a beverage vending machine is zone-cooled or fully-cooled, the ambient conditions that a machine operates in can also affect its energy efficiency. EEI and NFESC stated that there should be separate equipment classes for indoor-only and indoor/outdoor machines. (Public Meeting Transcript, No. 8 at p. 50 and NFESC, No. 15 at p. 4) Dixie-Narco commented that a classification is needed for the outdoor machines simply because of the large number of machines that Coca-Cola and PepsiCo own; some smaller operators may primarily have indoor locations, but no one should be excluded. (Public Meeting Transcript, No. 8 at p. 94) Coca-Cola stated that a distinction between indoor-only and indoor/outdoor machines has to do with weatherization and how they tolerate environmental effects. Specifically, Coca-Cola stated that indoor/outdoor machines are more weatherproof and designed to be less influenced by environmental effects, such as high humidity and direct contact with moisture. (Public Meeting Transcript, No. 8 at p. 55) Dixie-Narco commented that the primary differences between indoor-only and indoor/outdoor machines are vandalism-prevention features. (Public Meeting Transcript, No. 8 at p. 53)

Southern California Edison's Refrigeration and Thermal Test Center (RTTC) asked whether it would be appropriate to have a category for outdoor-only machines since there probably will be glass-front outdoor machines in the future. RTTC stated that the larger refrigeration system needed for an outdoor machine would not be the proper size for indoor conditions. (Public Meeting Transcript, No. 8 at p. 89) In contrast, Dixie-Narco stated that outdoor machines today can be used indoors and outdoors, but that classification is acceptable because the machine can be tested to the worst-case environment. According to Dixie-Narco, indoor-only machines are tested to the 75 °F/45 percent RH condition, so when an outdoor machine is tested indoors, lower energy use is measured because of the lower rating conditions. Dixie-Narco did not see any need to have additional specifications. (Public Meeting Transcript, No. 8 at p. 89) ACEEE summarized the discussion at the

Framework public meeting, stating it heard there should be an outdoor category with subcategories for zone-cooled and fully-cooled machines, and an indoor category without any subcategories. (Public Meeting Transcript, No. 8 at p. 94) ACEEE suggested three equipment classes based on the discussion at the Framework public meeting: (1) A zone-cooled machine tested at 90 °F; (2) a fully-cooled machine tested at 75 °F; and (3) a fully-cooled machine tested at 90 °F. (Public Meeting Transcript, No. 8 at p. 68).

Dixie-Narco stated that variable-speed compressors are increasingly being used in vending machines, and they adapt to the load indoors and outdoors. Moreover, Dixie-Narco argued that these compressors are no less efficient indoors, even if they are sized to operate outdoors. Dixie-Narco stated that in order to be able to meet ENERGY STAR Tier 2 levels and above, manufacturers will have to use variable speed compressor technology. (Public Meeting Transcript, No. 8 at p. 91) Dixie-Narco recommended consolidating into one rating condition so that both indoor and outdoor vending machines are tested at a standard of 75 °F/45 percent RH. (Dixie-Narco, No. 14 at p. 2).

Based on the public comments above and anecdotal information that few glass-front or fully-cooled machines (certified for indoor use only) are actually installed outdoors (because of safety and vandalism reasons) and very few other machines are certified for indoor use only, DOE now intends to designate the following two equipment classes of beverage vending machines for this rulemaking:

(a) Class A Machine (fully-cooled machines).

(b) Class B Machine (any beverage vending machine not considered to be Class A)

DOE recognizes that fully-cooled beverage vending machines virtually always have glass fronts, and DOE has designated these machines as ''Class A.'' DOE has designated as ''Class B'' any other beverage vending machine that cannot be considered Class A. DOE intends to use these two equipment classes rather than four as suggested in the Framework Document. DOE does not find it necessary to establish separate equipment classes for indoor machines and outdoor machines, because of the similarities between average indoor and outdoor operating conditions. Thus, DOE intends to use two equipment classes (Class A and Class B), as described in further detail below.

The ''Class A'' beverage vending machine equipment class is comprised of machines that cool the entire internal volume. Class A machines generally use ''shelf-style'' vending mechanisms and tend to utilize a transparent (glass or transparent polymer) front,. Because the next-to-be-vended product is visible to the consumer and any product can be selected by the consumer off of the shelf, all bottled or canned beverage containers are necessarily enclosed within the refrigerated volume.

The ''Class B'' beverage vending machine equipment class is generally composed of machines that have an opaque front (which provides better insulation from ambient conditions) and utilize a ''stack-style'' vending mechanism. These machines are usually installed either indoors or outdoors. The energy consumption of the outdoor machines varies with the varying ambient conditions. However, as stated earlier, the average energy consumption of these machines is very similar to that of machines installed indoors. Typically, though, unlike the Class A machines, only a fraction (or a zone) of the volumes of the Class B machines (usually the bottom third of the machine) is cooled. Hence, they are also sometimes referred to as ''zone-cooled'' machines.

3. Selection of Baseline Equipment—Use of the ENERGY STAR Criteria

Once DOE establishes equipment classes, it selects a baseline model as a reference point for each class, and measures changes resulting from energy conservation standards against the baseline. The baseline model in each equipment class represents the characteristics of equipment typical of that class (e.g., vendible capacity, physical size). Generally, a baseline model is one that just meets current energy conservation standards, or, if no standards are in place, the baseline is typically the most common or least efficient unit on the market. At present, there are no existing energy conservation standards for beverage vending machines covered under this rulemaking.

However, the U.S. Environmental Protection Agency (EPA) has developed voluntary energy performance criteria for beverage vending machines as part of the ENERGY STAR labeling program. ENERGY STAR has a two-tiered specification for refrigerated beverage machines. Tier 1 has been in effect for new machines since April 1, 2004, and for refurbished machines since April 31, 2006. The Tier 2 criteria went into effect on July 1, 2007 for all new machines.

Originally, the top 25 percent of beverage vending machines qualified for ENERGY STAR Tier 1. Now, however, some manufacturers are producing even more-efficient machines that qualify for Tier 2, and a majority of the machines being manufactured meet or exceed Tier 1 levels. However, there are some models currently in the market that are less efficient than the Tier 1 levels. In the Framework Document, DOE suggested setting the ENERGY STAR Tier 1 specification as the baseline efficiency level for all classes of beverage vending machines covered under this rulemaking. (More details regarding the specifications can be found in Chapter 3 of the TSD.)

ACEEE asserted that the ENERGY STAR Tier 1 specification can probably be considered the baseline for solid-front machines, but that for glass-front machines, the baseline may have to be slightly lower. (Public Meeting Transcript, No. 8 at p. 114) In contrast, Dixie-Narco stated that Tier 1 level would be a good baseline for glass-front machines. Dixie-Narco further commented that all of the glass-front machines that both of its competitors sell are ENERGY STAR qualified, and that it would be comfortable meeting those levels for its glass-front machines as well. (Public Meeting Transcript, No. 8 at p. 116) EEI and Royal Vendors agreed that Tier 1 would be an appropriate baseline level. (Public Meeting Transcript, No. 8 at p. 118; Royal, No. 11 at p. 3)

The Joint Comment agreed that models meeting the ENERGY STAR Tier 1 specification should be used as the baseline because more than 90 percent of indoor/outdoor beverage vending machines meet this specification, and a large and growing volume of indoor-only machines meet this specification as well. The Joint Comment added that in the next two years, it is expected that nearly all indoor-only machines will meet this specification, because of the trend for beverage companies to only want to purchase ENERGY STAR-qualified equipment. (Joint Comment, No. 13 at p. 3) Moreover, PepsiCo stated that it requires the manufacturers with which it contracts to build new machines to meet the California Energy Commission standard, which is the same as the ENERGY STAR Tier 1 requirement. (Public Meeting Transcript, No. 8 at p. 265) Coca-Cola stated that it has mandated that all Coca-Cola vending machines are to use half as much energy by 2010 as in 2000, adding that this reduction would certainly meet ENERGY STAR Tier 1 qualifications.

USA Technologies noted that there are three primary manufacturers in the industry and that each makes three primary models. According to USA Technologies, these nine models probably represent more than 90 percent of the beverage vending machines purchased each year. Thus, USA Technologies commented that by considering the energy consumption of these models and the number of units purchased over the last five years, the baseline model would be clear. (Public Meeting Transcript, No. 8 at p. 115)

Based on stakeholder feedback and current market trends, DOE expects that in the absence of new standards, most, if not all, new machines will meet the ENERGY STAR Tier 1 level by 2012. Therefore, DOE is using ENERGY STAR Tier 1 as the baseline efficiency level since it roughly represents the least-efficient equipment likely to be sold in 2012.

4. Normalization Metric

For both residential and commercial refrigerators, EPCA and DOE implementing regulations set standards for each of several classes. These classes, for the most part, are not defined by size, but are instead based upon their design configurations and whether rated for indoor or outdoor use; therefore, these classes include equipment of varying sizes. Because a refrigerator's energy use is a function of its size, the standard for each class incorporated a formula which, in effect, prescribes a maximum amount of energy use that varies by size of equipment within that class. (10 CFR 430.32(a) and 10 CFR 431.66) A key factor in each such formula is a ''normalization metric,'' which represents equipment size (e.g., refrigerated volume) and allows the maximum allowed energy use to vary by the size of the equipment. DOE is using the same approach in developing standards in this beverage vending machine rulemaking.

In the Framework Document, however, DOE set forth the currently used industry metric of vendible capacity (i.e., number of cans) of a beverage vending machine as well as the refrigerated volume metric as is being used in commercial refrigerators. During the Framework public meeting, DOE asked for comment on which of these normalization metrics would be most appropriate for the beverage vending machines in this rulemaking.

In response, Coca-Cola stated that for the current test metric (i.e., vendible capacity), the DOE test procedure does not reflect the current state of the beverage vending machine industry. (Public Meeting Transcript, No. 8 at p. 69) Dixie-Narco, Crane Merchandising Systems, Coca-Cola, and PepsiCo all agreed that refrigerated volume would provide the best normalization metric for beverage vending machines. (Public Meeting Transcript, No. 8 at pp. 86–125) Dixie-Narco then asked whether industry consensus standards (e.g., AHAM standards) exist for measuring refrigerated volume in refrigerators that could be adapted for use in assessing beverage vending machines. (Public Meeting Transcript, No. 8 at p. 87) At the meeting, DOE responded that the test procedures in ANSI/AHAM HRF–1–2004, may be relevant and is currently in use for residential refrigerators.

Dixie-Narco stated that a method to measure refrigerated volume must be determined. Dixie-Narco stated that the industry must examine residential and commercial refrigeration equipment and try to develop an agreed-upon method of measuring the refrigerated volume of vending machines. Dixie-Narco stated that once this is done, it will have energy-consumption data it can provide to DOE for analysis. (Public Meeting Transcript, No. 8 at p. 134) Royal Vendors stated that California just published new energy standards,[20] and that California will require manufacturers to measure and report the refrigerated volume of all vending machines according to the AHAM 1974 volume calculation (i.e., ANSI/AHAM HRF–1–1979). Therefore, Royal Vendors stated that manufacturers will be measuring refrigerated volumes for their machines, and it will be public information. (Public Meeting Transcript, No. 8 at p. 135)

Based on the public comments and the recently published California standards which use refrigerated volume for all vending machines, DOE decided to use refrigerated volume as the normalization metric for measuring daily energy consumption for all equipment classes of beverage vending machines. DOE will collect industry data to develop a translation from vendible capacity to refrigerated volume.

5. Scope and Coverage of Equipment

a. Combination Machines

At the Framework public meeting, stakeholders raised a number of questions regarding what types of beverage vending machines would be covered in the present rulemaking. Whirlpool asked whether this rulemaking will cover beverage vending machines that have separate sections for refrigerated and non-refrigerated beverages. (Public Meeting Transcript, No. 8 at p. 45) Dixie-Narco and Crane Merchandising Systems also expressed concern about zone-cooled machines that contain different products in different sections held at different temperatures. These stakeholders suggested that this may cause confusion and may raise questions about the definition of ''zone cooled.'' (Public Meeting Transcript, No. 8 at p. 104)

EEI stated that the types and quantities of products sold in refrigerated vending machines are changing and will have an impact on energy use, which may result in confusion about what this rulemaking covers. EEI suggested that, based on stakeholder feedback, this rulemaking should cover all machines that have at least 50–75 percent of their capacity dedicated to refrigerated, packaged beverages. (EEI, No. 12 at p. 2) EEI also suggested that DOE consider a definition for a ''refrigerated product machine'' to cover machines that sell food along with beverages. EEI noted that if more machines sell both food and beverages, and DOE does not cover this equipment in this rulemaking, there could be a loophole for manufacturers to produce machines that do not meet the standard if there is at least one food (or other non-beverage) item for sale in the equipment. (EEI, No. 12 at p. 3) PG&E asked if DOE could benefit from the California designations of multi-package equipment and non-multi-package equipment[21] when considering what beverage vending machines will be included in this rulemaking. (Public Meeting Transcript, No. 8 at p. 62)

EPCA does not explicitly address ''combination machines'' (i.e., vending machines that dispense cooled beverages as well as other beverages and food items). As discussed above, EPCA directs DOE to set standards for vending machines that cool bottled or canned beverages and dispense them upon payment. (42 U.S.C. 6291(40) and 6295(v)) DOE believes that the language used to define beverage vending machines is broad enough to include any vending machine, as long as some portion of that machine cools bottled or canned beverages and dispenses them upon payment. For this rulemaking, DOE interprets these provisions to cover any vending machine that can dispense at least one type of refrigerated bottled or canned beverage, regardless of the

[20] California Energy Commission, Title 20, 2007 Appliance Efficiency Regulations.

[21] The California Energy Commission defines a ''refrigerated multi-package beverage vending machine'' as a refrigerated beverage vending machine that is able to display and dispense at least 20 discrete types of beverages. (California Energy Commission, Title 20, 2007 Appliance Efficiency Regulations).

other types of vended products (some of which may not be refrigerated).

b. Refurbished Equipment

At the Framework public meeting, PepsiCo also asked whether the new standards would apply to refurbished and remanufactured equipment. (Public Meeting Transcript, No. 8 at p. 230) USA Technologies indicated that, to establish meaningful regulations, DOE must consider the existing machines that are remanufactured or refurbished, as well as new machines. (Public Meeting Transcript, No. 8 at p. 22)

In response to the possibility that DOE could use ENERGY STAR criteria when defining energy standards for beverage vending machines, stakeholders commented on how this would affect their equipment that is currently on the market. Dixie-Narco stated they make some vending machines that do not meet ENERGY STAR criteria, but these machines could be modified to achieve them. (Public Meeting Transcript, No. 8 at p. 131) Royal Vendors volunteered that it also has a model series that does not meet ENERGY STAR criteria because of the loading configuration of the machines, but the series has very low sales. (Public Meeting Transcript, No. 8 at p. 131) PepsiCo stated that a very small percentage of its machines built before 2004 meet ENERGY STAR Tier 1 criteria, but that it would be very expensive to upgrade these machines. (Public Meeting Transcript, No. 8 at p. 245)

DOE has carefully considered its authority to establish energy conservation standards for rebuilt and refurbished beverage vending machines in light of these comments, and as discussed below, has tentatively concluded that its authority does not extend to rebuilt and refurbished equipment. The relevant statutory provisions are discussed below, as well as the agency's rationale in reaching this conclusion.

Section 332 of EPCA provides that it shall be unlawful for any manufacturer or private labeler to distribute in commerce any new covered equipment which is not in conformity with an applicable energy conservation standard. (42 U.S.C. 6302(a)(5) and 6316(a)–(b) (emphasis added)) [22] Congress made section 332 applicable to beverage vending machines because an applicable energy conservations standard is prescribed for that equipment under section 325(v) of EPCA. (42 U.S.C. 6295(v)) Section 332(b) defines ''new covered product'' to mean ''a covered product the title of which has not passed to a purchaser who buys such a product for purposes other than (1) reselling such product, or (2) leasing such product for a period in excess of one year.'' (42 U.S.C. 6302(b)) That is, a new covered product is one for which the title has not passed to a customer.[23]

DOE believes that the definition of ''new covered product'' in section 332 is ambiguous on the question of whether a rebuilt or refurbished beverage vending machine is subject to DOE's authority to set energy conservation standards. On this point, DOE notes that section 332 does not expressly provide that ''new covered product'' means new equipment the title of which is transferred by the original manufacturer to an original owner. Conversely, the definition of ''new covered product'' does not expressly exclude substantially remanufactured equipment that is subsequently resold (i.e., equipment sold or disposed of by the original owner that is rebuilt or refurbished by an entity which resells it to another person). In order to resolve this ambiguity regarding DOE's authority to regulate rebuilt and refurbished beverage vending machines, DOE considered both congressional intent and the nature of the existing beverage vending machine market.

There is no legislative history that reflects Congress's intent. However, DOE views the way Congress chose to define ''new covered product'' in EPCA as the strongest indicator that the term was not intended to apply to rebuilt or refurbished equipment. Specifically, it is unlikely that Congress would have made transfer of ''title'' the test of whether equipment was ''new'' if it intended to cover rebuilt or refurbished equipment. The most reasonable interpretation of the statutory definition is that Congress intended that this provision apply to newly manufactured equipment the title of which has not passed for the first time to a purchaser of the equipment. Such interpretation provides certainty and clarity for the regulated entities subject to these statutory provisions.

In addition, if DOE were to interpret ''new covered product'' as applying to other than *newly* manufactured equipment, EPCA's testing and labeling provisions would be much harder to implement and enforce. Identifying ''manufacturers'' under such an interpretation likely would be difficult,[24] and it also likely would be difficult for DOE to distinguish between rebuilt equipment that is not covered and equipment that has been so extensively rebuilt as to be considered ''new,'' and therefore, subject to these provisions.

DOE understands the concern of some stakeholders that there is a possibility that the energy conservation standards for beverage vending machines could be circumvented if remanufactured machines are not deemed to be ''new covered products.'' DOE understands that the rebuilt and refurbished beverage vending machine market is comprised of either: (1) Equipment sold by the original manufacturer or private labeler, which after purchase by a commercial customer, is then modified and resold by another party; or (2) equipment that, following purchase by a commercial customer, is modified and retained by that customer. However, for the above-stated reasons, DOE has concluded that rebuilt and refurbished beverage vending machines are not ''new covered products'' under EPCA, and therefore, are not subject to DOE's energy conservation standards or test procedures.[25] With respect to the first scenario, upon transfer of the title of the beverage vending machine to the commercial customer, the beverage vending machine is no longer new covered equipment, and therefore, it is not subject to DOE regulations even if it is subsequently resold. Similarly, with respect to beverage vending machines that are refurbished or rebuilt for or by the commercial customer (i.e., they are not resold), DOE lacks authority over those beverage vending machines because they are neither ''new'' covered equipment nor distributed in commerce. Furthermore, if refurbished or rebuilt beverage vending machines that are sold

[22] DOE only regulates equipment that is either specifically enumerated as ''covered products'' or is equipment for which DOE has been granted authority to regulate in another statutory provision. Section 325 of EPCA (42 U.S.C. 6295) grants DOE authority to regulate beverage vending machines, without including the specific language designating them as ''covered products.'' The failure to include the words ''covered product'' in Section 325 of EPCA or to include beverage vending machines in Section 322 of EPCA, which lists the covered products in Part A, does not mean that beverage vending machines will not be treated as ''covered products'' for purposes of DOE exercising its regulatory authority.

[23] In the context of this discussion, the term ''customer'' is used to identify equipment's end user; e.g., ''customer'' does not include a party that takes title of equipment solely for the purpose of resale or for leasing equipment for less than a year.

[24] For example, a business that rebuilds or remanufactures equipment, instead of reselling it and transferring title, could operate as a repair facility for consumers who already own the used equipment. The business would simply rebuild the equipment for a fee and return it to the owner; there would be no transfer of title.

[25] DOE notes that *de minimis* use of used or recycled parts would not make a ''new product'' into a used product.

to another party were covered but not those that are refurbished or rebuilt for the commercial customer, DOE believes this would likely create an inequity that Congress would not have intended since a purpose of EPCA was to establish a single national standard, not multiple standards for the same equipment.

Throughout the history of the energy conservation standards program, DOE has not regulated used consumer products or commercial equipment that has been refurbished, rebuilt, or undergone major repairs, since EPCA only covers new covered equipment distributed in commerce. For all of these reasons, DOE concludes that rebuilt or refurbished beverage vending machines are not new covered equipment under EPCA and, therefore, are not subject to DOE's energy conservation standards or test procedures.

6. Market Assessment

In the market assessment, DOE develops a qualitative and quantitative characterization of the beverage vending machine industry and market structure based on publicly-available information and information submitted by manufacturers and other stakeholders.

Three major beverage vending machines manufacturers hold the vast majority (about 75 percent) of the domestic market share:

• Crane Merchandising/Dixie-Narco, Inc.[26]
• Royal Vendors, Inc.
• Sanden-Vendo America

Several other manufacturers also produce beverage vending machines for the domestic market, including:

• Automatic Merchandising Systems (AMS)
• Distributed Vending Company
• Jofemar USA
• Seaga Manufacturing, Inc.
• The Wittern Group

PepsiCo and Coca-Cola are, by far, the largest customers of beverage vending machines. They do not manufacture beverage vending machines. Instead, they contract with manufacturers that produce equipment with specific design characteristics.

DOE is considering the possibility that small businesses would be particularly affected by the promulgation of energy conservation standards for beverage vending machines. The Small Business Administration (SBA) lists small business size standards for this industry as they are described in the North American Industry Classification System (NAICS) code 333311, *Automated Vending Machine Manufacturing*. The size standard for an industry sets the largest average annual receipts or average number of employees that a for-profit concern can have and still qualify as a small business for Federal Government programs. SBA defines small business manufacturing enterprises for beverage vending machines as having 500 employees or fewer. DOE identified six small business manufacturers in the beverage vending machine industry. DOE will study the potential impacts on these small businesses in detail during the manufacturer impact analysis, which will be conducted as part of the NOPR analysis. See Chapter 3 of the TSD for more information regarding small business manufacturers of beverage vending machines.

DOE recognizes that smaller manufacturers, niche manufacturers, and manufacturers exhibiting a cost structure that differs substantially from the industry average may be differentially affected by the imposition of standards. NAMA stated that it could provide a list of manufacturers along with associated contact information that could be useful for DOE's research. (Public Meeting Transcript, No. 8 at p. 76) DOE is using NAMA's information on manufacturers and contacts to define subgroups of smaller manufacturers. DOE will use this information to analyze how standards enacted by this rulemaking affect smaller manufacturers.

In the Framework Document, DOE requested suggestions for obtaining historical energy usage and equipment shipping information. NAMA stated that shipment data are now privately held and are not reported to NAMA or the Census Bureau. NAMA noted that DOE will have to request historical shipment information directly from manufacturers. (Public Meeting Transcript, No. 8 at p. 75) Dixie-Narco stated that it would provide historical shipment information if asked, but requested the data remain confidential. Dixie-Narco added that obtaining energy-usage information back to 1990 would be difficult, if not impossible, because such information was not recorded by manufacturers at that time. (Public Meeting Transcript, No. 8 at p. 76)

PepsiCo and Coca-Cola recommended that DOE request historical shipment and energy-usage data from EPA and State organizations. (Public Meeting Transcript, No. 8 at pp. 78–82) PepsiCo urged all manufacturers to provide NAMA with all available historical shipment and energy-usage data for aggregation. (Public Meeting Transcript, No. 8 at p. 79)

NAMA stated that it collected some aggregated historical shipment and energy-usage data for the ENERGY STAR program. (Public Meeting Transcript, No. 8 at p. 83) EPA stated that it is creating a summary report for the 2005 shipment information from NAMA and will at least include the shipments of ENERGY STAR-qualified models and an estimate of market penetration. EPA also suggested that, depending on how high market penetration is, shipment of ENERGY STAR-qualified models could serve as a proxy for determining the makeup of the overall market, although the data would not be manufacturer-specific. (Public Meeting Transcript, No. 8 at p. 83) Dixie-Narco stated that EPA has the company's shipment data for 2005, but it did not collect data before 2005. (Dixie-Narco, No. 14 at p. 2) ACEEE summarized that there seem to be two paths for collection and aggregation of historical shipment and energy-usage data: (1) By NAMA, or (2) by a DOE contractor. (Public Meeting Transcript, No. 8 at p. 82)

Dixie-Narco stated at the Framework public meeting that it will try to provide data on its forthcoming models, keeping in mind that ENERGY STAR Tier 2 will take effect in July 2007. Dixie-Narco added that it estimates 80 percent of installed machines will exceed ENERGY STAR Tier 1 levels by 2012. (Public Meeting Transcript, No. 8 at p. 246) Royal Vendors stated that it will cooperate with NAMA to develop equipment shipment data on an industry basis. Royal Vendors noted, however, that trends may be difficult to decipher. (Royal, No. 11 at p. 2)

EEI stated that according to public meeting participants, ''stack-style'' machines were 90 percent of the market and glass-front machines were 10 percent of the market in 2001. However, stack-style and glass-front machines were each 50 percent of the market in 2006. EEI noted that if market shares continue changing in this direction, baseline energy-usage and energy-efficiency upgrade possibilities could be affected. (EEI, No. 12 at p. 3)

In summary, it is evident that NAMA does not have the historical shipment and energy-usage data necessary to determine efficiency trends in the industry. Therefore, DOE will contact ENERGY STAR program staff and State organizations and use their websites and various industry reports to obtain historical shipment and energy-usage data.

[26] Crane Merchandising purchased Dixie-Narco, Inc. on October 23, 2006, after the Framework public meeting was held.

7. Technology Assessment

In the technology assessment, DOE identifies technologies and design options that could improve the efficiency of beverage vending machines. This assessment provides the technical background and structure on which DOE bases its screening and engineering analyses. For beverage vending machines, DOE based its list of technologically-feasible design options on input from manufacturers, industry experts, component suppliers, trade publications, and technical papers. See Chapter 3 of the TSD for additional detail on the technology assessment and technologies analyzed. However, the following discussion provides an overview of the salient aspects of the technology assessment, including issues on which DOE seeks public comment.

In the Framework Document, DOE identified and sought feedback on the applicable technologies and designs which have the potential to improve the energy efficiency of the identified equipment classes. A detailed discussion of these technologies and design options is given in Chapter 3 of the TSD. In response, Dixie-Narco asserted that certain technology options on DOE's list are not compatible with each other. (Public Meeting Transcript, No. 8 at p. 155) Furthermore, EEI commented that several of the technologies may already be incorporated into the baseline units being manufactured and installed in the United States. (EEI, No. 12 at p. 4)

Several stakeholders addressed other means for reducing the energy use of beverage vending machines, offering both general and specific suggestions. Specifically, Royal Vendors stated that the important systems and components which may impact the energy efficiency of a beverage vending machine are the sealed cooling unit, evaporator/circulating fan, lighting, insulation, and door-sealing systems. It noted that ENERGY STAR Tier 1 qualified machines include an effective combination of these systems with a focus on lighting, compressor efficiency, and efficient evaporator/circulating fan motor impellers. To improve the energy efficiency of beverage vending machines, Royal Vendors suggested adding T8 lamps with electronic ballasts, low-ballast-factor ballasts, electronically-commutated fan motors with engineered impeller and venturi rings, and capillary tube systems with liquid-suction heat exchangers. Royal Vendors also stated that anti-sweat heaters are no longer in use and can be removed from the list of technologies considered. (Royal, No. 11 at p. 3)

On this issue, Coca-Cola stated that the manufacturers which supply the company with beverage vending machines have already discontinued use of capillary tube expansion devices (which consume more energy) and are starting to instead use more-efficient thermostatic and electronic expansion valves. Coca-Cola stated that some manufacturers are researching other technologies such as Stirling refrigeration, which uses temperature differential to provide electrical power. (Public Meeting Transcript, No. 8 at p. 92) EEI and ACEEE agreed that ballasts using dimming technology should be considered a technology option as a means of decreasing the energy consumption associated with beverage vending machine lighting. (Public Meeting Transcript, No. 8 at p. 92; Joint Comment, No. 13 at p. 3) EEI added that DOE may want to investigate other lighting technologies such as T5 fluorescent lamps and dimmable light emitting diode (LED) systems. (EEI, No. 12 at p. 4) PG&E expressed a similar opinion that there are many opportunities to save energy in lighting beverage vending machines. PG&E also suggested considering additional fan motor technologies. (Public Meeting Transcript, No. 8 at p. 172) USA Technologies stated that the technology options list should also include energy-management systems, which restrict the energy use of equipment in a room when it is not occupied. (Public Meeting Transcript, No. 8 at p. 149).

DOE is addressing all the technology options suggested and welcomes further public comment on this issue. See the screening analysis portion of this ANOPR and Chapter 3 of the TSD for more details on these technology options.

B. Screening Analysis

The purpose of the screening analysis is to evaluate the technology options identified as having the potential to improve the efficiency of equipment, in order to determine which technologies to consider further and which to screen out. DOE consulted with industry, technical experts, and other interested parties to develop a list of technologies for consideration. DOE then applied the following four screening criteria to determine which technologies are unsuitable for further consideration in the rulemaking:

(1) *Technological Feasibility.* Technologies incorporated in commercial equipment or in working prototypes will be considered 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 of the effective date of the standard, then that technology will be considered practicable to manufacture, install, and service.

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

(4) *Adverse Impacts on Health or Safety.* If it is determined that a technology will have significant adverse impacts on health or safety, it will not be considered further.

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

1. Technology Options Screened Out

In the market and technology assessment (Chapter 3 of the TSD), DOE developed an initial list of technologies expected to have the potential to reduce the energy consumption of beverage vending machines. In the screening analysis, DOE screened out technologies based on four criteria discussed above (i.e., technological feasibility, practicability to manufacture, changes to equipment utility, and safety). The list of remaining technologies becomes one of the key inputs to the engineering analysis (discussed subsequently). For reasons explained below, DOE screened out a number of technologies (which were not input into the energy consumption model), including higher-efficiency evaporator and condenser fan blades, low-pressure differential evaporators, and defrost mechanisms.

Higher-efficiency evaporator and condenser fan blades reduce motor shaft power requirements by moving air more efficiently. Current beverage vending machine designs use stamped sheet metal or plastic axial fan blades. These fan blades are lightweight and inexpensive. DOE was not able to identify any axial fan blade technology that is significantly more efficient than that which is currently in use, but it did identify and consider one alternative fan blade technology that could potentially improve efficiency—tangential fan blades. Tangential fan blades can produce a wide, even airflow, and have the potential to allow for increased saturated evaporator temperature (SET) through improved air distribution across the evaporator coil, which would reduce compressor power. However, tangential fan blades are less efficient at moving air, and, thus, require greater motor shaft power. Because of these competing effects, the use of tangential fan blades would not be expected to improve energy efficiency, so DOE did not consider tangential fan blades as a design option.

Low-pressure differential evaporators reduce energy consumption by reducing the power level required of evaporator fan motors. However, in space-constrained equipment such as beverage vending machines, this reduction usually comes from a decrease in evaporator coil surface area, which generally requires a lower SET to achieve the same discharge air temperature and cooling potential. This, in turn, results in a reduction in compressor efficiency. Because of these competing effects, the use of low-pressure differential evaporators would not be expected to improve energy efficiency, so DOE did not consider low-pressure differential evaporators as a design option.

Defrosting for beverage vending machines is typically accomplished with off-cycle defrost (which uses no energy and decreases compressor on-time), although DOE understands that this function also may be accomplished with electric resistance heating. Because the vast majority of machines already use off-cycle defrost (a typical feature in baseline equipment), DOE has determined that there is currently no defrost design option capable of more effectively reducing defrost energy consumption for equipment that uses off-cycle defrost. For these reasons, DOE did not consider off-cycle defrost as a design option for achieving further improvements in energy efficiency.

DOE eliminated four other technologies considered in the market and technology assessment—thermoacoustic refrigeration, magnetic refrigeration, electro-hydrodynamic heat exchangers, and copper rotor motors—because all four are currently in the research stage, and DOE believes that they would not be practicable to manufacture, install, and service on the scale necessary to serve the relevant market at the time of the effective date of the standard (i.e., 2012). Because these technologies are in the research stage, DOE also cannot assess whether they would have any adverse impacts on utility to significant subgroups of consumers, would result in the unavailability of any types of equipment, or would present any significant adverse impacts on health or safety. Therefore, DOE will not consider these technologies as design options for improving the energy efficiency of beverage vending machines.

2. Technology Options Considered Further in Analysis

After screening out technologies in accordance with the provisions set forth in 10 CFR Part 430, Subpart C, Appendix A, (4)(a)(4) and (5)(b), DOE is considering the following nine technologies, or ''design options,'' as viable means of improving energy efficiency of the beverage vending machines covered under this ANOPR. The market and technology assessment (TSD Chapter 3) provides a detailed description of these design options. These design options will be considered by DOE in the engineering analysis:

- More-efficient lighting and ballasts.
- More-efficient evaporator fan motors.
- Evaporator fan motor controllers.
- Improved evaporator design.
- Insulation increases or improvements.
- Improved glass pack (for Class A machines).
- Higher efficiency condenser fan motors.
- Improved condenser design.
- More-efficient compressors.

In the Framework Document, DOE stated that to the greatest extent possible, it would base its engineering analysis on commercially-available equipment which incorporates one or more of the design options listed above. In this way, DOE is better able to apply these features in a manner consistent with real world applications. DOE stated that it would consider a proprietary design in the subsequent analyses only if it is not a unique path to a given efficiency level.

Several stakeholders provided comments on the issue of proprietary technologies in the context of the beverage vending machine rulemaking. NFESC responded that DOE should consider whether efficiency levels attainable only through proprietary technologies can be made part of the efficiency standard if that technology were to be made available through licensing agreements at a reasonable cost. (NFESC, No. 15 at p. 6) USA Technologies stated that its products are patented, but available to anyone in the industry anywhere in the world. (Public Meeting Transcript, No. 8 at p. 182) USA Technologies also noted that it has a proprietary patented design that will take many of the ENERGY STAR Tier 1 machines to Tier 2 levels and make some Tier 2 machines even more efficient. USA Technologies added that there is technology in the market today capable of driving energy costs down at a very reasonable cost to the manufacturer. USA Technologies urged DOE not to exclude these proprietary technologies from the analysis, although it also acknowledged that the market should remain competitive. (Public Meeting Transcript, No. 8 at p. 176).

PepsiCo agreed with DOE's approach, claiming that certain proprietary technologies should be excluded. PepsiCo cited the example of how Coca-Cola has patented several energy management technologies that are not available to PepsiCo. (Public Meeting Transcript, No. 8 at p. 181) Dixie-Narco stated that proprietary designs that include add-on or non-permanent energy management devices not installed by the manufacturer must be excluded from consideration in this rulemaking, since the manufacturer is ultimately responsible for all technologies incorporated in beverage vending machines. (Dixie-Narco, No. 14 at p. 4)

As noted previously, DOE will consider all proprietary designs unless they are the only way to reach a given efficiency level, in which case they will be rejected from further analysis. With regard to proprietary add-on energy management devices, DOE has not considered these devices as design options because they are external to the vending machine and/or are not installed by the manufacturer. DOE is sensitive to stakeholder concerns regarding proprietary designs and will make provisions to maintain the confidentiality of any proprietary data stakeholders submit. This information will provide input to the competitive impact assessment and other economic analyses.

For more details on how DOE developed the technology options and the process for screening these options and the design options that DOE is considering, see the market and technology assessment (Chapter 3 of the TSD) and the screening analysis (Chapter 4 of the TSD).

C. Engineering Analysis

The purpose of the engineering analysis is to establish the relationship between the cost and efficiency of beverage vending machines. For each equipment class, this relationship estimates the baseline manufacturer cost, as well as the incremental cost for equipment at efficiency levels above the baseline. In determining the performance of higher-efficiency equipment, DOE considers technologies and design option combinations not eliminated by the screening analysis. The output of the engineering analysis is a set of cost-efficiency ''curves'' that are used in downstream analyses (i.e., the LCC and PBP analyses and the NIA).

DOE typically structures its engineering analysis around one of three methodologies: (1) The design-option approach, which calculates the incremental costs of adding specific design options to a baseline model; (2) the efficiency-level approach, which calculates the relative costs of achieving increases in energy efficiency levels; and (3) the reverse-engineering or cost-assessment approach, which involves a ''bottoms-up'' manufacturing cost assessment based on a detailed bill of materials derived from beverage vending machine tear-downs.

1. Approach

In this rulemaking, DOE is adopting a design-option approach, which calculates the incremental costs of adding specific design options to a baseline model. For each equipment class, DOE analyzed three machines of different sizes to assess how energy use varies with size. A small, a medium, and a large machine were chosen for Class A and Class B beverage vending machines, based on current market offerings. See Chapter 3 of the TSD for a detailed description of the Class A and Class B equipment classes and Chapter 5 of the TSD for additional detail on the different machines analyzed.

In the Framework Document, DOE requested feedback on possible use of an efficiency-level approach supported, as needed, by a design-option approach to determine the cost-efficiency relationship for beverage vending machines. DOE stated that it plans to create an industry-wide analysis based primarily on data from stakeholders. The data are intended to represent the average incremental production cost to improve a baseline model to a specified efficiency level. This methodology constitutes an efficiency-level approach to the engineering analysis because it establishes the relationship between manufacturer cost and increased efficiency at predetermined efficiency levels above the baseline. Under this approach, manufacturers typically provide incremental manufacturer cost data for incremental increases in efficiency. Although DOE specifically requested this information from the industry, no such information was provided.

Since an efficiency-level approach was not possible for beverage vending machines, DOE instead decided to use cost estimates of specific design options. This methodology constitutes a design-options approach because it uses individual or combinations of design options to identify increases in efficiency. Under this approach, estimates are based on manufacturer or component supplier data or derived from engineering computer simulation models. Individual design options or combinations of design options are added to the baseline model in ascending order of cost. This approach also involves consultation with outside experts and/or further review of publicly available cost and performance information.

The Joint Comment stated that using manufacturer-supplied efficiency levels that have been checked against design options derived by DOE was acceptable if DOE verified a sufficient number of efficiency improvements with design option data to provide confidence in DOE's overall estimates. The Joint Comment added that for a robust approach, DOE must compare multiple points per equipment class and do additional analysis if the design option and efficiency level data are not in alignment. (Joint Comment, No. 13 at p. 1) The Joint Comment stated that DOE should explore methods of making the detailed manufacturer cost data publicly available, although it recognized that this task would be difficult given DOE's need to strike a balance between manufacturers' requirements for confidentiality and the public's need for transparency in government decision making. In making this request, the Joint Comment explained that manufacturer cost estimates are a ''black box'' for other stakeholders, and making the data submitted by manufacturers publicly available could greatly improve the transparency of the process. (Joint Comment, No. 13 at p. 2)

As explained above, an efficiency-level approach was not possible, so DOE relied solely on a design-option approach in the engineering analysis. Given that there were no manufacturer-provided cost-efficiency curves, DOE was not able to compare the two approaches as suggested by the Joint Comment. However, the design-option approach allows advocates, manufacturers, and other stakeholders the opportunity to review DOE's methodology and assumptions, including cost estimates, as this information is made publicly available through the ANOPR TSD and engineering spreadsheet. Through consultation with outside experts, review of publicly-available cost and performance information, and modeling of equipment cost and energy consumption, DOE believes it has conducted a robust engineering analysis. Chapter 5 of the TSD describes the methodology used to perform the design-option analysis in detail.

2. Equipment Classes Analyzed

Beverage vending machines can be divided into different equipment classes categorized by physical characteristics that affect equipment efficiency. Most of these characteristics affect the merchandise that the equipment cools and vends, and how the customer accesses that merchandise. Key physical characteristics are the door type (e.g., glass-front or solid-front) and the machine's vendible capacity (or refrigerated volume). As described in Section II.A.2, DOE analyzed two equipment classes: Class A (fully-cooled machines) and Class B (all other machines). Furthermore, as discussed above, beverage vending machine energy use varies with volume, so DOE analyzed three different machine sizes for each equipment class to assess how energy use varies with size.

3. Analytical Models

In the design-option approach, DOE used models to develop cost and energy consumption estimates for each equipment class at each efficiency level. DOE used a cost model to estimate the manufacturer production cost (MPC) in dollars, and an energy consumption model to estimate the daily energy consumption in kilowatt hours (kWh) of covered beverage vending machines. Each of these models is discussed in further detail below.

a. Cost Model

DOE used a cost model to estimate the core case cost (i.e., the MPC of the structure, walls, doors, shelving and fascia of the case, but does not include the cost of any energy-using components) of beverage vending machines. This model was adapted from a cost model developed for DOE's rulemaking on commercial refrigeration equipment.[27] The approach for commercial refrigeration equipment involved disassembling a self-contained refrigerator, analyzing the materials and manufacturing processes for each component, and developing a parametric spreadsheet to model the cost to fabricate (or purchase) each component and the cost of assembly. Because of the similarities in manufacturing processes between self-contained commercial refrigeration equipment and vending machines, DOE

[27] See *http://www.eere.energy.gov/buildings/appliance_standards/commercial/refrigeration_equipment.html* for further detail on and validation of the commercial refrigeration equipment cost model.

was able to adapt the commercial refrigeration equipment cost model for beverage vending machines by maintaining many of the assumptions about materials and manufacturing processes but modifying the dimensions and types of components to be specific to beverage vending machines. To confirm the accuracy of the cost model, DOE obtained input from stakeholders on beverage vending machine production cost estimates and on other assumptions used in the model. DOE believes this approach is acceptable, given the similarities in materials and manufacturing processes between commercial refrigeration equipment and beverage vending machines. Chapter 5 of the TSD provides details of the cost model.

In the Framework Document, DOE sought feedback from manufacturers on incremental manufacturing costs and components in terms of design options to improve energy efficiency. The Joint Comment stated that the cost estimates should assume mass production, since efficiency standards could make today's expensive niche products tomorrow's lower-cost commodity products. (Joint Comment, No. 13 at p. 2)

The Joint Comment stated that DOE should account for market forces in computing typical costs using manufacturer cost estimates. Based on past experience, the Joint Comment explained that the various cost estimates that DOE will collect from manufacturers can vary significantly from manufacturer to manufacturer. Also, manufacturers with below-average costs will determine market prices, because higher-priced manufacturers will need to reduce costs to remain competitive. Therefore, the Joint Comment recommended that DOE should use the simple average of the market-share-weighted average cost estimate and the lowest cost estimate. (Joint Comment, No. 13 at p. 2)

EEI mentioned that the increasing cost of commodities such as steel, copper, aluminum, and plastic may affect this rulemaking. EEI stated that commodity prices for plastics, for example, have risen dramatically in the past few years because of the increase in oil prices. However, EEI also noted that high prices may dictate redesigns to avoid using those materials. (Public Meeting Transcript, No. 8 at p. 181 and EEI, No. 12 at p. 5) PG&E stated that just as the prices of raw materials have gone up, so have the prices of primary energy. (Public Meeting Transcript, No. 8 at p. 183)

In response to these comments, DOE conducted a sensitivity analysis on material prices similar to the analysis presented in the commercial refrigeration equipment rulemaking. DOE determined the cost of raw materials by using prices for copper, steel, and aluminum from the American Metals Market.[28] Prices for rifled and unrifled copper tubing were obtained directly from a tubing manufacturer. Because metal prices have fluctuated drastically over the last few years, DOE used metal prices that reflect a five-year average of the Bureau of Labor Statistics Producer Price Indices (PPIs)[29] from 2002 to 2006 with an adjustment to 2006$. DOE used the PPIs for copper rolling, drawing, and extruding, and steel mill products, and DOE made the adjustments to 2006$ using the gross domestic product implicit price deflator. Because it is not clear if these material price trends will continue, DOE conducted a sensitivity analysis to illustrate the effect of raw material price variability on the cost of beverage vending machines. See Chapter 5 of the TSD for more details on this sensitivity analysis.

DOE applied a manufacturer markup to the MPC estimates to arrive at the MSP. MSP is the price of equipment sold at which the manufacturer can recover both production and non-production costs and earn a profit. DOE developed a market-share-weighted average industry markup by examining gross margin information from the annual reports of several major beverage vending machine manufacturers and Securities and Exchange Commission (SEC) 10–K reports.[30] The manufacturers whose gross margin information DOE examined represent approximately 70 percent of the beverage vending machine market, and each of these companies is a subsidiary of a more diversified parent company that manufactures equipment other than beverage vending machines. Because the SEC 10–K reports do not provide gross margin information at the subsidiary level, the estimated markups represent the average markups that the parent company applies over its entire range of offerings.

Markups were evaluated for 2001 to 2006. The manufacturer markup is calculated as 100/(100 − average gross margin), where average gross margin is calculated as revenue − cost of goods sold (COGS). To validate the information, DOE reviewed its assumptions with beverage vending machine manufacturers. During interviews (see Chapter 12 of the TSD), beverage vending machine manufacturers stated that many manufacturers generate revenue and profit by providing other goods and services, and their margins for beverage vending machines are lower than their company-wide margin. Taking this information into consideration, DOE is using an industry-wide manufacturer markup of 1.03 in the engineering analysis.

b. Energy Consumption Model

The energy consumption model estimates the daily energy consumption of beverage vending machines at various performance levels using a design-option approach. The model is specific to the equipment covered under this rulemaking, but is sufficiently generalized to model the energy consumption of all covered equipment classes. For a given equipment class, the model estimates the daily energy consumption for the baseline and the energy consumption of several performance levels above the baseline. The model is used to calculate each performance level separately. For the baseline level, a corresponding cost is calculated using the cost model. For each level above the baseline, the cost increases resulting from the addition of various design options are used to recalculate the cost.

In developing the energy consumption model, DOE made certain assumptions, including general assumptions about the analytical methodology and specific assumptions regarding load components and design options. DOE based its energy consumption estimates on new equipment tested in a controlled-environment chamber under the procedures and conditions specified in ANSI/ASHRAE Standard 32.1–2004, *Methods of Testing for Bottled, Canned, and Other Sealed Beverages*.[31] Manufacturers of beverage vending machines must certify that their equipment complies with Federal standards using this test method, which specifies a certain ambient temperature, humidity, and other requirements. One relevant specification that DOE noted is absent from this standard is the operating hours of the display case lighting during a 24-hour period. Thus, DOE is considering the operating time to be 24 hours (i.e., that lights are on throughout the 24-hour period) when conducting the analyses for this rulemaking. Chapter 5 of the TSD

[28] American Metals Market, *http://www.amm.com/*.

[29] U.S. Department of Labor, Bureau of Labor Statistics, Producer Price Indices, *http://www.bls.gov/ppi/*.

[30] Available at: *http://www.sec.gov/edgar.shtml*.

[31] These test procedures are incorporated by reference at 10 CFR 431.294.

details these and other beverage vending machine considerations.

The energy consumption model calculates daily energy consumption (DEC) as being comprised of two major components: (1) Compressor energy consumption; and (2) component energy consumption (expressed as kWh/day). ''Component energy consumption'' is a sum of the direct electrical energy consumption of fan motors, lighting, vend mechanisms, control systems, and coin and bill validators. ''Compressor energy consumption'' is calculated from the total refrigeration load (expressed as British thermal units per hour (Btu/h)) and a compressor model based on the 10-coefficient compressor model in American Refrigeration Institute (ARI) Standard 540–2004, *Performance Rating of Positive Displacement Refrigerant Compressors and Compressor Units.* The total refrigeration load is a sum of the component heat load and the non-electric load. The component heat load is a sum of the heat emitted by evaporator fan motors and lighting inside the refrigerated space. (Condenser fan motors are outside the refrigerated space and do not contribute to the component heat load.) The non-electric load is a sum of the heat contributed by radiation through glass doors (in Class A machines); heat conducted through walls and doors; and sensible and latent loads from warm, moist air infiltration through vend doors and cracks. Chapter 5 of the TSD provides details on component energy consumption, compressor energy consumption, and heat load models.

4. Baseline Models

As mentioned above, the engineering analysis estimates the incremental costs for equipment with efficiency levels above a baseline model in each equipment class. As an initial matter, DOE defined baseline specifications for each equipment class. These specifications include dimensions, numbers of components, operating temperatures, nominal power ratings, and other necessary features to calculate the energy consumption of each equipment class. The baseline specifications define the energy consumption and cost of the typical equipment (i.e., units of typical efficiency) on the market today, namely beverage vending machines meeting ENERGY STAR Tier 1.

DOE established baseline specifications for each of the equipment classes modeled in the engineering analysis by reviewing available manufacturer data, selecting several representative units based upon that data, and then aggregating the physical characteristics of the selected units. As noted above, DOE chose the baseline specifications such that the baseline machines met ENERGY STAR's Tier 1 criteria (see TSD Chapter 3 for further details on the criteria). This process created a representative unit for each equipment class with average characteristics for physical parameters (e.g., volume, wall area), and typical performance for energy-consuming components (e.g., fans, lighting). See Chapter 5 of the TSD for these specifications.

5. Alternative Refrigerants

Generally, DOE must consider in its engineering analysis the effects of regulatory changes outside DOE's statutory energy conservation standards rulemaking process that can affect manufacturers of the covered equipment. Some of these changes could also affect the energy efficiency or energy consumption of the equipment.

In the Framework Document, DOE sought stakeholder input as to whether there are any regulatory issues that it should consider in its analysis of beverage vending machines. DOE identified the phaseout of hydrochlorofluorocarbons (HCFCs) [32] as an example of an external regulatory issue the beverage vending machine industry must address that could affect the engineering analysis. HCFCs contain chlorine, a chemical known to deplete stratospheric ozone. Due to this phaseout, the beverage vending machine industry must transition to non-ozone-depleting refrigerants, such as hydrofluorocarbons (HFCs), hydrocarbons (HCs), and other natural refrigerants (e.g., carbon dioxide (CO_2)). As a result, the beverage vending machine industry generally has been transitioning away from the HCFC-based refrigerants in its equipment. For the beverage vending machines covered in this rulemaking, DOE understands that much of the industry has already been using HFC-based refrigerants, specifically R–134a. Therefore, to address the imminent phaseout of HCFCs, DOE considered the effects of HFC-based refrigerants from the outset of its analyses. Some stakeholders stated, however, that DOE should consider examining other types of refrigerants such as HCs and CO_2.

Coca-Cola commented that it has made a corporate commitment to move beyond HCFC and HFC refrigerants to vending machines that use HCs and CO_2 (i.e., R–744). Coca-Cola expressed concern that current CO_2 systems are not as efficient as systems using HCFC refrigerants, thereby making compliance with any new energy conservation standard more difficult for such machines, if their unique characteristics are not taken into account. (Public Meeting Transcript, No. 8 at p. 146)

EEI stated that the HFC [sic] phaseout begins in 2010 and that the final rule for this rulemaking will be in 2009, with standards becoming effective in 2012. EEI commented that, because of this timing, if Coca-Cola could provide input to DOE on new refrigeration technologies, DOE would not have to perform its own analysis on alternative refrigerants. (Public Meeting Transcript, No. 8 at p. 170) (DOE notes, however, that the phaseout occurring in 2010 is for HCFC-based refrigerants and that no U.S. phaseout of HFC-based refrigerants is currently scheduled.) EEI also stated that it appears that new refrigerants will be in use in beverage vending machines by 2010. According to EEI, certain new technology options should be compatible with the refrigerant of choice starting in 2010, when HCFC-based refrigerants are phased out in the United States. EEI added that due to the global nature of this equipment and the ban on HFC-based refrigerants in some countries, manufacturers are considering CO_2 in all beverage vending machines, and such action could affect design options and baseline energy usage. (EEI, No. 12 at p. 4)

In response to the comments by Coca Cola and EEI, DOE conducted a qualitative examination of the use of HC refrigerants and CO_2 in the beverage vending machine industry. Based on conversations with beverage vending machine manufacturers and industry experts, DOE understands that HC refrigerants (e.g., butane and propane) are extremely flammable, and are classified as A3 refrigerants (low toxicity, high flammability) in the United States. Because of this classification, there are significant difficulties in selling and certifying equipment in the United States that use hydrocarbon refrigerants, and there are currently no manufacturers in the beverage vending machine industry who do so. DOE recognizes that other countries (e.g., Germany) have begun to adopt the use of HC refrigerants. But in the United States, these barriers and the perception of high safety risk has prevented their wide-spread use. DOE believes that the use of these refrigerants in beverage vending machines is not

[32] EPA is phasing out the production and importation of certain HCFC refrigerants (i.e., HCFC–142b and HCFC–22) in new equipment in the U.S. by January 1, 2010. Further, EPA is phasing out the production and importation of all HCFC refrigerants in new equipment in the U.S. by January 1, 2015. 42 U.S.C. 7671(d).

likely and, therefore, did not conduct an analysis using HC refrigerants.

Although CO_2 does not have the volatility issues of HC refrigerants, CO_2 can have lower cycle efficiencies than HFC-based refrigerants such as R–134a. DOE also understands that necessary components, such as compressors, do not yet exist in the market in sizes appropriate for beverage vending machines. Thus, DOE was not able to conduct an analysis on CO_2-based refrigeration systems.

Therefore, due to volatility and availability issues associated with HC refrigerants and CO_2, HFC-based refrigerants are the only alternative refrigerant option DOE plans to consider in this rulemaking. DOE requests additional stakeholder input or data on this issue.

6. Cost-Efficiency Results

The results of the engineering analysis are reported as cost-efficiency data (or ''curves'') in the form of daily energy consumption (DEC) (in kWh) versus MSP (in dollars), which form the basis for subsequent analyses in the ANOPR. DOE developed six curves representing the two equipment classes and three different size machines in each equipment class. The methodology for developing the curves started with determining the energy consumption for baseline equipment and MPCs for this equipment. Above the baseline, DOE implemented design options using the ratio of cost to savings, and implemented only one design option at each level. Design options were implemented until all available technologies were employed (i.e., at a max-tech level). See TSD Chapter 5 for additional detail on the engineering analysis and TSD Appendix B for complete cost-efficiency results.

D. Markups To Determine Equipment Price

This section explains how DOE developed the distribution channel (supply chain) markups to determine installed prices for beverage vending machines (see Chapter 6 of the TSD). DOE used the supply chain markups it developed (including sales taxes and installation costs), along with the MSPs developed from the engineering analysis, to arrive at the final installed equipment prices for baseline and higher-efficiency equipment. Whereas the manufacturer markup DOE used in the engineering analysis was applied to the MPC to arrive at the MSP, these supply chain markups (baseline and incremental markups described below) were applied to the MSPs to arrive at the final installed equipment prices. At the Framework public meeting, the NPCC stated that among universities, school districts, and other public agencies, direct purchases of beverage vending machines by these sectors might be a fairly significant fraction of total machine purchases, and it added that the weighting between the different sectors should be the same as for energy prices. (Public Meeting Transcript, No. 8 at p. 227)

DOE subsequently reviewed different sources of data, including industry reports, and concluded there are three main channels of distribution for beverage vending machines. Businesses and other entities that directly purchase the equipment typically obtain their machines through an equipment wholesaler/distributor and not directly from the manufacturer. Such direct ownership of vending machines by site owners, however, constitutes only about five percent of the total market. Instead, most institutions and manufacturing facilities have machines installed on-site through a ''location contract'' from a vending machine operator or bottler/distributor that owns and stocks the machines.

As Table II.1 demonstrates, DOE identified three distribution channels for beverage vending machines which describe how the equipment passes from the manufacturer to the customer. In the first distribution channel, the manufacturer sells the equipment directly to the beverage bottler/distributor, who installs and operates the machine at a given site. In the second and third distribution channels, the manufacturer sells the beverage vending machine to the equipment wholesaler/distributor, who in turn may sell it to a vending machine operator (who installs and operates the machine at a given site) or to a site owner (who stocks and operates the machine). Table II.1 also provides the estimated distribution channel shares (in percentage of total sales) through each of the three distribution channels.

TABLE II.1.—DISTRIBUTION CHANNELS AND SHARES FOR BEVERAGE VENDING MACHINES

Channel 1	Channel 2	Channel 3
Manufacturer ↓ Beverage Bottler/Distributor	Manufacturer ↓ Equipment Wholesaler/Distributor ↓ Vending Machine Operator	Manufacturer ↓ Equipment Wholesaler/Distributor ↓ Site Owner
68%	27%	5%

For each step in the distribution channels presented above, DOE estimated a baseline markup and an incremental markup, which are additional amounts added when equipment is sold and installed. A baseline markup is applied for the purchase of baseline equipment. An incremental markup is applied to the incremental increase in MSP for the purchase of higher-efficiency equipment. The overall baseline or overall incremental markup is the product of all the markups at each step in the distribution channel. Overall, weighted average baseline or incremental markups for the entire beverage vending machine market can be determined using the shipment weights through each distribution channel and the corresponding overall baseline markup or the corresponding overall incremental markup, respectively, for each distribution channel, and any applicable sales tax.

DOE developed markups for each step of a given distribution channel based on available financial data. Specifically, DOE based the equipment wholesaler/distributor markups on U.S. Census Bureau data [33] for Other Commercial Equipment Merchant Wholesalers (NAICS 423440). This sector includes those establishments primarily engaged in distributing and wholesaling

[33] U.S. Census Bureau. 2002. 2002 Economic Census Release Date: 12/3/2004. Sector 42: Wholesale Trade: Industry Series: Product Lines by Kind of Business for the United States: 2002 at *http://factfinder.census.gov/servlet/IBQTable?_bm=y&-MFG=10971:42&-ds_name=EC0242I3&-_lang=en* (Accessed on April 16, 2007).

refrigerated beverage vending machines and other equipment to restaurants and hotels (NAICS 4234401) and stores (NAICS 4234402). The U.S. Census Bureau data for this sector include revenue and expense data in total dollars, rather than in typical values for an average or representative business. Because of this, DOE assumed the total dollar values that the U.S. Census Bureau reported, once converted to an individual entity basis, represents revenues and expenses for an average or typical wholesaler/distributor business.

DOE calculated baseline markups for wholesalers as total revenue (equal to all expenses paid plus profit) divided by the cost of goods sold (COGS). Expenses include direct costs for equipment, labor expenses, occupancy expenses, and other operating expenses (e.g., insurance, advertising). DOE presumed some expenses (i.e., labor and occupancy) to be fixed and not subject to change with the increases in the efficiency of the equipment being sold. Other expenses are variable costs that may change in response to changes in the COGS. In developing incremental markups, DOE again considered the labor and occupancy costs to be fixed, and the other operating costs and profit to be proportional to the MSP.

The overall markup for a distribution channel is the product of all the markups plus sales tax within that channel. DOE calculated both baseline and incremental overall markups for each distribution channel. DOE calculated sales taxes based on State-by-State sales tax data reported by the Sales Tax Clearinghouse.[34] Sales tax varies by State, so the markup analysis develops distributions of markups within each distribution channel as a function of State.

For the third distribution channel, the site owner of a beverage vending machine usually consists of a business type (e.g., manufacturing facility, office buildings, health care buildings, and retail). Because the State-by-State distribution of beverage vending machines may vary by business type (e.g., manufacturing facilities may be more prevalent relative to retail stores in one part of the country than another), a national level distribution of the markups may be different for each business type.

Average overall markups in each distribution channel can be calculated using estimates of the shipments of beverage vending machines by distribution of State population. However, markups are not uniform among wholesalers. DOE used the Excel spreadsheet-based Crystal Ball program, which employs Monte Carlo analysis, to reflect this uncertainty in the LCC analysis. DOE applied the same baseline and incremental markups to all sales of beverage vending machines passing through equipment wholesaler/distributors, whether to the vending machine operator (channel 2) or to the site owner (channel 3). Table II.2 and Table II.3 show overall baseline and incremental markups for sales within each distribution channel. Chapter 6 of the TSD provides additional detail on markups.

TABLE II.2.—OVERALL AVERAGE BASELINE MARKUPS BY DISTRIBUTION CHANNEL INCLUDING SALES TAX

	Manufacturer direct	Wholesaler/distributor	Overall weighted average
Markup	1.000	1.46	1.147
Sales Tax	1.068	1.068	1.068
Overall Markup	1.068	1.559	1.226

TABLE II.3.—OVERALL AVERAGE INCREMENTAL MARKUPS BY DISTRIBUTION CHANNEL INCLUDING SALES TAX

	Manufacturer direct	Wholesaler/distributor	Overall weighted average
Markup	1.000	1.20	1.064
Sales Tax	1.068	1.068	1.068
Overall Markup	1.068	1.282	1.137

E. Energy Use Characterization

The energy use characterization analysis estimates the annual energy consumption of individual beverage vending machines (both baseline and higher-efficiency units) installed indoors or outdoors around the country. DOE uses this estimate, which represents typical energy consumption in the field, as an input in the subsequent LCC and PBP analyses (Chapter 8 of the TSD) and NIA (Chapter 10 of the TSD). DOE estimated the energy use for machines in the two equipment classes (Class A and Class B vending machines)[35] analyzed in the engineering analysis based on the DOE test procedure[36] (Chapter 5 of the TSD).

Beverage vending machines are typically installed in manufacturing facilities and commercial buildings and are considered part of the ''plug loads''[37] of the building. They also contribute to the heat gain to the building on a 24-hour basis. At the Framework public meeting, DOE asked whether it should quantify the effect of more-efficient beverage vending machines (presumably contributing less heat to the building) on building space conditioning loads and, if so, what would be the most effective way of doing this. EEI responded that there might be some impact on building space conditioning loads for about five percent of the installations, based upon their location and concentration. (Public Meeting Transcript, No. 8 at p. 208) In general, EEI remarked that in many situations (e.g., a single machine in a facility or one machine per occupied floor) these impacts are likely to be minimal; however, EEI stated that there could be an appreciable impact on space conditioning loads in indoor areas where multiple machines are concentrated. On this topic, the Joint

[34] The Sales Tax Clearinghouse. Available at: *https://thestc.com/STRates.stm* (Accessed on June 25, 2007).

[35] Class A and Class B vending machines are as described in Section II.A.2 of the ANOPR.

[36] DOE incorporated by reference, ANSI/ASHRAE Standard 32.1–2004, with two modifications, as the DOE test procedure for the beverage vending machines. 71 FR 71340, 71375 (Dec. 8, 2006); 10 CFR 431.294. ''Plug loads'' are those appliances and equipment that are plugged into the power outlets in a building.

[37] ''Plug loads'' are those appliances and equipment that are plugged into the power outlets in a building.

Comment recommended that DOE perform a limited set of sensitivity analyses to determine whether a reasonable estimate of the impacts is feasible and whether such impacts would be significant, given variations in climate, space conditioning system type, and other building loads. (ACEEE, No. 13 at p. 4) Dixie-Narco asserted that the impact would be minimal and that DOE should not attempt to quantify this effect. (Dixie-Narco, No. 14 at p. 5) NFESC recommended that DOE account for the additional electricity attributable to the added heat load on air-conditioning systems in determining what efficiency standard will be cost-effective. (NFESC, No. 15 at p. 5)

Based on these comments, DOE conducted a brief sensitivity analysis of the impact of a beverage vending machine's energy consumption and its magnitude compared to other plug loads in a commercial building, where more than two-thirds of the beverage vending machines are installed. Using the Energy Information Administration (EIA)'s Commercial Building Energy Consumption Survey (CBECS) data,[38] DOE examined 16 commercial building types (i.e., principal building activity (PBA) categories) in which beverage vending machines are typically installed. Annual energy consumption of these machines was calculated, based on 8 kWh of daily electricity consumption and 365 days of operation, which equated to three percent of the total electricity consumption for lighting in a typical commercial building. Based on these findings which suggest that the impact is minimal, DOE has decided to conduct no further analyses regarding the impact of more-efficient beverage vending machines on building space-conditioning loads.

Another question related to the energy use of beverage vending machines is the ''heating mode'' for machines installed outdoors in cold climates. At the Framework public meeting, Royal Vendors stated that a very small number of machines have a heater kit, although these kits do not run much of the time, even in very cold climates such as Alaska (Public Meeting Transcript, No. 8 at p. 211). Therefore, DOE decided that it will not consider the ''heating mode'' to be a significant factor in its energy use analysis.

As discussed above, DOE analyzed two equipment classes of beverage vending machines, Class A and Class B. Although Class A machines may be certified for indoor/outdoor use, there are few Class A machines installed outdoors because of concerns about vandalism. Therefore, DOE assumed Class A machines to be installed indoors only and subject to the constant indoor air temperature and relative humidity conditions of 75 °F/45 percent RH, matching one of the test conditions in the DOE test procedure. Further, based on market data as to the installation of Class B machines and discussions with several beverage vending machine distributors, DOE assumed that 25 percent of these machines are placed outdoors and that the remaining 75 percent of these machines are installed indoors. DOE seeks stakeholder input on this approach, which is identified as Issue 1 under ''Issues on Which DOE Seeks Comment'' in Section IV.E of this ANOPR.

Furthermore, for both Class A and Class B machines, DOE analyzed the three typical sizes (vendible capacities) defined in the engineering analysis (Chapter 5 of the TSD). Each machine has a different refrigerated volume as measured by ANSI/AHAM HRF–1–2004 and shown in Table II.4.

TABLE II.4.—CONFIGURATIONS OF THE BEVERAGE VENDING MACHINES ANALYZED

Configuration	Class A machine			Class B machine		
	Small (A–S–IN)*	Medium (A–M–IN)	Large (A–L–IN)	Small (B–S–IO)	Medium (B–M–IO)	Large (B–L–IO)
Vendible Capacity (number of cans)	270	350	410	450	650	800
Refrigerated Volume (ft^3)	19	31	35	19	24	31

* This nomenclature denotes a combination of equipment class, size, and assumed application. For example, A–S–IN denotes a Class A small machine used indoors only, whereas B–S–IO denotes a Class B small machine that can be installed either indoors or outdoors.

DOE estimated the annual energy consumption for Class A vending machines as the product of the average daily energy consumption from the DOE test procedure indoor test condition of 75 ° F/45 percent RH, and 365 days per year. For Class A machines, the annual energy consumption did not vary by State.

DOE calculated the energy consumed by Class B vending machines using the following relationship:

$$E_{ann} = 25\% \; x \; E_{ann,outdoor} + 75\% \; x \; E_{ann,indoor} \qquad Eq.\, II.1$$

Where:

E_{ann} = Annual average energy consumption,

$E_{ann,outdoor}$ = Annual average energy consumption for an outdoor machine, and

$E_{ann,indoor}$ = Annual average energy consumption for an indoor machine.

For the 25 percent of the Class B machines located outdoors, DOE developed a spreadsheet-based energy performance model that uses Typical Meteorological Year (TMY2) climate data.[39] DOE created temperature and relative humidity bins with temperatures ranging from 130 °F to −40 °F in 5 °F increments, and percent relative humidity values ranging from 100 percent RH to 0 percent RH in 5 percent RH increments. The model calculates the annual energy consumption of a vending machine at any of the chosen engineering efficiency levels (derived from the engineering

[38] EIA 2003. EIA (Energy Information Administration), 2003, 2003 CBECS Detailed Tables. *http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/detailed_tables_2003.html. Accessed June 14, 2007.*

[39] TMY2 data expresses the annual average weather data for 237 cities in the United States. TMY2 National Renewable Energy Laboratory. *Typical Meterological Years Derived from the 1961–1990 National Solar Radiation Database (1995).* Available at: *http://rrede.nredl.gov/solar/old_data/nsrdb/1961-1990.*

analysis) for a variety of temperatures and relative humidity values. The model calculates the annual energy use for each TMY2 city by stepping through the binned weather data, calculating the daily average energy consumption for the beverage vending machine from the energy performance model for each bin, dividing by 24 to convert to average hourly energy consumption, and multiplying by the number of hours in the bin. The sum of the hourly energy consumption for all bins provides the annual energy consumption.

DOE estimated annual energy consumed by the remaining 75 percent of the Class B machines located indoors as the product of the daily energy consumption calculated at the DOE test procedure indoor test condition of 75 °F/45 percent RH, and 365 days per year.

DOE calculated the average annual energy use for each Class B machine for all 237 TMY2 stations in the United States. DOE mapped each TMY2 station to a certain State, based on its location. Within each State, DOE assigned a relative weight to each TMY2 station, based on the total population of identifiable population centers (cities, towns, other) that can be shown to be most climatically similar to that TMY2 location. The annual energy consumption data for the TMY locations were then weighted to obtain annual energy consumption data for each State.

As described below, DOE developed the annual energy consumption for each equipment class and at each efficiency level for each State in the United States as inputs for the LCC and PBP analyses.

1. Selection of Efficiency Levels for Further Analysis

The engineering analysis considered an efficiency level corresponding to the present market efficiency level (below the Tier 1 efficiency level) which DOE designated as Level 0. DOE then developed up to thirteen efficiency levels for some equipment classes to obtain a range of cost-efficiency relationships in the engineering analysis. For each equipment class, DOE then down-selected only nine efficiency levels to consider in the energy use characterization and subsequent economic analyses. The efficiency levels range from a baseline efficiency level to the max-tech level. As part of that range, DOE selected ENERGY STAR levels (Tier 1 and Tier 2) and intermediate levels that would yield a smooth LCC curve. Table II.5 shows the mapping of the efficiency levels that DOE will use in the further economic analyses of the efficiency levels from the engineering analysis. These nine efficiency levels, chosen for the subsequent economic analyses, the corresponding annual energy consumption figures, and manufacturer selling prices for beverage vending machines determined in the engineering analysis are all inputs to DOE's LCC analysis.

TABLE II.5.—MAPPING OF THE EFFICIENCY LEVELS FOR SUBSEQUENT ECONOMIC ANALYSES TO THE ENGINEERING EFFICIENCY LEVELS

Efficiency levels for LCC and PBP analyses	Engineering efficiency levels for class A machines (all sizes)	Engineering efficiency levels for class B machines (all sizes)
Level 0	Level 0	Level 0.
Level 1 (ENERGY STAR Tier 1) or Baseline Level.	Level 1	Level 1.
Level 2	Level 3	Level 3.
Level 3 (ENERGY STAR Tier 2)	Level 4	Level 4.
Level 4	Level 7	Level 6.
Level 5	Level 8	Level 7.
Level 6	Level 9	Level 9.
Level 7	Level 11	Level 10.
Level 8 (Max Tech)	Level 13	Level 11.

2. Annual Energy Consumption Results

As explained above, DOE assumes that all Class A machines and 75 percent of Class B machines are installed indoors and that 25 percent of Class B machines are located outdoors. To calculate a weighted energy use of Class B machines, DOE added aggregated State-by-State results by using data from each of the 237 TMY2 weather stations to the annual energy consumption of the remaining 75 percent of Class B machines located indoors, in order to determine the total energy consumption of all Class B machines. DOE further aggregated energy consumption at the State level to arrive at the national average energy consumption, using the 2000 Census population data.[40] Table II.6 presents the national average annual energy consumption figures for the three different sizes of Class B machines.

TABLE II.6.—NATIONAL AVERAGE ANNUAL ENERGY CONSUMPTION FOR CLASS B MACHINES, BY EFFICIENCY LEVELS (KWH)

	Level 0 (market baseline)	Level 1 (ENERGY STAR Tier 1)	Level 2	Level 3 (ENERGY STAR Tier 2)	Level 4	Level 5	Level 6	Level 7	Level 8 (Max Tech)
Large (B–L–IO)	4,033	2,244	1,901	1,740	1,598	1,533	1,348	1,336	1,315
Medium (B–M–IO)	3,899	2,108	1,763	1,623	1,488	1,426	1,250	1,240	1,221
Small (B–S–IO)	3,699	1,934	1,589	1,461	1,376	1,214	1,149	1,140	1,125

[40] The U.S. Census Bureau, *2000 Census, http://factfinder.census.gov/servlet/GCTTable?_bm=y&-geo_id=01000US&box_head_nbr=GCT-PHI&-context=gct&-ds_name=DEC_2000_SFI_U&-tree_id=4001&-format=US-9.* (Accessed on March 25, 2007.)

Table II.7 shows annual energy consumption for each size of Class A machine. National average energy consumption figures are identical to State energy consumption figures. These national average annual energy consumption figures are used in the subsequent LCC, PBP, NES and rebuttable presumption payback period analyses.

TABLE II.7.—ANNUAL ENERGY CONSUMPTION FOR CLASS A MACHINES, ALL SIZES AND ALL LOCATIONS, BY EFFICIENCY LEVELS (KWH)

Size	Energy use (all locations, kWh)								
	Level 0 (market baseline)	Level 1 (ENERGY STAR Tier 1)	Level 2	Level 3 (ENERGY STAR Tier 2)	Level 4	Level 5	Level 6	Level 7	Level 8 (Max Tech)
Large (A–L–IN)	3,173	2,452	2,229	2,045	1,882	1,790	1,773	1,654	1,586
Medium (A–M–IN)	3,005	2,321	2,102	1,933	1,775	1,692	1,675	1,576	1,510
Small (A–S–IN)	2,796	2,117	1,902	1,737	1,585	1,518	1,502	1,417	1,356

DOE's energy use characterization assumes both that there are no controls limiting display lighting or compressor operation in a beverage vending machine to certain hours of the day and that the display lighting or compressor operation would not be affected by occupancy patterns in the building. However, using occupancy sensors and other controllers might reduce a vending machine's energy requirements during long periods of non-use, such as overnight and weekends. This occupancy controller option is often used when de-lamping a vending machine is not advisable (i.e., when a vending machine does not have a captive audience or when de-lamping results in reduced vending sales revenues). Controllers can either be added on or enabled in certain beverage vending machines. DOE requests comments on the need to incorporate such controls in its energy use characterization analysis and, if so, how to do so in the NOPR analysis. See Issue 2 under ''Issues on Which DOE Seeks Comment'' in Section IV.E of this ANOPR. Chapter 7 of the TSD provides additional details on the energy use characterization.

F. Rebuttable Presumption Payback Periods

A more energy-efficient device will usually cost more to purchase than a device of standard energy efficiency. However, the more-efficient device will usually cost less to operate due to reductions in operating costs (i.e., lower energy bills). The payback period (PBP) is the time (usually expressed in years) it takes to recover the additional installed cost of the more-efficient device through energy cost savings. In considering standard setting for beverage vending machines, sections 325(o)(2)(B)(iii) and (v)(3) of EPCA (42 U.S.C. 6295(o)(2)(B)(iii) and (v)(3)) establish a rebuttable presumption that a standard is economically justified if the Secretary finds that ''the additional cost to the consumer of purchasing a product complying with an energy conservation standard level will be less than three times the value of the energy * * * savings during the first year that the consumer will receive as a result of the standard, as calculated under the applicable test procedure * * *.'' (42 U.S.C. 6295(o)(2)(B)(iii)) This rebuttable presumption test is an alternative path to establishing economic justification as compared to consideration of the seven factors set forth in 42 U.S.C. 6295(o)(2)(B)(i)(I)–(VII).

To evaluate the rebuttable presumption, DOE estimated the additional cost of a more-efficient, standard-compliant unit, and compared this cost to the value of the energy saved during the first year of operating the equipment. DOE assumed that the increased cost of purchasing a standard-compliant unit includes the cost of installing the equipment for use by the purchaser. DOE calculated the rebuttable presumption PBP, or the ratio of the value of the increased installed price above the baseline efficiency level to the first year's energy cost savings. When this PBP is less than three years, the rebuttable presumption is satisfied; when this PBP is equal to or more than three years, the rebuttable presumption is not satisfied.

DOE calculated rebuttable presumption PBPs based on a distribution of installed costs and energy prices that included seven types of businesses and all 50 States. Unlike the other PBPs calculated in the LCC analysis (see Section II.G.4 of this ANOPR), the rebuttable presumption PBPs do not include maintenance or repair costs.[41] As with the LCC analysis (see Section II.G.2), the baseline efficiency level for the rebuttable presumption calculation is Level 1. From the range of efficiency levels for which cost data was determined in the engineering analysis, DOE selected nine efficiency levels in each equipment class, including the baseline efficiency level, for the LCC and subsequent ANOPR analyses. Chapter 7 of the TSD discusses the selection of these efficiency levels. For each equipment class, DOE calculated the rebuttable presumption PBP at each efficiency level higher than the baseline. Inputs to the PBP calculation are the first seven inputs shown in Table II.9 in Section II.G.2 of this ANOPR.

Table II.8 shows the nationally-averaged rebuttable presumption payback periods calculated for all equipment classes and efficiency levels. Table II.8 also shows the highest efficiency level with a rebuttable presumption payback of less than 3 years for each equipment class.

As is the case in other DOE energy conservation standards rulemakings, while DOE has examined the rebuttable presumption PBPs, it has not determined economic justification for any of the standard levels analyzed based on the ANOPR rebuttable presumption analysis. Instead, when setting candidate standard levels (CSLs), DOE will consider the more detailed analysis of the economic impacts of increased efficiency according to section 325(o)(2)(B)(i) of EPCA. (42 U.S.C. 6295(o)(2)(B)(i))

[41] Energy cost savings are the only costs addressed with respect to rebuttable presumption payback periods. 42 U.S.C. 6295(o)(2)(B)(iii).

TABLE II.8.—REBUTTABLE PRESUMPTION PAYBACK PERIODS BY EFFICIENCY LEVEL AND EQUIPMENT CLASS

Equipment type	Rebuttable presumption payback period (years)								Highest level with PBP <3 years
	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	
B–L–IO	NA	0.7	1.1	1.5	3.6	3.9	4.1	122.9	Level 4.
B–M–IO	NA	0.7	1.1	1.6	3.8	4.1	4.4	112.3	Level 4.
B–S–IO	NA	0.7	1.3	1.8	3.6	4.8	5.1	5.1	Level 4.
A–L–IN	NA	1.1	1.4	1.6	2.1	2.3	6.3	145.4	Level 6.
A–M–IN	NA	1.1	1.5	1.7	2.3	2.5	6.1	347.9	Level 6.
A–S–IN	NA	1.2	1.4	1.7	2.2	2.4	6.1	75.4	Level 6.

G. Life-Cycle Cost and Payback Period Analyses

The LCC and PBP analyses determine the economic impact of potential standards on customers. The effects of standards on individual commercial customers include changes in operating expenses (usually lower) and changes in total installed cost (usually higher). DOE analyzed the net effect of these changes for beverage vending machines by calculating the changes in customers' LCCs likely to result from a CSL compared to a base case (no new standards). The LCC calculation considers total installed cost (includes MSP, sales taxes, distribution channel markups, and installation cost), operating expenses (i.e., energy, repair, and maintenance costs), equipment lifetime, and discount rate. DOE performed the LCC analysis from the perspective of the purchaser of a beverage vending machine.

DOE calculated the LCC for all customers as if each would purchase a new beverage vending machine in the year the standard takes effect. The standard takes effect on the future date when it begins to apply to newly-manufactured equipment. Section 135(c)(4) of EPACT 2005 amended EPCA to add new subsections 325(v)(2), (3) and (4) (42 U.S.C. 6295(v)(1), (2) and (3)), which directs the Secretary to issue a final rule for refrigerated bottled or canned beverage vending machines no later than August 8, 2009, with the energy conservation standard levels in the rule applying to all equipment manufactured on or after August 8, 2012. Consistent with EPCA, DOE used these dates in the ANOPR analyses.

DOE based the cost of the equipment on projected costs in 2012, although all dollar values are expressed in 2007$. DOE projected that the cost for equipment in 2012 when expressed in real terms (2007$) would be identical to the cost determined in the engineering analysis. DOE also considered annual energy prices for the life of the beverage vending machine, based on EIA's Annual Energy Outlook 2007 (AEO2007).

DOE also analyzed the effect of changes in operating expenses and installed costs by calculating the PBP of potential standards relative to a base case. The PBP estimates the amount of time it would take the commercial customer to recover the anticipated, incrementally higher purchase expense of more energy-efficient equipment through lower operating costs. Similar to the LCC analysis, the PBP is based on the total installed cost and the operating expenses. However, unlike the LCC, the PBP only considers the first year's operating expenses. Because the PBP does not account for changes in operating expense over time or the time value of money, this calculation is also referred to as a simple PBP. Usually, the benefits of a regulation exceed the costs of that regulation if the service life of the covered equipment is substantially longer than the PBP.

The following discussion provides an overview of the approach and inputs for the LCC and PBP analyses performed by DOE, as well as a summary of the preliminary results generated for the beverage vending machines under consideration in this rulemaking. However, for a more detailed discussion on the LCC and PBP analyses, see Chapter 8 of the ANOPR TSD.

1. Approach

The LCC analysis estimates the impact on commercial customers of potential energy conservation standards for beverage vending machines by calculating the net cost of those machines under two scenarios: (1) A ''base case'' of no new standard; and (2) a ''standards case'' under which beverage vending machines must comply with a new energy efficiency standard. Recognizing that each type of commercial customer who uses a beverage vending machine is unique, DOE analyzed variability and uncertainty by performing the LCC and PBP calculations for seven types of businesses. Six of these typically purchase and install beverage vending machines in their buildings. The seventh business type, which is the most common purchaser of the equipment, is a local bottler or vending machine operator that typically has the machine installed in one of the other six business types, provides vending services, and splits the coin box receipts through a contractual arrangement with the site owner.

Of the six business types analyzed, four have a Principal Building Activity (PBA) category assigned to them in the CBECS data. These four business types analyzed are: (1) Office/healthcare (including a large number of firms engaged in financial and other services, medical and dental offices, and nursing homes); (2) retail (including all types of retail stores and food and beverage service facilities); (3) schools (including colleges and universities and large groups of housing facilities owned by State governments, such as prisons); and (4) ''other'' (including warehouses, hotels/motels, and assembly buildings). The two remaining business types analyzed are manufacturing facilities and military bases that are typically large utility customers and pay industrial rates for their electricity consumption.

Aside from energy, the most important factors influencing the LCC and PBP analyses are related to where the beverage vending machine is installed. These factors include energy prices, installation cost, markup, and sales tax. The LCC analysis used the annual energy consumption determined in the energy use characterization analysis (Chapter 7 of the TSD). Energy consumption calculated using this approach is sensitive to climatic conditions, especially for the vending machines located outdoors. Therefore, energy consumption in the LCC analysis varies by geographical location. At the national level, the LCC analysis explicitly modeled both the uncertainty and the variability in the model's inputs using probability distributions. These are based on the shipment of units to different States, as determined by population weights.

2. Life-Cycle Cost Analysis Inputs

For each efficiency level analyzed, the LCC analysis requires input data for the total installed cost of the equipment, the operating expense, and the discount rate. Table II.9 summarizes the inputs and key assumptions used to calculate the economic impacts to commercial customers of various efficiency levels for each beverage vending machine. A more detailed discussion of the inputs follows.

TABLE II.9.—SUMMARY OF INPUTS AND KEY ASSUMPTIONS USED IN THE LIFE-CYCLE COST ANALYSIS

Input	Description
Baseline Efficiency Level	Energy savings and energy cost savings are compared to a pre-selected baseline efficiency level (in this case Level 1).
Higher Efficiency Levels	Certain number of higher efficiency levels are pre-selected up to the max-tech level for LCC and PBP analyses.
Baseline Manufacturer Selling Price	Price charged by manufacturer to either a wholesaler or large customer for baseline equipment.
Standard-Level Manufacturer Selling Price Increases.	Incremental change in manufacturer selling price for equipment at each of the higher efficiency levels.
Markups and Sales Tax	Associated with converting the manufacturer selling price to a customer price (see Chapter 6 of TSD).
Installation Price	Cost to the customer of installing the equipment. This includes labor, overhead, and any miscellaneous materials and parts. The total installed cost equals the customer equipment price plus the installation price.
Equipment Energy Consumption	Site energy use associated with the use of beverage vending machines, which includes only the use of electricity by the equipment itself.
Electricity Prices	Average commercial electricity price ($/kWh) in each State and for seven classes of commercial and industrial customers, as determined from EIA data for 2003 converted to 2007$.
Electricity Price Trends	Used the *AEO2007* reference case to forecast future electricity prices.
Maintenance Costs	Labor and material costs associated with maintaining the beverage vending machines (e.g., cleaning heat exchanger coils, checking refrigerant charge levels, lamp replacement).
Repair Costs	Labor and material costs associated with repairing or replacing components that have failed.
Equipment Lifetime	Age at which the beverage vending machine is retired from service (estimated to be 14 years).
Discount Rate	Rate at which future costs are discounted to establish their present value to beverage vending machine purchasers.
Rebound Effect	A rebound effect was not taken into account in the LCC analysis.
Analysis Period	Analysis period is the time span over which DOE calculated the LCC (i.e., 2012–2042).

a. Baseline Manufacturer Selling Price

The ''baseline MSP'' is the price manufacturers charge to either a wholesaler/distributor or very large customer for beverage vending machine equipment meeting baseline efficiency levels. The MSP includes a markup that converts the MPC to MSP. DOE developed the baseline MSPs using a cost model (detailed in Chapter 5 of the TSD). MSPs were developed for two equipment classes and three typical sizes within each equipment class.

DOE was not able to identify relative shipments data for equipment classes by efficiency level. For the equipment on which DOE performed a design-option analysis as the basis for the engineering analysis, DOE designated Level 1 as the baseline efficiency level. Level 1 also coincided with the ENERGY STAR Tier 1 level, which is assumed to represent the least efficient equipment likely to be sold in 2012.

b. Increase in Selling Price

The standard-level MSP increase is the change in MSP associated with producing beverage vending machine equipment at higher efficiency levels (or with lower energy consumption). MSP increases are associated with decreasing equipment energy consumption (or higher efficiency) levels through a combination of energy consumption level and design-option analyses. See Chapter 5 of the TSD for details. DOE developed these MSP increases for the two equipment classes.

c. Markups

As discussed earlier, overall markups are based on one of three distribution channels for beverage vending machines. Site owners purchase approximately five percent of equipment from wholesaler/distributors; vending machine operators purchase 27 percent of equipment from wholesaler/distributors; and beverage bottler/distributors purchase 68 percent of equipment directly from manufacturers, based on input received by DOE.

d. Installation Costs

DOE derived installation costs for beverage vending machines from U.S. Bureau of Labor Statistics (BLS) data.[42] BLS provides median wage rates for installation, maintenance, and repair occupations that reflect the labor rates for each State. These data allow DOE to compute State labor cost indices relative to the national average for these occupations. DOE incorporated these cost indices into the analysis to capture variations in installation cost by location. DOE calculated the installation cost by multiplying the number of person-hours by the corresponding labor rate as reported by Foster-Miller Inc.[43] Foster-Miller data were more specific to the beverage vending machine industry and service calls, and were used whenever possible. DOE decided that the installation costs (including overhead and profit) represent the total installation costs for baseline equipment. Further, since data were not available to indicate how installation costs vary by the beverage vending machine class or efficiency, DOE considered installation costs to be fixed and independent of the cost or efficiency of the equipment. Although the LCC spreadsheet allows for alternative scenarios, DOE did not find a compelling reason to change its basic premise for the ANOPR analysis.

As described earlier, the total installed cost is the sum of the equipment purchase price and the installation cost. DOE derived the

[42] Bureau of Labor Statistics, Occupational Employment and Wage Estimates (May 2006). Available at: *http://www.bls.gov/oes_dl.htm*.

[43] Foster-Miller, Inc., *Vending Machine Service Call Redution Using the Vending Miser (2002).*

customer equipment purchase price for any given efficiency level by multiplying the baseline MSP by the baseline markup and adding to it the product of the incremental MSP and the incremental markup. Because MSPs, markups, and the sales tax can take on a variety of values depending on location, the resulting total installed cost for a particular efficiency level will not be a single-point value, but a distribution of values. DOE used a Monte-Carlo analysis, which is a stochastic approach, to determine this distribution of values.

e. Energy Consumption

DOE based its estimate of the annual electricity consumption of beverage vending machines on the energy use characterization described in Section II.E of this ANOPR.

f. Electricity Prices

Electricity prices are necessary to convert electric energy savings into energy cost savings. In its Framework Document, DOE suggested using average commercial and/or industrial electricity prices depending on the purchaser of the beverage vending machine to develop its life-cycle cost analysis. Based on comments made at the Framework public meeting, DOE estimated that about 30 percent of installed beverage vending machines are located at manufacturing facilities with industrial electricity prices.

On this topic, EEI recommended that DOE should use industrial as well as commercial electricity prices in the analysis. (EEI, No. 12 at p. 6) In its analyses, DOE will use average electricity prices for the following types of locations: (1) Industrial buildings; (2) Federal military buildings; and (3) large office, small office, education, and mercantile buildings. These average electricity prices will be determined on a State-by-State basis in order to include regional variations in energy prices, while reducing the overall complexity of the analysis. DOE will use a Monte-Carlo stochastic analysis (using Crystal Ball) to capture the variation of energy prices across the different building types and geographic regions. Because of the wide variation in electricity consumption patterns, wholesale costs, and retail rates across the country, it is important to consider regional differences in electricity prices. DOE used average commercial electricity prices at the State level from the EIA publication, *State Energy Consumption, Price, and Expenditure Estimates*. The latest available prices from this source are for 2006. Because actual prices were available for all of 2006, DOE used the forecasted ratio between 2007 and 2006 national commercial retail electricity prices from *AEO2007* to adjust the 2006 State-level prices to 2007$.

DOE decided to use average electricity prices paid by seven different classes of beverage vending machine customers on a State-by-State basis. DOE also adjusted for different effective prices, since different kinds of businesses typically use electricity in different amounts at different times of the day, week, and year. To make this adjustment, DOE used the 2003 CBECS data set to identify the average prices four of the seven business types paid compared with the average prices all commercial customers paid. Two of the seven business types were manufacturing facilities and military/Federal facilities, which DOE assumed pay industrial electricity prices. DOE used the ratios of prices paid by the four types of businesses to the national average commercial prices seen in the 2003 CBECS as multiplying factors to increase or decrease the average commercial 2006 price data previously developed. Once the electricity prices for the four types of businesses were adjusted, those prices were used in the LCC analysis.

To obtain a weighted-average national electricity price, the prices paid by each business in each State is weighted by the estimated sales of beverage vending machines to each business type. The State/business type weights are the probabilities that a given beverage vending machine unit shipped will be operated with a given electricity price. For evaluation purposes, the prices and weights can be depicted as a cumulative probability distribution. The effective electricity prices range from approximately 4 cents per kWh to approximately 16 cents per kWh. This approach will include regional variations in energy prices and provide for estimated electricity prices suitable for the target market, yet reduce the overall complexity of the analysis. The development and use of State-average electricity prices by business type is described in more detail in Chapter 8 of the TSD.

g. Electricity Price Trends

The electricity price trend provides the relative change in electricity prices for future years out to the year 2042. Estimating future electricity prices is difficult, especially considering that there are efforts in many States throughout the country to restructure the electricity supply industry. DOE applied the *AEO2007* reference case as the default scenario and extrapolated the trend in values from 2020 to 2030 of the forecast to establish prices in 2030 to 2042. This method of extrapolation is in line with methods that EIA uses to forecast fuel prices for the Federal Energy Management Program (FEMP). DOE provides a sensitivity analysis of the life-cycle costs savings and PBP results to future electricity price scenarios using both the *AEO2007* high-growth and low-growth forecasts in Chapter 8 of the TSD. DOE is committed to using the latest available EIA forecast of energy prices in this rulemaking. For the NOPR analysis, DOE expects to use *AEO2008*. Since the Final Rule is expected to be published by August 2009, DOE expects to use AEO2009 in the Final Rule analysis. Prior to issuance of the NOPR, updates of the ANOPR analytical spreadsheets using AEO2008 will be made available on the Web: *http://www.eere.energy.gov/buildings/appliance_standards/commercial/beverage_machines.html*.

h. Repair Costs

The equipment repair cost is the cost to the customer of replacing or repairing failed components in the beverage vending machine. DOE based the annualized repair cost for baseline efficiency equipment on the following equation:

$$RC = k \times EQP/LIFE$$

Where:

RC = repair cost in dollars,
k = fraction of equipment price (estimated to be 0.5),
EQP = baseline equipment price in dollars, and
LIFE = average lifetime of the equipment in years (estimated to be 14 years).

Because data were unavailable on how repair costs vary with equipment efficiency, DOE held repair costs constant as the default scenario for the LCC and PBP analyses.

i. Maintenance Costs

DOE estimated the annualized maintenance costs for beverage vending machines from data provided by Foster-Miller, Inc. (2002). The report by Foster-Miller provides estimates on the person-hours, labor rates, and materials required for routine preventive maintenance of beverage vending machines. DOE adjusted the total annual maintenance cost and used a single figure of $31.37/year (2007$) for preventive maintenance for all beverage vending machine classes. In addition to routine maintenance, industry contacts stated that most beverage vending machines are fully refurbished every three to five years at an average cost of approximately $930. DOE calculated the annual cost of refurbishment by assuming two refurbishments (one in year 4 and another in year 8) and then annualizing the present value of the cost using the discount rate that applied to the business type assumed to own the beverage vending machine. DOE added the two maintenance components together to produce an overall annual maintenance cost of $165.44 (2007$). Because data are not available for how maintenance costs vary with equipment efficiency, DOE held maintenance costs constant even as equipment efficiency increased. DOE seeks feedback on the frequency of refurbishment cycles, its assumptions regarding constant maintenance costs, and how changes to the machines might affect energy use in the field. Section IV.E of this ANOPR discusses this subject, identified as Issue 3 under ''Issues on Which DOE Seeks Comment.''

j. Lifetime

DOE defines ''lifetime'' as the age when a beverage vending machine is retired from service. Based upon discussions with industry experts and other stakeholders, DOE concluded that a typical equipment lifetime of 14 years is appropriate for beverage vending machines. As described earlier, beverage vending machines are refurbished every three to five years, and they are usually completely replaced after two rounds of refurbishment (by which time they are typically obsolete or physically worn out). Chapter 3 of the TSD, market and technology assessment, contains a discussion of equipment life data and the sources of such data.

k. Discount Rate

The ''discount rate'' is the rate at which future expenditures are discounted to establish their present value. DOE received comments on the development of discount rates for this rulemaking at the Framework public meeting. Specifically, EEI stated that in terms of average cost of capital and discount rates, DOE should account for the rise in U.S. interest rates over the past few years. EEI also stated that DOE should determine how many vending machine owners are small businesses, which may have higher costs of capital and, therefore, higher discount rates. (EEI, No. 12 at p. 7) The following explains DOE's approach to discount rates for this rulemaking in light of these comments.

DOE derived discount rates for the LCC analysis by estimating the cost of capital for companies that purchase beverage vending machines. The cost of capital is commonly used to estimate the present value of cash flows to be derived from a typical company project or investment. For most companies, the cost of capital is the weighted average of the cost to the company of equity and debt financing. DOE estimated the cost of equity financing with the Capital Asset Pricing Model (CAPM), among the most widely used models to estimate such costs. CAPM considers the cost of equity to be proportional to the amount of systematic risk for a company. The cost of equity financing tends to be high when a company faces a large degree of systematic risk and low when the company faces a small degree of systematic risk.

To estimate the weighted average cost of capital (WACC; defined as the weighted average cost of debt and equity financing) of purchasers, DOE used a sample of companies involved in the six ownership categories, according to their type of activity. DOE sought financial information for all of the firms in the full sample involved in the seven types of business drawn from a database of 7,687 U.S. companies on the Damodaran Online Web site.[44] This resulted in a sample of about 6,661 firms. In cases where one or more of the variables needed to estimate the discount rate was missing or could not be obtained, DOE discarded the firm from the analysis. Overall, it discarded about 36 percent of the firms in the full database for this reason, resulting in a final count of 4,240 firms. The WACC approach for determining discount rates accounts for the current tax status of individual firms on an overall corporate basis. DOE did not evaluate the marginal effects of increased costs, and thus depreciation due to more expensive equipment, on the overall tax status.

DOE used the final sample of 4,240 companies to represent beverage vending machines purchasers. For each company in the sample, DOE derived the cost of debt, percent debt financing, and systematic company risk from information on the Damodaran Online Web site. Damodaran estimated the cost of debt financing from the long-term government bond rate (4.39 percent) and the standard deviation of the stock price. DOE then determined the weighted average values for the cost of debt, range of values, and standard deviation of WACC for each category of the sample companies. Deducting expected inflation from the cost of capital provided estimates of real discount rate by ownership category.

The above methodology yielded the following average after-tax discount rates, weighted by the percentage shares of total purchases of beverage vending machines: (1) 5.08 percent for bottlers and distributors; (2) 6.04 percent for manufacturing facilities; (3) 5.07 percent for office and health care businesses; (4) 5.98 percent for retail stores; (5) 2.20 percent for schools and colleges; (6) 2.89 percent for military bases; and (7) 4.98 percent for all other types of businesses.[45]

l. Rebound Effect

A ''rebound effect'' occurs when a piece of equipment that is made more efficient is used more intensively, so that the expected energy savings from the efficiency improvement do not fully materialize. Because beverage vending machines operate on a 24-hour basis to maintain adequate conditions for the merchandise being retailed, a rebound effect resulting from increased refrigeration energy consumption seemed unlikely. Thus, there is no rebound effect to be accounted for in the LCC analysis.

m. Effective Date

For purposes of this discussion, the ''effective date'' is the future date when a new standard becomes operative (i.e., the date by and after which beverage vending machine manufacturers must manufacture equipment that complies with the standard). DOE publication of a final rule in this standards rulemaking is required by August 8, 2009. Pursuant to section 42 U.S.C. 6295(v)(3), as amended by EPACT 2005, the effective date of any new energy conservation standard for beverage vending machines must be three years after the final rule is published. DOE calculated LCC for commercial customers, based upon an assumption that each would purchase the new equipment in the year the standard takes effect.

3. Split Incentive Issue

DOE mentioned the ''split incentive issue'' in the Framework public meeting when discussing distribution channels for beverage vending machines sold directly to the bottler or a vending machine operator. The bottler or the vending machine operator installs these machines at different business sites through a ''location contract,'' maintains and stocks the machine, and receives a certain percentage of the coin-box revenue. The business site owner, in

[44] Damodaran Online, Leonard N. Stern School of Business, New York University. Available at: *http://www.stern.nyu.edu/~adamodar/New_Home_Page/data.html. (Accessed May 23, 2007.)*

[45] These discount rates are what private companies pay as beverage vending machine purchasers. Government agencies use three-percent and seven-percent discount rates for economic calculations.

this case, allows the machine to be placed on-site, receives a percentage of the coin-box revenue and/or other remuneration, and most relevant to this rulemaking, pays the electricity bill. In principle, the business site owner would be willing to accept a lower percentage of revenue for a machine that uses less electricity. However, where it is costly to renegotiate contracts, the incentive to purchase more-efficient machines may be lessened or eliminated. Nonetheless, there may be a growing market for energy-efficient beverage vending machines since environmentally-conscious beverage companies and bottlers are pushing to install energy-efficient machines on-site, and certain business site owners are demanding that energy-efficient machines be installed to reduce electricity costs.

At the Framework public meeting, Coca-Cola stated that it has ''full-service vending'' (a split-incentive) that allows a Coca-Cola bottler to buy the vending machine and give it to an operator. The operator may or may not pay some or all of the energy costs, depending on its contract with the customer. (Public Meeting Transcript, No. 8 at p. 190) Meanwhile, EEI stated that information about distribution channels and machine contracts would be important for the LCC analysis. EEI explained that unless there is a provision in the contract for energy costs, there will be a split incentive for site owners. (EEI, No. 12 at p. 5).

In response, DOE agrees that split incentive is a critical issue to consider in the LCC analysis. DOE will assume that operating cost savings due to energy cost savings are transferred to the owner/operator of the beverage vending machine through the coin-box revenue contract. This assumption not only addresses the split incentive issue but also will result in the highest energy savings for the minimum LCC and the lowest total LCC. DOE will also conduct limited sensitivity analyses of alternate scenarios to explore how the LCC savings might change as the site owner retains some fraction (e.g., 50 percent) of the operating cost savings.

4. Payback Period

The PBP is the amount of time it takes the customer to recover the incrementally higher purchase cost of more energy-efficient equipment as a result of lower operating costs (i.e., through energy cost savings). Payback analysis is a technique used to obtain a rough indication of whether an investment is worthwhile. Numerically, the PBP is the ratio of the increase in purchase cost (i.e., from a less-efficient design to a more-efficient design) to the decrease in annual operating expenditures. This type of calculation is known as a ''simple PBP,'' because it does not take into account other changes in operating expenses over time or the time value of money.

The equation for PBP is:

$$PBP = \Delta IC / \Delta OC$$

Where:

PBP = payback period in years,
ΔIC = difference in the total installed cost between the more-efficient standard level equipment (energy consumption levels 2, 3, etc.) and the baseline (energy consumption level 1) equipment, and
ΔOC = difference in annual operating costs.

PBPs are expressed in years. If the PBP is greater than the life of the equipment, then the increased total installed cost of the more-efficient equipment would not be recovered in reduced operating costs. The PBP thus calculated differs from the rebuttable presumption payback calculation discussed in Section II.F in that it includes repair and maintenance costs, which are part of the annual operating costs.

The data inputs to PBP analysis are the total installed cost of the equipment to the customer for each energy consumption level and the annual (first year) operating costs for each energy consumption level. The inputs to the total installed cost are the equipment price and the installation cost. The inputs to the operating costs are the annual energy cost, the annual repair cost, and the annual maintenance cost. The PBP uses the same inputs as the LCC analysis, except that electricity price trends and discount rates are not required. Since the PBP is a simple (undiscounted) payback, the required electricity cost is only for the year in which a new energy conservation standard is to take effect—in this case, 2012. The electricity price used in the PBP calculation of electricity cost was the price projected for 2012, expressed in 2007$, but not discounted to 2007. Discount rates are not used in the PBP calculation.

PBP is one of the economic indicators that DOE uses when assessing economic impact to a customer. As expressed above, PBP does not take into account the time value of money explicitly (e.g., through a discount factor), the life of the efficiency measure, or changing fuel costs over time. In addition, because PBP takes into account the cumulative energy and first-cost impact of a set of efficiency measures, it can be sensitive to the baseline level assumed. In addition, what is deemed an acceptable payback period can vary. By contrast, when examining LCC savings by efficiency levels, there is generally a maximum LCC savings point (minimum LCC efficiency level) indicative of maximum economic benefit to the customer. The selection of the baseline efficiency level does not effect the identification of the minimum LCC efficiency level, although a baseline efficiency is used when calculating net LCC savings or costs. DOE considers both LCC and PBP as related to the seven factors discussed in Section I.C to determine whether a standard is economically justified and whether the benefits of an energy conservation standard will exceed its burdens to the greatest extent practicable. However, because LCC uses a range of discount rates (that depend on customers' cost of financing), takes into account changing energy prices, and does not require selection of a baseline efficiency level, it is given greater weight in DOE decision-making.

5. Life-Cycle Cost and Payback Period Results

This section presents the LCC and PBP results for the energy consumption levels analyzed for this ANOPR. While both types of indicators of cost-effectiveness will be considered by DOE, greater weight is usually given to the LCC savings results because they account for customer discount rates and changing energy prices. Because the values of most inputs to the LCC analysis are uncertain, DOE represents them as a distribution of values rather than a single-point value. Thus, DOE derived the LCC results also as a distribution of values. For example, the difference in LCC for the different efficiency levels from the baseline efficiency level (Level 1 in this case) can be provided by percentiles of distribution of values as shown in Table II.10.

Chapter 8 and Appendix F of the TSD provide a summary of the change in LCC from the baseline efficiency level (Level 1 in this case) by percentile groupings of the distribution of results for each equipment class. Table II.10 provides an example of such LCC changes for a portion of one equipment class (B–L–IO). Table II.10 also shows the mean LCC savings and the percent of units with LCC savings at each efficiency level.

TABLE II.10.—DISTRIBUTION OF LIFE-CYCLE COST SAVINGS FROM A BASELINE LEVEL (LEVEL 1) BY EFFICIENCY LEVEL FOR THE CLASS B LARGE INDOOR/OUTDOOR (B–L–IO) EQUIPMENT CLASS

Efficiency level	Decrease in LCC from baseline (level 1) shown by percentiles of the distribution of results (2007$)											Mean savings	Percent of units with LCC savings
	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%		
Level 2	$32	$123	$149	$175	$200	$223	$251	$279	$314	$374	$693	$239	100
Level 3	31	158	198	236	271	306	347	389	440	529	978	329	100
Level 4	17	174	224	272	318	362	415	468	535	649	1,215	392	100
Level 5	−83	65	121	167	218	265	325	375	448	568	1,189	298	97
Level 6	−123	59	129	187	252	311	386	451	542	692	1,494	352	97
Level 7	−136	45	117	175	240	300	377	441	533	686	1,501	341	95
Level 8	−1,304	−1,115	−1,045	−989	−935	−892	−833	−766	−672	−524	339	849	1

The following example explains how to interpret the information in Table II.10. The row concerning Efficiency Level 4 in Table II.10 (row 3) shows that the minimum change in LCC for this Efficiency Level for B–L–IO equipment is a savings of $17 (zero percentile column). In other words, all beverage vending machines of this type would have an LCC savings at Efficiency Level 4. For 90 percent of the cases studied (90th percentile), the change in LCC is a reduction of $649 or less. The largest reduction in LCC is $1,215 (100th percentile). The mean change in LCC is a net savings of $392. The last column shows that 100 percent of the sample machines have LCC savings (i.e., reductions in LCC greater than zero) when compared to the baseline efficiency level.

Table II.11 provides the national average life-cycle cost savings calculated for each efficiency level when compared to the baseline efficiency (Level 1) for all three machine sizes in each of the two equipment classes. Review of Table II.11 shows that most of the efficiency levels analyzed generated national average life-cycle cost savings compared with the baseline efficiency level.

TABLE II.11.—AVERAGE LIFE-CYCLE COST SAVINGS FROM A BASELINE EFFICIENCY LEVEL (LEVEL 1) BY EFFICIENCY LEVEL AND EQUIPMENT CLASS

Equipment class	National average LCC savings (2007$)							
	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8
B–L–IO	0	239	329	392	298	352	341	−849
B–M–IO	0	240	313	370	272	320	307	−779
B–S–IO	0	238	296	318	290	253	238	−683
A–L–IN	0	148	259	348	373	369	194	−774
A–M–IN	0	144	242	326	343	338	187	−722
A–S–IN	0	139	238	316	326	319	171	−574

DOE seeks feedback on the validity of selecting Level 1 (which is the same level as ENERGY STAR Tier 1) as the baseline for the LCC analysis. Since more-efficient equipment is available in the market, DOE seeks input on whether a distribution of efficiencies should be used for the LCC analysis baseline instead of a single efficiency level, and if so, what data could be used to populate this distribution. Section IV.E of this ANOPR discusses this subject, identified as Issue 4 under ''Issues on Which DOE Seeks Comment.''

Table II.12 provides summary PBP results for each efficiency level for B–L–IO equipment as an example. Results are summarized for PBP by percentile groupings of the distribution of results. The chart also shows the mean PBP for each efficiency level.

TABLE II.12.—SUMMARY OF PAYBACK PERIOD RESULTS FOR CLASS B, LARGE INDOOR/OUTDOOR (B–L–IO) EQUIPMENT

Efficiency level	Payback period in years shown by percentiles of the distribution of results											Mean PBP
	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
Level 2	0.3	0.4	0.5	0.6	0.6	0.7	0.7	0.8	0.9	1.1	1.6	0.7
Level 3	0.4	0.7	0.7	0.9	1.0	1.0	1.1	1.2	1.4	1.6	2.4	1.1
Level 4	0.5	0.9	1.0	1.2	1.3	1.4	1.5	1.7	1.9	2.3	3.5	1.5
Level 5	1.1	2.0	2.3	2.7	3.0	3.3	3.6	4.1	4.7	5.6	9.7	3.6
Level 6	1.1	2.2	2.5	2.9	3.3	3.6	3.9	4.4	5.1	6.2	10.9	3.9
Level 7	1.2	2.3	2.6	3.1	3.4	3.8	4.1	4.7	5.4	6.5	11.8	4.1
Level 8	6.6	18.2	26.0	37.2	55.5	85.5	100.0	100.0	100.0	146.6	4,808.0	122.9

Table II.13 provides the national average payback calculated for each efficiency level when compared to the baseline efficiency level (Level 1) for all three machine sizes of the two equipment classes. Table II.13 also shows the percentage of units that would have PBPs of less than three years (i.e., the rebuttable presumption

PBP for economic justification under 42 U.S.C. 6295(o)(2)(B)(iii)). The results of the analysis show that purchases of more-efficient machines would result in PBPs (when compared to the purchase of baseline efficiency units) of about six years or less (often substantially less) for all but the most efficient machines analyzed for both equipment classes.

TABLE II.13.—NATIONAL AVERAGE PAYBACK PERIODS BY EFFICIENCY LEVEL AND EQUIPMENT CLASS

Equipment Class	National average payback period (years)							
	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8
B–L–IO	NA	0.7	1.1	1.5	3.6	3.9	4.1	122.9
B–M–IO	NA	0.7	1.1	1.6	3.8	4.1	4.4	112.3
B–S–IO	NA	0.7	1.3	1.8	3.6	4.8	5.1	198.0
A–L–IN	NA	1.1	1.4	1.6	2.1	2.3	6.3	145.4
A–M–IN	NA	1.1	1.5	1.7	2.3	2.5	6.1	347.9
A–S–IN	NA	1.2	1.4	1.7	2.2	2.4	6.1	75.4
Percent of Units With Payback Period of Less Than Three Years								
B–L–IO	NA	100	100	99	39	35	25	0
B–M–IO	NA	100	100	99	37	25	23	0
B–S–IO	NA	100	100	93	39	21	19	0
A–L–IN	NA	100	99	99	87	81	3	0
A–M–IN	NA	100	99	97	83	77	5	0
A–S–IN	NA	100	99	99	85	77	5	0

The PBPs shown in Table II.13 and the rebuttable PBPs shown in Table II.8 account for the cumulative impact of all technologies used in a design option to reach a specific energy efficiency level when compared to the baseline equipment. Every design option is made up of a mix of technologies, some of which may have relatively short PBPs and others that may have relatively longer PBPs, if considered separately. For this reason, the choice of baseline efficiency level affects the PBP for more-efficient machines. The LCC spreadsheet allows the user to select alternate baseline efficiency levels for each equipment class and to calculate the LCC savings and PBP for all higher levels compared to the selected baseline. See Chapter 8 and Appendix F of the TSD for additional details on the LCC and PBP analyses.

H. Shipments Analysis

This section presents DOE's shipments analysis, which is an input to the NIA (Section II.I) and MIA (Section II.K). DOE will undertake revisions to the NIA and conduct the final MIA after the ANOPR is published, and then report the results of both in the NOPR.

The results of the shipments analysis are driven primarily by historical shipments data for the two equipment classes of beverage vending machines under consideration. The model estimates that, in each year, equipment in the existing stock of beverage vending machines either ages by one year or is worn out and replaced. In addition, new equipment can be shipped into new commercial building floor space, and old equipment can be removed through demolitions. DOE chose to analyze all efficiency levels analyzed in the LCC in the NIA. Because DOE is assessing impacts and presuming each level analyzed represents a possible standard level, DOE refers to the efficiency levels analyzed in the NIA as candidate standard levels (CSLs). DOE determined shipments forecasts for all of the CSLs analyzed in the NIA and NPV analysis.

According to an analysis of the beverage vending machine market,[46] there were about 3.67 million beverage vending machines in the United States in 2005. Industry estimates that about 5 percent of these units are Class A machines intended for indoor use only, while 95 percent are Class B machines intended for either indoor or outdoor use. Annual shipments have decreased from about 338,000 in 2000 to less than 100,000 in 2006. DOE estimates that total 2006 shipments were about 67,000 units. The industry estimates that about 10 percent of units shipped were Class A units, while 90 percent of units shipped are Class B machines intended for either indoor or outdoor use. (NAMA, No. 17 at p. 3).

DOE was not able to locate any market data concerning shipments by machine size (i.e., vendible capacity); therefore, the shipments analysis focused on the three sizes (small, medium, and large) believed to be typical and which were analyzed in the preceding LCC and PBP analyses. DOE assumed that each size is about one-third of the market for Class A units and translated the three sizes to the corresponding vendible capacity. Under this approach, the large-size Class A machine would correspond to having a vendible capacity of 410 12-ounce cans, the medium-size Class A machine would have a capacity of 350 cans, and the small-size Class A machine would have a capacity of 270 cans. Similarly, DOE assumed that each size is about one-third of the market for Class B units. Under this approach, the large-size Class B machine would have a vendible capacity of 800 cans, the medium-size Class B machine would have a capacity of 650 cans, and the small-size Class B machine would have a capacity of 450 cans.

Because several different types of businesses own beverage vending machines and use them in a variety of locations, machines are divided into several market segments. Table II.14 gives the business locations and the approximate size of the market segments from 2002 to 2005.

[46] Automatic Merchandiser, *State of the Vending Industry Report* (August 2006). Available at: *www.AMonline.com.*

TABLE II.14.—MARKET SEGMENTS FOR THE BEVERAGE VENDING MACHINES (2002–2005)

Business location	Percent of machines	Ownership	Percent of machines
Manufacturing	30.4	Bottlers and Vendors	75.0
Offices	23.1	Business-Owned	25.0
Retail	13.6	Manufacturing	7.6
Schools/Colleges	13.0	Offices and Health Care	7.3
Health Care	6.1	Retail, Restaurants, Bars, and Clubs	4.1
Hotels/Motels	3.0	Schools, Colleges, and Public Facilities (including correctional).	3.8
Restaurants/Bars/ Clubs	2.6	Military Bases	0.5
Correctional Facilities	2.3	Other (including hotels/motels)	1.8
Military Bases	1.9	Subtotal, Business Owned	25.0
Other	4.0		
Total	100.0	Total	100.0

Source: State of the Vending Industry (2006).

Table II.15 shows the forecasted shipments of the three typical sizes of beverage vending machines for Class A and Class B units for selected years, and cumulatively, between 2012 and 2042. As equipment purchase price increases with higher efficiency levels, a drop in shipments could occur relative to the base case. On the other hand, as annual energy consumption is reduced, equipment sales could increase due to more frequent installations and use of beverage vending machines by retailers. DOE has no information by which to calibrate either such relationship. Therefore, although the spreadsheet allows for changes in projected shipments in response to efficiency level increases or energy consumption level decreases, for the ANOPR analysis, DOE presumed that the shipments would not change in response to the changing CSLs. Table II.15 also shows the cumulative shipments for the 31-year period between 2012 and 2042 for all beverage vending machines. Because there has been a decrease in shipments from 2000 to 2006 and as more and more units are retired, there has to be an increase in future shipments to replenish the existing stock of equipment. Chapter 9 of the TSD provides additional details on the shipments analysis.

TABLE II.15.—FORECASTED SHIPMENTS FOR BEVERAGE VENDING MACHINES (BASELINE EFFICIENCY, LEVEL 1)

Equipment class	Year (thousands of units shipped)								
	2012	2015	2020	2025	2030	2035	2040	2042	Cumulative shipments (2012–2042)
A–L–IN	7.7	7.6	7.9	8.3	8.8	9.2	9.7	9.9	265.9
A–M–IN	7.7	7.6	7.9	8.3	8.8	9.2	9.7	9.9	265.9
A–S–IN	7.7	7.6	7.9	8.3	8.8	9.2	9.7	9.9	265.9
B–L–IO	77.6	77.0	79.8	84.2	88.8	93.4	98.4	100.5	2,688.3
B–M–IO	77.6	77.0	79.8	84.2	88.8	93.4	98.4	100.5	2,688.3
B–S–IO	77.6	77.0	79.8	84.2	88.8	93.4	98.4	100.5	2,688.3

I. National Impact Analysis

The NIA assesses cumulative national energy savings (NES) and the cumulative national economic impacts of candidate standard levels. The analysis measures economic impacts using the NPV metric (i.e., future amounts discounted to the present) of total commercial customer costs and savings expected to result from new standards at specific efficiency levels. For a given CSL, DOE calculated the NPV, as well as the NES, as the difference between a base-case forecast and the standards-case forecasts. Chapter 10 of the TSD provides additional details on the national impacts analysis for beverage vending machines.

For each year of the analysis, the beverage vending machine stock is composed of units shipped in previous years (or vintages). Each vintage has a characteristic distribution of efficiency levels. DOE first determined the average energy consumption of each vintage in the stock accounting for all efficiency levels in that vintage. The national annual energy consumption is then the product of the annual average energy consumption per beverage vending machine at a given vintage and the number of beverage vending machines of that vintage in the stock for the particular year. This approach accounts for differences in unit energy consumption from year to year. Annual energy savings are calculated for each standard level by subtracting national energy consumption for that standard level from that calculated for the baseline. Cumulative energy savings are the sum of the annual NES over the period of analysis.

In a similar fashion, DOE tracks the first costs for all equipment installed at each efficiency level for each vintage. It also tracks the annual operating cost (sum of the energy, maintenance, and repair costs) by vintage for all equipment remaining in the stock for each year of the analysis. DOE then calculates the net economic savings each year as the difference between total operating cost savings and increases in the total installed costs (which consist of manufacturer selling price, sales tax, and installation cost). The NPV is the annual net cost savings calculated for each year, discounted to the year 2012, and expressed in 2007$. Cumulative NPV savings reported are the sum of the annual NPV over the analysis period.

1. Approach

Over time, in the standards case, more-efficient equipment gradually replaces less-efficient equipment. This affects the calculation of both the NES and NPV, both of which are a function of the total number of units in use and their efficiencies and thus depend on annual shipments and the lifetime of equipment. Both calculations start by using the estimate of shipments and the quantity of units in service, which are derived from the shipments model. As more-efficient beverage vending machines gradually replace less-efficient ones, the energy per unit of capacity that beverage vending machines in service use gradually decreases in the standards case relative to the base case, leading to an estimate of NES.

To estimate the total energy savings for each candidate efficiency level, DOE first calculated the national site energy consumption [47] for beverage vending machines each year, beginning with the expected effective date of the standards (i.e., 2012). DOE did this calculation for both the base-case forecast and the standards-case forecast. Second, DOE determined the annual site energy savings, which is the difference between site energy consumption in the base case and in the standards case. Third, DOE converted the annual site energy savings into the annual amount of energy saved at the source of electricity generation (the source energy). Then, DOE summed the annual source energy savings from 2012 to 2042 to calculate the total NES for that period. DOE performed these calculations for each CSL.

2. Base-Case and Standards-Case Forecasted Efficiencies

A key component of DOE's estimates of NES and NPV are the energy efficiencies for shipped equipment that it forecasts over time for the base case (without new standards) and for each of the standards cases. The forecasted efficiencies represent the distribution of energy efficiency of the equipment under consideration that is shipped over the forecast period (i.e., from the assumed effective date of a new standard to 30 years after the standard becomes effective). Because key inputs to the calculation of the NES and NPV depend on the estimated efficiencies, they are of great importance to the analysis. In the case of the NES, the per-unit annual energy consumption is a direct function of efficiency. Regarding the NPV, the per-unit total installed cost and the per-unit annual operating cost both depend on efficiency. The per-unit total installed cost is a direct function of efficiency. Increased efficiency results in reduced energy consumption which results in reduced energy costs. However, the maintenance cost portion of the operating cost may go up and hence, the per-unit annual operating cost is an indirect function of the equipment efficiency.

The annual per-unit energy consumption is the average energy consumed by a beverage vending machine in a year as determined in the energy use characterization (see Chapter 7 of the TSD). The annual energy consumption is directly tied to the efficiency of the unit. DOE determined annual forecasted market shares by efficiency level that, in turn, enabled a determination of shipment-weighted annual national average energy consumption values. At the Framework public meeting, several manufacturers and ACEEE offered their estimates of shipments of new beverage vending machines that would meet ENERGY STAR levels by 2012. ACEEE also stated that virtually 100 percent of all beverage vending machines will meet Tier 1 levels, and it further expects that 100 percent of the indoor-outdoor zone-cooled (Class B) machines would meet Tier 2 levels. (ACEEE, No. 13 at p. 4) Dixie-Narco estimated that 100 percent of new equipment would meet Tier 1, and about 75 percent would meet Tier 2 levels in 2012. (Dixie-Narco, No. 14 at p. 7). Based on these comments, DOE assumed for purposes of its analyses that 100 percent of beverage vending machine shipments will meet ENERGY STAR Tier 1 level and that about 55 percent of shipments will meet Tier 2 level by 2012.

Because no data were available on market shares broken down by efficiency level, DOE developed estimates. First, DOE converted 2005 shipment information by equipment class into market shares by equipment class, and then adapted a cost-based method similar to that used in the NEMS to estimate market shares for each equipment class by efficiency level. This cost-based method relied on cost data developed in the engineering and life-cycle cost analyses, as well as economic purchase criteria data taken directly from NEMS. From those market shares and shipment projections, DOE developed the future efficiency scenarios for a base case (i.e., without new standards) and for various standards cases (i.e., with new standards).

DOE developed base-case efficiency forecasts based on the estimated market shares by equipment class and efficiency level. Because there are no historical data to indicate how equipment efficiencies or relative equipment class preferences have changed over time, DOE assumed that forecasted market shares would remain frozen at the 2012 efficiency level until the end of the forecast period (30 years after the effective date or 2042). Realizing that this prediction likely overstates the estimates of savings associated with these efficiency standards, DOE seeks comment on this assumption and the potential significance of the overestimate. In particular, DOE requests data that would help characterize the likely increases in efficiency that would occur over the 30-year modeling period in absence of a standard.

For its estimate of standards-case forecasted efficiencies, DOE used a "roll-up" scenario to establish the market shares by efficiency level for the year that standards become effective (i.e., 2012). Information available to DOE suggests that equipment shipments with efficiencies in the base case that did not meet the standard level under consideration would roll up to meet the new standard level. Also, DOE assumed that all equipment efficiencies in the base case that were above the standard level under consideration likely would not be affected.

DOE seeks feedback on how it predicts base-case and standards-case efficiencies, and how standards affect efficiency distributions. Section IV.E of this ANOPR discusses this subject, identified as Issue 5 under "Issues on Which DOE Seeks Comment." DOE also seeks feedback on whether higher standard levels in specific equipment classes are likely to cause beverage vending machine customers to shift to less-efficient equipment classes. Section IV.E of this ANOPR discusses this subject, identified as Issue 6 under "Issues on Which DOE Seeks Comment."

3. National Impact Analysis Inputs

DOE used the difference in shipments by equipment efficiency level between the base case and standards cases to determine the reduction in per-unit annual energy consumption that could result from new standards. The beverage vending machine stock in a given year is the total number of beverage vending machines shipped from earlier years that survive in the given year. The NES

[47] "Site energy" is the energy directly consumed by the units in operation.

spreadsheet model tracks the total number of beverage vending machines shipped each year. For purposes of the ANOPR NES and NPV analyses, DOE assumed that retirements follow a Weibull form of statistical distribution with a 14-year average lifetime for beverage vending machines. Retirements for any given vintage build to about eight percent per year by year 7, then tail off gradually to less than one percent per year by year 20. Retired units are replaced until 2042. For units shipped in 2042, any units still remaining at the end of 2062 are replaced.

The site-to-source conversion factor is the multiplicative factor used for converting site energy consumption (expressed in kWh) into primary or source energy consumption (expressed in quads (quadrillion Btu)). DOE used annual site-to-source conversion factors based on U.S. average values for the commercial sector, calculated from *AEO2007*, Table A5. The average conversion factors vary over time, due to projected changes in electricity generation sources (i.e., the power plant types projected to provide electricity to the country).

To estimate NPV, DOE calculated the net impact each year as the difference between total operating cost savings (including electricity, repair, and maintenance cost savings) and increases in total installed costs (consisting of MSP, sales taxes, distribution channel markups, and installation cost). DOE calculated the NPV of each CSL over the life of the equipment using three steps. First, DOE calculated the difference between the equipment costs under each CSL and the base case to determine the net equipment cost increase resulting from each CSL. Second, DOE calculated the difference between the base-case operating costs and the operating costs at each CSL to determine the net operating cost savings from each CSL. Third, DOE calculated the difference between the net operating cost savings and the net equipment cost increase to determine the net savings (or expense) for each year. DOE then discounted the annual net savings (or expenses) for beverage vending machines purchased on or after 2012 to 2007$, and summed the discounted values to arrive at the NPV of a CSL. An NPV greater than zero shows net savings (i.e., the CSL would reduce overall customer expenditures relative to the base case in present-value terms). An NPV less than zero indicates that the CSL would result in a net increase in customer expenditures in present-value terms. Table II.16 summarizes the NES and NPV inputs to the NES spreadsheet model, and briefly describes the data source for each input.

TABLE II.16.—NATIONAL ENERGY SAVINGS AND NET PRESENT VALUE INPUTS

Input data	Description
Shipments	Annual shipments from shipments model (see Chapter 9 of the TSD, Shipments Analysis).
Effective Date of Standard	2012.
Base-Case Efficiencies	Distribution of base-case shipments by efficiency level.
Standards-Case Efficiencies	Distribution of shipments by efficiency level for each standards case. Standards-case annual market shares by efficiency level remain constant over time for the base case and each standards case.
Annual Energy Consumption per Unit	Annual weighted-average values are a function of energy consumption level per unit, which are established in the Energy Use Characterization (Chapter 7 of the TSD).
Total Installed Cost per Unit	Annual weighted-average values are a function of energy consumption level (see Chapter 8 of the TSD).
Repair Cost per Unit	Annual weighted-average values increase with manufacturer's cost level (see Chapter 8 of the TSD).
Maintenance Cost per Unit	Annual weighted-average value equals $165.44 (see Chapter 8 of the TSD).
Escalation of Electricity Prices	EIA *AEO2007* forecasts (to 2030) and extrapolation beyond 2030 (see Chapter 8 of the TSD).
Electricity Site-to-Source Conversion	Conversion varies yearly and is generated by DOE/EIA's NEMS * model (a time-series conversion factor that includes electric generation, transmission, and distribution losses).
Discount Rate	3% and 7% real.
Present Year	Future costs are discounted to 2008.
Rebound Effect	As explained in the LCC inputs section, DOE does not anticipate unit energy consumption rebounding above the levels used in the LCC analysis and passed to the NIA analysis. Further, the shipments model develops shipment projections in order to meet historical market saturation levels. The shipment model does not further adjust shipments as a function of unit energy consumption levels, because DOE has no information by which to calibrate such a relationship.

* Chapter 13 (utility impact analysis) and Chapter 14 (environmental assessment) provide more detail on NEMS.

4. National Impact Analysis Results

Table II.17 presents the cumulative NES results for the CSLs analyzed for three sizes of each equipment class of beverage vending machines. Results are cumulative to 2042 and are shown as primary energy savings in quads. Inputs to the NES spreadsheet model are based on weighted-average values, yielding results that are discrete point values, rather than a distribution of values as in the LCC analysis. DOE based all the results on electricity price forecasts from the *AEO2007* reference case. The range of overall cumulative energy impacts for standards above the baseline efficiency level (Level 1) is from 0.006 quad (Class A machines) and 0.048 quad (Class B machines) for a standard established at Level 2, to 0.036 quad (Class A machines) and 0.351 quad (Class B machines) at the max tech efficiency level (Level 8).

TABLE II.17.—CUMULATIVE NATIONAL ENERGY SAVINGS FOR BEVERAGE VENDING MACHINES (2012–2042) (QUADS)

Equipment class	National energy savings (Quads) by candidate standard level						
	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8
Class A	0.006	0.011	0.018	0.023	0.023	0.031	0.036

TABLE II.17.—CUMULATIVE NATIONAL ENERGY SAVINGS FOR BEVERAGE VENDING MACHINES (2012–2042) (QUADS)—Continued

Equipment class	National energy savings (Quads) by candidate standard level						
	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8
Class B	0.048	0.106	0.181	0.222	0.234	0.300	0.351

Below are the NPV results for the CSLs DOE considered for the three sizes of each of the two equipment classes of beverage vending machines. Results are cumulative and shown as the discounted value at seven percent of these savings in present dollar terms. The present value of increased total installed costs is the total installed cost increase (i.e., the difference between the standards case and base case), discounted to 2007, and summed over the time period in which DOE evaluates the impact of standards (i.e., from the effective date of standards, 2012 to 2062 when the last beverage vending machine is retired).

Under the NPV analysis, savings represent decreases in operating costs (including electricity, repair, and maintenance) associated with the higher energy efficiency of beverage vending machines purchased in the standards case compared to the base case. Total operating cost savings are the savings per unit multiplied by the number of units of each vintage (i.e., the year of manufacture) surviving in a particular year. The beverage vending machine consumes energy and must be maintained over its entire lifetime. For units purchased in 2042, the operating cost includes energy consumed and maintenance and repair costs incurred until the last unit retires from service in 2062.

Table II.18 shows the NPV results for the CSLs for beverage vending machines based on a seven-percent discount rate. DOE based all results on electricity price forecasts from the *AEO2007* reference case. Appendix H of the TSD provides detailed results showing the breakdown of the NPV into national equipment costs and national operating costs. At a seven-percent discount rate, the maximum national NPV benefits calculated for different CSL scenarios above the baseline was about $30 million for Class A machines and about $280 million for Class B machines.

TABLE II.18.—CUMULATIVE NET PRESENT VALUE RESULTS BASED ON A SEVEN-PERCENT DISCOUNT RATE (BILLION 2007$) *

Equipment class	Standard level						
	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8
Class A	0.009	0.018	0.028	0.030	0.027	(0.009)	(0.221)
Class B	0.079	0.171	0.269	0.280	0.264	(0.081)	(1.916)

* Values in parentheses indicate negative NPV.

Table II.19 provides the NPV results based on the three-percent discount rate and electricity price forecasts from the *AEO2007* reference case. Appendix H of the TSD provides detailed results showing the breakdown of the NPV into national equipment costs and national operating costs based on a three-percent discount rate. At this rate, the maximum overall NPV benefits calculated for different CSL scenarios above the assumed baseline was $80 million for Class A machines and $764 million for Class B machines.

TABLE II.19.—CUMULATIVE NET PRESENT VALUE RESULTS BASED ON A THREE-PERCENT DISCOUNT RATE (BILLION 2007$) *

Equipment class	Standard level						
	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8
Class A	0.021	0.046	0.072	0.080	0.079	0.010	(0.419)
Class B	0.204	0.443	0.709	0.764	0.741	0.085	(3.654)

* Values in parentheses indicate negative NPV.

As discussed previously in Section II.E, roughly 25 percent of the Class B machines are used outdoors, and DOE assumes that all Class A machines are used indoors. To be thorough, DOE developed analytical tools with the capability of separately analyzing Class B machines certified for indoor use only and Class A machines certified for indoor/outdoor use. However, DOE was not able to locate any sales data for these two equipment markets, so sales are assumed to be zero and DOE did not report LCC or NIA results separately for these equipment markets.

J. Life-Cycle Cost Sub-Group Analysis

The LCC sub-group analysis evaluates impacts of standards on identifiable groups of customers, such as customers of different business types that may be disproportionately affected by a national energy conservation standards level. In the NOPR phase of this rulemaking, DOE will analyze the LCCs and PBPs for these customers, and determine whether they would be adversely affected by any of the CSLs.

Also, DOE plans to examine variations in energy prices and energy use that might affect the NPV of a standard to customer sub-populations. To the extent possible, DOE will obtain estimates of the variability of each input parameter and consider this variability in the calculation of customer impacts.

Variations in energy use for a particular equipment class may depend on factors such as climate and type of business.

DOE will determine the effect on customer sub-groups using the LCC spreadsheet model. The standard LCC analysis includes various customer types that use beverage vending machines. DOE can analyze the LCC for any sub-group, such as a particular type of school or institution, by using the spreadsheet model and sampling only that sub-group. Section II.G explains the details of this model. DOE will be especially sensitive to purchase price increases (''first-cost'' increases) to avoid negative impacts on identifiable population groups such as small businesses (*i.e.*, those with low annual revenues) that may not be able to afford a significant increase in the price of beverage vending machines. Some of these customers may retain equipment past its useful life. This older equipment is generally less efficient, and its efficiency may deteriorate further if it is retained beyond its useful life. Large increases in first cost also could preclude the purchase and use of equipment altogether, resulting in a potentially large loss of utility to the customer.

Although DOE does not know business income and annual revenues for the types of businesses analyzed in the LCC analysis, the floor space occupied by a business may be an indicator of annual income. If this proves true, DOE can perform sub-group analyses on smaller businesses. DOE can also use SBA data for businesses with 500 or fewer employees as a proxy for ''smaller businesses.''

K. Manufacturer Impact Analysis

The purpose of the manufacturer impact analysis is to identify the likely impacts of energy conservation standards on manufacturers. DOE has begun and will continue to conduct this analysis with input from manufacturers and other interested parties and apply this methodology to its evaluation of standards. DOE will also consider financial impacts and a wide range of quantitative and qualitative industry impacts that might occur following the adoption of a standard. For example, a particular standard level adopted by DOE could require changes to beverage vending machine manufacturing practices. DOE will identify and understand these impacts through interviews with manufacturers and other stakeholders during the NOPR stage of its analysis.

DOE announced changes to its process for the manufacturer impact analysis through a report submitted to Congress on January 31, 2006 (as required by section 141 of EPACT 2005), entitled ''Energy Conservation Standards Activities.'' Previously, DOE did not report any manufacturer impact analysis results during the ANOPR phase; however, under this new process, DOE has collected, evaluated, and reported preliminary information and data in the ANOPR (see Section II.K.6 of this ANOPR). Such preliminary information includes the anticipated conversion capital expenditures by efficiency level and the corresponding anticipated impacts on jobs. DOE solicited this information during the ANOPR engineering analysis manufacturer interviews and reported the results in the preliminary manufacturer impact analysis (see Chapter 12 of the TSD).

DOE conducts the manufacturer impact analysis in three phases, and then tailors the analytical framework based on public comments. In Phase I, DOE creates an industry profile to characterize the industry and conducts a preliminary manufacturer impact analysis to identify important issues that require consideration. The ANOPR TSD presents results of the Phase I analysis. In Phase II, DOE prepares an industry cash flow model and an interview questionnaire to guide subsequent discussions. In Phase III, DOE interviews manufacturers and assesses the impacts of standards both quantitatively and qualitatively. DOE uses the Government Regulatory Impact Model (GRIM) to assess industry and sub-group cash flow and net present value, and then assesses impacts on competition, manufacturing capacity, employment, and regulatory burden based on manufacturer interviews. The NOPR TSD presents results of the Phase II and Phase III analyses. For more detail on the manufacturer impact analysis, see Chapter 12 of the TSD.

1. Sources of Information for the Manufacturer Impact Analysis

Many of the analyses described above provide input data for the MIA. Such information includes manufacturing costs and prices from the engineering analysis, retail price forecasts, and shipments forecasts. DOE will supplement this information with company financial data and other information gathered during manufacturer interviews. This interview process plays a key role in the manufacturer impact analysis because it allows interested parties to privately express their views on important issues. To preserve confidentiality, DOE aggregates these perspectives across manufacturers, creating a combined opinion or estimate for DOE. This process enables DOE to incorporate sensitive information from manufacturers in the rulemaking process without specifying which manufacturer provided a certain set of data.

DOE conducts detailed interviews with manufacturers to gain insight into the range of potential impacts of standards. During the interviews, DOE typically solicits both quantitative and qualitative information on the potential impacts of efficiency levels on sales, direct employment, capital assets, and industrial competitiveness. DOE prefers interactive interviews, rather than written responses to a questionnaire, because DOE can clarify responses and identify additional issues. Before the interviews, DOE circulates a draft document showing the estimates of the financial parameters based on publicly-available information. DOE solicits comments and suggestions on these estimates during the interviews.

DOE asks interview participants to identify any confidential information that they have provided, either orally or in writing. DOE considers all information collected, as appropriate, in its decision-making process. However, DOE does not make confidential information available in the public record. DOE also asks participants to identify all information that they wish to have included in the public record, but do not want to have associated with their interview. DOE incorporates this information into the public record, but reports it without attribution.

DOE collates the completed interview questionnaires and prepares a summary of the major issues. For more detail on the methodology used in the manufacturer impact analysis, see Chapter 12 of the TSD.

2. Industry Cash Flow Analysis

The industry cash flow analysis relies primarily on the GRIM. DOE uses the GRIM to analyze the financial impacts of more stringent energy conservation standards on the industry. The GRIM analysis uses several factors to determine annual cash flows from a new standard: (1) Annual expected revenues; (2) manufacturer costs (including COGS, depreciation, research and development, selling, and general and administrative expenses); (3) taxes; and (4) conversion capital expenditures. DOE compares the GRIM results against base-case projections that involve no new standards. The financial impact of new standards is the difference between the two sets of discounted annual cash flows. For more information on the industry cash flow analysis, see Chapter 12 of the TSD.

3. Manufacturer Sub-Group Analysis

Industry-wide cost estimates are not adequate to assess differential impacts among sub-groups of manufacturers. For example, small and niche manufacturers, or manufacturers whose cost structure differs significantly from the industry average, could experience a more negative impact. Ideally, DOE would consider the impact on every firm individually; however, it typically uses the results of the industry characterization to group manufacturers exhibiting similar characteristics.

During the interviews, DOE will discuss the potential sub-groups and sub-group members it has identified for the analysis. DOE will encourage manufacturers to recommend sub-groups or characteristics that are appropriate for the sub-group analysis. For more detail on the manufacturer sub-group analysis, see Chapter 12 of the TSD.

4. Competitive Impacts Assessment

DOE must also consider whether a new standard is likely to reduce industry competition, and the Attorney General must determine the impacts, if any, of any reduced competition. DOE makes a determined effort to gather and report firm-specific financial information and impacts. The competitive analysis includes an assessment of the impacts on smaller manufacturers. DOE bases this assessment on manufacturing cost data and on information collected from interviews with manufacturers. The manufacturer interviews focus on gathering information to help assess asymmetrical cost increases to some manufacturers, increased proportions of fixed costs that could increase business risks, and potential barriers to market entry (e.g., proprietary technologies).

5. Cumulative Regulatory Burden

DOE recognizes and seeks to mitigate the overlapping effects on manufacturers of new or revised DOE standards and other regulatory actions affecting the same equipment. DOE will analyze and consider the impact on manufacturers of multiple, equipment-specific regulatory actions.

In the Framework Document, DOE asked what regulations or pending regulations it should consider in the analysis of cumulative regulatory burden. DOE stated it will study the potential impacts of these cumulative burdens in greater detail during the MIA conducted during the NOPR phase.

During the Framework comment period, several stakeholders commented on cumulative regulatory burden on beverage vending machine manufacturers. PepsiCo stated that the beverage vending machine rulemaking should not establish standards that interfere with other Federal requirements, such as those related to greenhouse gases and global warming. (Public Meeting Transcript, No. 8 at p. 147) Dixie-Narco stated that other regulatory burdens are Restriction of Hazardous Substance rules, California Energy Commission regulations, Natural Resources Canada regulations, and new State and municipality regulations. (Public Meeting Transcript, No. 8 at p. 256) Royal Vendors stated that coordination with the California Energy Commission's and Canadian Standards Association's regulations would reduce the burden on the industry. (Public Meeting Transcript, No. 8 at p. 273) USA Technologies stated that the current technology puts U.S. manufacturers at a disadvantage in relation to other nations as we look toward 2012. In addition, USA Technologies commented that DOE should be aware that the phaseout of refrigerants currently used in beverage vending machines will require a complete overhaul of current parameters, which will make DOE's current work obsolete. (USA Technologies, No. 9 at p. 1) EEI stated that, regarding cumulative regulatory burden, DOE should consider current, new, and upcoming regulations in Canada, Europe, and Mexico (along with any U.S. State regulations) that may affect the refrigerated vending machine industry. (EEI, No. 12 at p. 7) Dixie-Narco stated that other burdens include requirements set by specific customers (e.g., Coca-Cola company and PepsiCo) relating to performance, marketing, and merchandising of the equipment; Dixie-Narco also suggested that DOE should consider sanitary standards published by NAMA and the National Sanitation Foundation applicable to vending equipment. (Dixie-Narco, No. 14 at p. 4)

In response, DOE identified several regulations relevant to beverage vending machines through its own research and discussions with manufacturers, including existing or new standards for beverage vending machines, phaseout of HCFCs and foam insulation blowing agents, standards for other equipment made by beverage vending machine manufacturers, State energy conservation standards, and international energy conservation standards. See Chapter 12 of the TSD for more detail. DOE understands that complying with such regulations requires corporations to invest in both human and capital resources. In addition, the emphasis on cumulative regulatory burden in the comments submitted during the Framework comment period further highlights the importance of such regulations to stakeholders. DOE will consider the substantial impact of other regulatory programs, both domestic and international, on beverage vending machine manufacturers. As mentioned above, DOE will study the potential impacts of these cumulative burdens in greater detail in the MIA conducted during the NOPR phase. DOE invites additional comment and data from stakeholders and manufacturers on regulations applicable to beverage vending machine manufacturers that contribute to their regulatory burden.

6. Preliminary Results for the Manufacturer Impact Analysis

DOE received views from manufacturers through preliminary interviews about what they perceive to be the possible impact of new standards on profitability. They stated that a new energy conservation standard has the potential to affect financial performance in several ways. The capital investment needed to upgrade or redesign equipment and equipment platforms before they have reached the end of their useful life can require conversion costs that otherwise would not be expended, resulting in stranded investments. In addition, more stringent standards can result in higher per-unit costs that may deter some customers from buying higher-margin units with more features, thereby decreasing manufacturer profitability.

DOE estimates that a beverage vending machine production line would have a life cycle of approximately 5 to 10 years in the absence of standards. During that period, manufacturers would not make major equipment changes that alter the underlying platforms. Thus, a standard that took effect and resulted in a major platform redesign before the end of the platform's life would strand a portion of the earlier capital investments.

DOE asked manufacturers what level of conversion costs they anticipated if efficiency standards were to take effect. In general, manufacturers expected only conversion costs associated with redesigning insulation foaming fixtures. Manufacturers stated that no capital investments would be needed to go from ENERGY STAR Tier 1 to Tier 2. One manufacturer estimated the retooling capital investments needed to comply with efficiency levels beyond Tier 2 to be several million dollars. One manufacturer indicated that it would experience stranded assets if standards were too stringent and production facilities needed to be moved out of the country.

The impact of new energy conservation standards on employment is another important consideration in the rulemaking process. To assess how domestic employment patterns might be affected by new energy conservation standards for beverage vending machines, DOE posed several questions to manufacturers on that topic.

In response, some beverage vending machine manufacturers stated that they have considered moving their production out of the United States, primarily because of concerns about profitability and the opportunity for lower labor costs if future standards are too stringent. If manufacturers need to make large capital investments to produce redesigned platforms, they have strong financial incentives to invest in a location with lower labor costs. Mexico is the most common location for U.S. manufacturers to establish new production capacity since it offers low labor rates (relative to the United States) and proximity to the U.S. market.

DOE asked manufacturers to what degree they expect industry consolidation to occur in the absence of standards. Manufacturers stated that they expect no industry consolidation in the future. Three companies now account for a large majority of beverage vending machine sales. Historically, the beverage vending machine industry has not seen extensive consolidation, although there has been a lot of consolidation in recent years of the industry's customers, such as bottling companies.

Manufacturers also discussed how standards would affect their ability to compete. Some stated that new standards would not disproportionately advance or harm their competitive positions. Others stated that if a company had more available access to capital, that company might meet the standard at a lower cost or in a shorter timeframe, and such company would thus have a better competitive position and possibly gain market share. For more preliminary results of the manufacturer impact analysis, such as impacts on financial performance, equipment utility and performance, and cumulative regulatory burden, see Chapter 12 of the TSD.

L. Utility Impact Analysis

For the NOPR, the utility impact analysis will estimate the effects on the utility industry of reduced energy consumption due to improved equipment efficiency resulting from any energy conservation standard for beverage vending machines. The analysis compares modeling results for the base case with results for each candidate standard's case. It consists of forecasted differences between the base case and standards case for electricity generation, installed capacity, sales, and prices.

To estimate the effects of potential beverage vending machine standard levels on the electric utility industry, DOE intends to use a variant of the EIA's NEMS.[48] NEMS, which is available in the public domain, is a large, multi-sectoral, partial equilibrium model of the U.S. energy sector. EIA uses NEMS to produce the *AEO2007*, which is a widely recognized baseline energy forecast for the U.S. DOE will use a variant of NEMS known as NEMS-Building Technologies (BT) to provide key inputs to the utility impact analysis. Again, NEMS–BT produces a widely recognized reference case forecast for the United States and is available in the public domain.

The use of NEMS–BT for the utility impact analysis offers several advantages. As the official DOE energy forecasting model, it relies on a set of assumptions that are transparent and have received wide exposure and commentary. NEMS–BT allows an estimate of the interactions between the various energy supply and demand sectors and the economy as a whole. The utility impact analysis will determine the changes for electric utilities in installed capacity and generation by fuel type produced by each CSL, as well as changes in electricity sales to the commercial sector. At the Framework public meeting, DOE asked whether there are tools besides NEMS–BT that the Department should consider using for conducting its utility impact analysis. EEI suggested that DOE consider the industrial building demand module in NEMS for this analysis, because beverage vending machines are installed in manufacturing and military/Federal facilities that typically pay industrial rates on their utility bills. (EEI, No. 12 at p. 7) DOE will investigate using this module in addition to the commercial building demand module during the NOPR phase of this rulemaking.

DOE plans to conduct the utility analysis as a policy deviation from the *AEO2007*, applying the same basic set of premises. For example, the operating characteristics (e.g., energy conversion efficiency, emissions rates) of future electricity generating plants are the same in the *AEO2007* reference case, as are the prospects for natural gas supply.

DOE also will explore deviations from some of the reference case premises to represent alternative future outcomes. Two alternative scenarios use the high- and low-economic-growth cases of *AEO2007*. (The reference case corresponds to medium growth.) The high-economic-growth case projects higher growth rates for population, labor force, and labor productivity, resulting in lower predicted inflation and interest rates relative to the reference case and higher overall aggregate economic growth. The opposite is true for the low-growth case. Starting in 2012, the high-growth case predicts growth in per capita gross domestic product of 3.5 percent per year, compared with 3.0 percent per year in the reference case and 2.5 percent per year in the low-growth case. While supply-side growth determinants vary in these cases, *AEO2007* uses the same reference case energy prices for all three economic growth cases so that the impact of differences in the three scenarios are comparable. Different economic growth scenarios will affect the rate of growth of electricity demand in different ways.

The electric utility industry analysis will consist of NEMS–BT forecasts for generation, installed capacity, sales, and prices. The model uses predicted growth in demand for each end use to create a projection of the total electric system load growth for each of fifteen electricity market module supply regions, and then to predict the necessary additions to capacity. For electrical end uses, the NEMS–BT accounts for the implementation of energy conservation standards by decrementing the appropriate reference case load shape. DOE determines the size of the decrement using data on the per-unit energy savings developed in the LCC and PBP analyses (Chapter 8 of the TSD) and the forecast of shipments developed for the NIA (see Chapter 9 of the TSD).

The predicted reduction in capacity additions is sensitive to the standard's peak load impacts. DOE will investigate the need to adjust the hourly load

[48] For more information on NEMS, please see the U.S. Department of Energy, Energy Information Administration (EIA) documentation. A useful summary is *National Energy Modeling System: An Overview 2003,* Report number: DOE/EIA–0581 (March 2003) (available at: *http://tonto.eia.gov/FTPROOT/forecasting/05812003.pdf*). 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 the present 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'' in this analysis.

profiles that include this end use in NEMS–BT. Since the *AEO2007* version of NEMS–BT forecasts only to 2030, DOE must extrapolate the results to 2042. It is not feasible to extend the forecast period of NEMS–BT for the purpose of this analysis, nor does EIA have an approved method for extrapolation of many outputs beyond 2030. Therefore, DOE will use the approach developed by EIA to forecast fuel prices for the FEMP. FEMP uses these prices to estimate LCCs of Federal equipment procurements. For petroleum products, EIA uses the average growth rate for the world oil price from 2010 to 2025, in combination with refinery and distribution markups from 2025, to determine regional price forecasts. Similarly, EIA derives natural gas prices from an average growth rate figure in combination with regional price margins from 2025. Results of the analysis will include changes in commercial electricity sales, and installed capacity and generation by fuel type, for each CSL in five-year, forecasted increments extrapolated to 2042. For more information on the utility impact analysis, refer to Chapter 13 of the TSD.

M. Employment Impact Analysis

At the NOPR stage, DOE estimates the impacts of standards on employment for equipment manufacturers, relevant service industries, energy suppliers, and the economy in general. The following discussion explains the methodology DOE plans to use in conducting the employment impact analysis for this rulemaking. Both indirect and direct employment impacts are analyzed. Direct employment impacts would result if standards led to a change in the number of employees at manufacturing plants and related supply and service firms.

Indirect employment impacts are impacts on the national economy other than the manufacturing sector being regulated. Indirect impacts may result both from expenditures shifting among goods (substitution effect) and changes in income that lead to a change in overall expenditure levels (income effect). DOE defines indirect employment impacts from standards as net jobs eliminated or created in the general economy as a result of increased spending driven by the increased equipment prices and reduced spending on energy.

Using an input/output model of the U.S. economy, this analysis seeks to estimate the effects on different sectors and the net impact on jobs. DOE will estimate national employment impacts for major sectors of the U.S. economy in the NOPR, using public and commercially-available data sources and software. DOE will make all methods and documentation pertaining to the employment impact analysis available for review in the TSD published in conjunction with the NOPR.

DOE developed Impact of Sector Energy Technologies (ImSET), a spreadsheet model of the U.S. economy that focuses on 188 sectors most relevant to industrial, commercial, and residential building energy use.[49] 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 that are considered by the DOE Office of Energy Efficiency and Renewable Energy. The current version of the model allows for more complete and automated analysis of the essential features of energy-efficiency investments in buildings, industry, transportation, and the electric power sectors compared to previous versions used in earlier rulemakings.

The ImSET software includes a personal computer-based I–O model with structural coefficients to characterize economic flows among the 188 sectors. ImSET's national economic I–O structure is based on the 1997 Benchmark U.S. table (Lawson, et al. 2002),[50] specially aggregated to 188 sectors. The time scale of the model is 50 years, with annual increments.

The model is a static I–O model, which allows a great deal of flexibility concerning the types of energy-efficiency effects that it can accommodate. For example, certain economic effects of energy efficiency improvements require an assessment of inter-industry purchases, which is handled in the model. Some energy-efficiency investments will not only reduce the costs of energy in the economy but the costs of labor and other goods and services as well, which is accommodated through a recalculation of the I–O structure in the model. Output from the ImSET model can be used to estimate changes in employment, industry output, and wage income in the overall U.S. economy resulting from changes in expenditures in the various sectors of the economy.

Although DOE intends to use ImSET for its analysis of employment impacts, it welcomes input on other tools and factors it might consider. For more information on the employment impacts analysis, see Chapter 14 of the TSD.

[49] Roop, J. M., M. J. Scott, and R. W. Schultz, ''ImSET: Impact of Sector Energy Technologies,'' PNNL-15273 (Pacific Northwest National Laboratory, Richland, WA) (2005).

[50] Lawson, Ann M., Kurt S. Bersani, Mahnaz Fahim-Nader, and Jiemin Guo, ''Benchmark Input-Output Accounts of the U.S. Economy, 1997,'' Survey of Current Business (Dec. 2002), pp. 19–117.

N. Environmental Assessment

For the NOPR, DOE will assess the impacts of energy conservation standards for beverage vending machine standard levels on certain environmental indicators, using NEMS–BT to provide key inputs to the analysis. The environmental assessment produces results in a manner similar to those provided in *AEO2007*. DOE anticipates that the primary environmental effects will be reduced power plant emissions resulting from reduced electricity consumption.

The intent of the environmental assessment is to provide estimates of reduced power plant emissions and to fulfill requirements to properly quantify and consider the environmental effects of all new Federal rules. The environmental assessment that will be produced by NEMS–BT considers potential environmental impacts from three pollutants (sulfur dioxide (SO_2), nitrogen oxides (NO_X), and mercury (Hg)) and from CO_2 emissions. For each of the trial standard levels, DOE will calculate total undiscounted and discounted power plant emissions using NEMS-BT and will use further external analysis as needed.

DOE will conduct each portion of the environmental assessment performed for this rulemaking as an incremental policy impact (i.e., an energy conservation standard for beverage vending machines) of the *AEO2007* forecast, applying the same basic set of assumptions used in *AEO2007*. For example, the emissions characteristics of an electricity generating plant will be exactly those used in *AEO2007*. Also, forecasts conducted with NEMS–BT consider the supply-side and demand-side effects on the electric utility industry. Thus, DOE's analysis will account for any factors affecting the type of electricity generation and, in turn, the type and amount of airborne emissions the utility industry generates.

The NEMS–BT model tracks carbon emissions with a specialized carbon emissions estimation subroutine, producing reasonably accurate results due to the broad coverage of all sectors and inclusion of interactive effects. Past experience with carbon results from NEMS–BT suggests that emissions estimates are somewhat lower than emissions based on simple average factors. One reason for this divergence is that NEMS–BT tends to predict that conservation measures will slow generating capacity growth in future years, and new generating capacity is expected to be more efficient than existing capacity. On the whole, NEMS–BT provides carbon emissions results of reasonable accuracy, at a level consistent with other Federal published results. In addition to providing estimates of quantitative impacts of beverage vending machine standards on CO_2 emissions, DOE will consider the use of monetary values to represent the potential value of such emissions reductions. DOE invites comment on how to estimate such monetary value of such effects or on any widely accepted values which might be used in DOE's analyses.

NEMS–BT also reports on SO_2 and NO_X, which DOE has reported in past analyses. The Clean Air Act Amendments of 1990 [51] set an SO_2 emissions cap on all large power plants. However, attainment of this target is flexible among generators through the use of emissions allowances and tradable permits. Although NEMS–BT includes a module for SO_2 allowance trading and delivers a forecast of SO_2 allowance prices, accurate simulation of SO_2 trading implies that the effect of energy conservation standards on physical emissions will be zero because emissions will always be at or near the ceiling. However, there may be an SO_2 economic benefit from energy conservation in the form of a lower SO_2 allowance price. Since the impact of any one standard on the allowance price is likely to be small and highly uncertain, DOE does not plan to monetize any potential SO_2 benefit.

NEMS–BT also has an algorithm for estimating NO_X emissions from power generation. The impact of these emissions, however, will be affected by the Clean Air Interstate Rule (CAIR) issued by the U.S. Environmental Protection Agency on March 10, 2005.[52] 70 FR 25162 (May 12, 2005). CAIR will permanently cap emissions of NO_X in 28 eastern States and the District of Columbia. As with SO_2 emissions, a cap on NO_X emissions means that equipment energy conservation standards are not likely to have a physical effect on NO_X emissions in States covered by the CAIR caps. Therefore, while the emissions cap may mean that physical emissions reductions in those States will not result from standards, standards could produce an environmental-related economic benefit in the form of lower prices for emissions allowance credits. However, as with SO_2 allowance prices, DOE does not plan to monetize this benefit for those States because the impact on the NO_X allowance price from any single energy conservation standard is likely to be small and highly uncertain. DOE seeks comment on how it might value NO_X emissions for the 22 States not covered under CAIR.

With regard to mercury emissions, NEMS–BT has an algorithm for estimating these emissions from power generation, and, as it has done in the past, DOE is able to report an estimate of the physical quantity of mercury emissions reductions associated with an energy conservation standard. DOE assumed that these emissions would be subject to EPA's Clean Air Mercury Rule [53] (CAMR), which would permanently cap emissions of mercury for new and existing coal-fired plants in all States by 2010. Similar to SO_2 and NO_X, DOE assumed that under such system, energy conservation standards would result in no physical effect on these emissions, but may result in a small and highly uncertain environmental-related economic benefit in the form of a lower price for emissions allowance credits.

On February 8, 2008, the U.S. Court of Appeals for the District of Columbia Circuit (D.C. Circuit) issued its decision in *State of New Jersey*, *et al.* v. *Environmental Protection Agency,*[54] in which the Court, among other actions, vacated the CAMR referenced above. Accordingly, DOE is considering whether changes are needed to its plan for addressing the issue of mercury emissions. DOE invites public comment on addressing mercury emissions in this rulemaking.

With regard to particulates, these emissions are a special case because they arise not only from direct emissions, but also from complex atmospheric chemical reactions that result from NO_X and SO_2 emissions. DOE does not intend to analyze or report on the particulate emissions from power stations because of the highly complex and uncertain relationship between particulate emissions and particulate concentrations that impact air quality.

In sum, the methodology for the environmental assessment is similar to the methodology (*i.e., based on NEMS*) used to estimate the environmental impacts published in the *AEO2007*. These results include power sector emissions for SO_2, NO_X, mercury and CO_2 in five-year forecasted increments extrapolated to 2042. The outcome of the NOPR analysis for each trial standard level is reported as a deviation from the *AEO2007* reference (base) case. For more detail on the environmental assessment, see the environmental assessment report of the TSD.

O. Regulatory Impact Analysis

DOE will prepare a draft regulatory impact analysis in compliance with Executive Order 12866, ''Regulatory Planning and Review,'' signed on September 30, 1993, which will be subject to review by the Office of Management and Budget's Office of Information and Regulatory Affairs (OIRA). 58 FR 51735 (Oct. 4, 1993).

As part of the regulatory impact analysis (and as discussed in Section II.K of this ANOPR), DOE will identify and seek to mitigate the overlapping effects on manufacturers of new or revised DOE standards and other regulatory actions affecting the same equipment. Through manufacturer interviews and literature searches, DOE will compile information on burdens from existing and impending regulations affecting the beverage vending machines covered under this rulemaking. DOE also seeks input from stakeholders about regulations whose impacts it should consider.

The regulatory impact analysis also will address the potential for non-regulatory approaches to supplant or augment energy conservation standards to improve the efficiency of beverage vending machines. The following list includes non-regulatory means of achieving energy savings that DOE may consider:

- No new regulatory action
- Consumer tax credits
- Manufacturer tax credits
- Performance standards
- Rebates
- Voluntary energy efficiency targets
- Early replacement
- Bulk government purchases

In support of DOE's NOPR, the TSD will include a complete quantitative analysis of each alternative to the proposed conservation standard. The methodology for this analysis is discussed briefly below.

DOE will use the NES spreadsheet model (discussed in Sections I.B.5 and II.I of this ANOPR) to calculate the NES and the NPV corresponding to each alternative to the proposed standards. See Chapter 10 of the TSD for details on the NES spreadsheet model. To compare each alternative quantitatively to the proposed conservation standards, the model will need to quantify the effect of each alternative on the purchase and

[51] The Clean Air Act Amendments of 1990 were signed into law as Pub. L. 101–549 on November 15, 1990. The amendment can be viewed at *http://www.epa.gov/air/caa/*.

[52] See *http://www.epa.gov/cleanairinterstaterule/*.

[53] 70 FR 28606 (May 18, 2005).

[54] No. 05–1097, 2008 WL 341338, at *1 (D.C. Cir. Feb. 8, 2008).

use of energy-efficient commercial equipment. Once each alternative is properly quantified, DOE will make the appropriate revisions to the inputs in the NES spreadsheet model. The following are key inputs that DOE may revise in the NES spreadsheet model:

- Energy prices and escalation factors;
- Implicit market discount rates for trading off purchase price against operating expense when choosing equipment efficiency;
- Customer purchase price, operating cost, and income elasticities;
- Customer price versus efficiency relationships; and
- Equipment stock data (purchase of new equipment or turnover rates for inventories).

The following are the key measures of the impact of each alternative:

- Commercial energy use (EJ = 10^{18} joule) is the cumulative energy use of the equipment from the effective date of the new standard (i.e., 2012) to 2042. DOE will report electricity consumption as primary energy.
- NES is the cumulative national energy use from the base-case projection less the alternative standards-case projection.
- NPV is the value of future operating cost savings from beverage vending machines bought between the effective date of the new standard and 2042. DOE calculates the NPV as the difference between the present value of equipment and operating expenditures (including energy) in the base case, and the present value of expenditures in each alternative policy case. DOE discounts future operating and equipment expenditures to 2007 using a seven-percent real discount rate. DOE calculates operating expenses (including energy) for the life of the equipment.

For more information on the regulatory impact analysis, see the regulatory impact analysis report in the TSD.

III. Candidate Energy Conservation Standards Levels

In terms of process, DOE specifies CSLs in the ANOPR, but it does not propose a particular standard at this stage of the rulemaking. DOE selected up to nine energy consumption levels for each class of beverage vending machine for use in the LCC and NIA. Based on the results of the ANOPR analysis, DOE selects a subset from the CSLs analyzed in the ANOPR for more detailed analysis during the NOPR stage of the rulemaking. The range of CSLs selected includes the most energy-efficient level or most energy-efficient combination of design options, the combination of design options or efficiency level with the minimum LCC, and a combination of design options or efficiency level with a PBP of no more than three years. DOE may also select CSLs that incorporate noteworthy technologies or fill in large gaps between efficiency levels of other CSLs.

As noted above, DOE has included the most energy-efficient level analyzed as a CSL, and DOE has identified the level with the maximum LCC savings for each equipment class. The calculated national average PBPs from the LCC analysis suggested that many of the energy efficiency levels analyzed provided a national average payback of less than three years when compared with the baseline equipment. DOE chose to designate the maximum energy efficiency level that provided a payback of less than three years as a CSL. These three selection criteria provided two or three CSL selections per equipment class. Therefore, DOE selected two other lower efficiency levels for each equipment class to provide greater variation in CSLs for future analysis. The selection of these additional levels reflects DOE review of the relative cost effectiveness of the levels when compared with the baseline equipment and other efficiency levels.

DOE selected four CSLs for each equipment class. Table III.1 shows the selected CSLs based on the energy consumption of the specific equipment analyzed in the engineering analysis. DOE seeks feedback on its selection of these specific candidate standard levels for the post-ANOPR analysis phase. Section IV.E of this ANOPR discusses this subject, identified as Issue 7 under ''Issues on Which DOE Seeks Comment.''

DOE will refine its final selection of CSLs for further analysis after receiving input from stakeholders on the ANOPR and after any revision of the ANOPR analyses. The CSLs will then be recast as Trial Standard Levels (TSLs). DOE will analyze specific TSLs during the post-ANOPR analysis and report the results in the NOPR.

TABLE III.1.—CANDIDATE STANDARD LEVELS AND FACTORS CONSIDERED IN THEIR SELECTION FOR FUTURE ANALYSIS

Equipment class	Candidate standard level selection considerations					
	Maximum efficiency level	Maximum efficiency level with positive LCC savings	Efficiency level with minimum LCC	Highest efficiency level with PBP <3 years	Additional candidate standard level selected for future analysis	
Class A	Level 8	Level 7	Level 5	Level 6	Level 4	Level 3.
Class B	Level 8	Level 7	Level 4	Level 4	Level 5	Level 3.

Because the equipment classes cover a variety of equipment sizes, DOE has suggested defining the standard in terms of upper limits on daily energy consumption normalized by refrigerated volume (''V,'' as measured by ANSI/AHAM HRF–1–2004). Table III.2 presents the CSLs for the analyzed equipment classes in terms of these normalized metrics.

TABLE III.2.—CANDIDATE STANDARD LEVELS FOR ANALYZED EQUIPMENT CLASSES EXPRESSED IN TERMS OF THE NORMALIZED TEST METRICS

Equipment class	Test metric	Candidate standard level in order of efficiency expressed in terms of the test metric				
		Baseline	CSL1	CSL2	CSL3	CSL4
Class A	Daily Energy Consumption/ Refrigerated Volume kWh/day/ft³.	1.08 (Level 1)	0.90 (Level 4)	0.75 (Level 6)	0.70 (Level 7)	0.64 (Level 8).
Class B	Daily Energy Consumption/ Refrigerated Volume kWh/day/ft³.	2.93 (Level 1)	2.61 (Level 3)	2.47 (Level 4)	2.46 (Level 5)	2.39 (Level 6).

When an energy conservation standard is defined for an equipment class, DOE must consider how to express the level in a manner suitable for all equipment within that class. This is of particular concern when the rating is in terms of energy consumption and energy consumption varies within a class due to variations in equipment size or capacity.

DOE plans to define energy conservation standards for refrigerated beverage vending machines in terms of:

Maximum energy consumption M (kWh/day) $= B \times V + K$

Where:

B is expressed in terms of kWh/day/ft³ of measured volume,

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

K is an offset factor expressed in kWh/day.

DOE seeks feedback on this approach for characterizing energy conservation standards for refrigerated beverage vending machines. If this approach is acceptable, DOE seeks comments on how it could develop the appropriate offset factor, K, for the two classes of equipment. Section IV.E of this ANOPR discusses this subject, identified as Issue 8 under ''Issues on Which DOE Seeks Comment.''

IV. Public Participation

A. Attendance at Public Meeting

The time, date, and location of the public meeting are set forth in the **DATES** and **ADDRESSES** sections at the beginning of this document. Anyone who wishes to attend the public meeting must notify Ms. Brenda Edwards at (202) 586–2945. As explained in the **ADDRESSES** section, foreign nationals visiting DOE Headquarters are subject to advance security screening procedures.

B. Procedure for Submitting Requests to Speak

Any person who has an interest in today's notice, or who represents a group or class of persons with an interest in these issues, may request an opportunity to make an oral presentation at the public meeting. Please hand deliver requests to speak to the address shown under the heading ''*Hand Delivery/Courier*'' in the **ADDRESSES** section of this ANOPR between 9 a.m. and 4 p.m., Monday through Friday, except Federal holidays. Requests may also be sent by mail to the address shown under the heading ''*Postal Mail*'' in the **ADDRESSES** section of this ANOPR, or by e-mail to *Brenda.Edwards@ee.doe.gov.*

Persons requesting to speak should briefly describe the nature of their interest in this rulemaking and provide a telephone number for contact. DOE asks persons scheduled to make an oral presentation at the public meeting to submit a copy of their statements at least two weeks before the public meeting, either in person, by postal mail, or by e-mail. Please include an electronic copy of your statement on a computer diskette or compact disk when delivery is by postal mail or in person. Electronic copies must be in WordPerfect, Microsoft Word, Portable Document Format (PDF), or text (American Standard Code for Information Interchange (ASCII)) file format. At its discretion, DOE may permit any person who cannot supply an advance copy of his or her statement to make an oral presentation, if that person has made alternative arrangements with the Building Technologies Program. In such situations, the request to give an oral presentation should ask for alternative arrangements.

C. Conduct of Public Meeting

DOE will designate a DOE official to preside at the public meeting and may also use a professional facilitator to aid discussion. The meeting will not be a judicial or evidentiary-type public hearing, but DOE will conduct it in accordance with 5 U.S.C. 553 and section 336 of EPCA. (42 U.S.C. 6306) A court reporter will be present to record and transcribe the proceedings. DOE reserves the right to schedule the order of presentations and to establish the procedures governing the conduct of the public meeting. After the public meeting, interested parties may submit further comments about the proceedings, and any other 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 presentations by participants, and encourage all interested parties to share their views on issues affecting this rulemaking. Each participant will be allowed to make a prepared general statement (within time limits determined by DOE) before discussion of a particular topic. DOE will permit 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 the public meeting. 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 proper conduct of the public meeting.

DOE will make the entire record of this proposed rulemaking, including the transcript from the public meeting, available for inspection at the U.S. Department of Energy, Resource Room of the Building Technologies Program, 950 L'Enfant Plaza, Suite 600, SW, Washington, DC, 20024, (202) 586–2945, between 9:00 a.m. and 4:00 p.m., Monday through Friday, except Federal holidays. Any person may purchase a copy of the transcript from the transcribing reporter.

D. Submission of Comments

DOE will accept comments, data, and information regarding all aspects of this ANOPR before or after the public meeting, but no later than July 16, 2008. Please submit comments, data, and information by e-mail to: *bever agevending.rulemaking@ee.doe.gov*. Please submit electronic comments in WordPerfect, Microsoft Word, PDF, or ASCII file format and avoid the use of special characters or any form of encryption. Comments in electronic format should be identified by the Docket Number EERE–2006–STD–0125 and/or RIN 1904–AB58, and whenever possible carry the electronic signature of the author. Absent an electronic signature, comments submitted electronically must be followed and authenticated by a signed original paper document. No telefacsimiles (faxes) will be accepted.

Under 10 CFR Part 1004.11, any person submitting information that he or she believes to be confidential and exempt by law from public disclosure should submit two copies. One copy of the document shall include all the information believed to be confidential, and the other copy of the document shall have the information believed to be confidential deleted. DOE will make its own determination about the confidential status of the information and treat it according to its determination.

Factors that DOE considers 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 that 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.

E. Issues on Which DOE Seeks Comment

DOE is interested in receiving comments on all aspects of this ANOPR. DOE particularly invites comments or data to improve DOE's analysis, including data or information that will respond to the following questions or concerns addressed in this ANOPR.

1. Equipment Classes

In accordance with EPCA section 325(p)(1)(A), DOE identified the equipment classes covered under this rulemaking. (42 U.S.C. 6295(p)(1)(A)) In making that determination, DOE decided to focus the present ANOPR analyses on two equipment classes of beverage vending machines based upon their two predominant applications, namely, Class A machines that are installed indoors and Class B machines that are installed both indoors and outdoors. Pursuant to EPCA section 325(p)(1)(B), DOE requests comments on the validity of this approach and invites interested persons to submit written presentations of data, views, and arguments. (42 U.S.C. 6295(p)(1)(B)) (See Section II.A.2 of this ANOPR for further details.)

2. Compressor and Lighting Operating Hours

DOE's energy use characterization presumes that there are no controls that limit display lighting or compressor operation in a beverage vending machine to certain hours of the day or would be affected by occupancy patterns in the building. It is known, however, that such controllers exist and can either be added on or enabled in certain beverage vending machines. DOE requests comments on the need to incorporate such controls in its energy analysis and how it might do so in the NOPR analysis. (See Section II.E of this ANOPR for further details.)

3. Refurbishment Cycles

DOE requests comments on refurbishment cycles for beverage vending machines that may be prevalent in the field and may differ from standardized practices or the two cycles during the equipment lifetime assumed by DOE. These refurbishment cycles could affect actual energy consumption savings as a result of increased energy efficiency as compared to those savings estimated in the energy use characterization analysis and as reported in the TSD. DOE requests comments on: (1) The frequency of refurbishment cycles; (2) how refurbishing the vending machines might affect energy use in the field; and (3) whether and how DOE could account for these changes in assessing the overall impacts of the candidate standards levels on beverage vending machines. (See Section IV.E.3 of this ANOPR for further details.)

4. Life-Cycle Cost Baseline Level

DOE did not receive data from the industry or in the manufacturer interviews concerning the average energy efficiency of beverage vending machines currently being shipped. An analysis of the literature suggests that little data on the energy characteristics of beverage vending machines in the general market are available. Therefore, DOE used the Level 1 established in the engineering analysis as the baseline efficiency for the LCC analysis.

Selection of the baseline efficiency level impacts the LCC and PBP analyses. It affects PBP, since payback is calculated from the baseline efficiency level, and affects the maximum efficiency level showing LCC savings, and the magnitude of LCC savings. It can also affect the number of users who experience LCC savings at any level. The selection of the baseline level does not generally affect the efficiency level with maximum LCC savings. DOE requests feedback on whether the Level 1 baseline DOE selected is valid for the LCC analysis, and if not, what changes DOE should make to provide a more realistic baseline. Since higher efficiency equipment is sold in the market, DOE also seeks input on whether it should use a distribution of efficiencies for the LCC analysis baseline, and if so, what data could be used to populate this distribution. If more detailed data to develop a distribution of efficiencies in the baseline cannot be provided, DOE seeks input on how a sensitivity analysis to alternative baselines could best be used to inform the LCC and NES analyses supporting the rulemaking. (See Section II.G.5 of this ANOPR for further details.)

5. Base-Case and Standards-Case Forecasts

Because key inputs to the calculation of the NES and NPV depend on the estimated efficiencies under the base case (without standards) and the standards case (with standards), forecasted efficiencies are of great importance to the analysis. Information available to DOE suggests that forecasted market shares would remain frozen throughout the analysis period (i.e., 2012–2042). For its determination of standards-case forecasted efficiencies, DOE used a roll-up scenario to establish market shares by efficiency level for the year that standards become effective (i.e., 2012). Available information suggests that equipment shipments with efficiencies in the base case that did not meet the standard level under consideration would roll up to meet the new standard level. Available information also suggests that no equipment efficiencies in the base case that were above the standard level under consideration would be affected. DOE requests feedback on its development of standards-case efficiency forecasts from the base-case efficiency forecast, and on how it determined that standards would affect efficiency distributions in the year that standards are to take effect. (See Section II.I.2 of this ANOPR for further details.)

6. Differential Impact of New Standards on Future Shipments by Equipment Classes

The shipment model used in the NES and NIA presumes that the relative market share of the different classes of beverage vending machines remains constant over the time period analyzed. While DOE is aware that market preferences for certain types of equipment may change in the future, DOE has no data with which to predict or characterize those changes. DOE is particularly concerned whether higher standards for one class of beverage vending machines are likely to generate significant market shifts to other equipment that may have higher energy consumption (or lower efficiency). By developing standards for both classes of beverage vending machines within the scope of this rulemaking using the same economic criteria, DOE hopes to mitigate this concern. However, DOE requests stakeholder input on the potential for standards-driven market shifts between equipment classes that could reduce national energy savings, and on how the standards-setting process can reduce or eliminate these shifts. (See Section II.I.2 of this ANOPR for further details.)

7. Selection of Candidate Standard Levels for Notice of Proposed Rulemaking Analysis

DOE is required to examine specific criteria for the selection of CSLs. Some of these criteria are economically based and the resulting CSLs selected may be affected by updates to the ANOPR analysis after input from stakeholders. DOE has discretion over the selection of additional standard levels it chooses to analyze. DOE seeks input on the candidate standard levels selected for future analysis shown in Table III.1 (See Section III of this ANOPR for further details.)

8. Approach to Characterizing Energy Conservation Standards

When an efficiency or energy conservation standard is defined for a class of equipment, DOE must consider how to express the level in a manner suitable for all equipment within that class. DOE seeks input on its approach for characterizing energy conservation standards for beverage vending machines as discussed in Section III. If the approach is acceptable, DOE seeks comments on how it could develop appropriate offset factors (K) for the two classes of equipment. (See Section III of this ANOPR for further details.)

V. Regulatory Review and Procedural Requirements

DOE submitted this ANOPR for review to the Office of Management and Budget (OMB), under Executive Order 12866, ''Regulatory Planning and Review,'' 58 FR 51735 (October 4, 1993). If DOE later proposes energy conservation standards for certain beverage vending machines, and if the proposed rule constitutes a significant regulatory action, DOE would prepare and submit to OMB for review the assessment of costs and benefits required under section 6(a)(3) of the Executive Order. The Executive Order requires that each agency identify in writing the market failure or other specific problem that it intends to address that warrant new agency action, as well as assess the significance of that problem, to enable assessment of whether any new regulation is warranted. (Executive Order 12866, § 1(b)(1)) DOE presumes that a perfectly functioning market would result in efficiency levels that maximize benefits to all affected persons. Consequently, without a market failure or other specific problem, a regulation would not be expected to result in net benefits to customers and the Nation. However, DOE also notes that whether it establishes standards for this equipment is determined by the statutory criteria expressed in EPCA. Even in the absence of a market failure or other specific problem, DOE nevertheless may be required to establish standards under existing law.

DOE's preliminary analysis suggests that beverage vending machines are predominantly owned either by site owners (i.e., the owner of the establishment where the vending machine is installed), or by bottlers or vending machine operators (i.e., the operator that installs, stocks, and services the equipment and retains a percentage of the coin-box-revenue). DOE believes that these owners and operators lack corporate direction in terms of energy policy. The transaction costs for these owners or operators to research, purchase, and install optimum-efficiency equipment are too high to make such action commonplace. DOE believes that there is a lack of information and/or information processing capability about energy efficiency opportunities in the beverage vending machine market available to site owners. Unlike residential heating and air conditioning equipment, beverage vending machines are not included in energy labeling programs such as the Federal Trade Commission's energy labeling program. Furthermore, the energy use of beverage vending machines is dependent on how often the machines are used and, as such, the relevant information is not readily available for the owners or operators to make a decision on whether improving the energy efficiency of beverage vending machines is cost-effective. To better understand this market, DOE seeks data on the efficiency levels of existing beverage vending machines in use by owner (i.e., site owner or machine operator), electricity price, equipment class (Class A or Class B machines) and installation type (i.e., indoors or outdoors).

DOE recognizes that beverage vending machines are not purchased in the same manner as regulated appliances that are sold in retail stores (e.g., room air conditioners). When purchased by the end user, beverage vending machines are more likely purchased directly from individual manufacturers through equipment catalogs or specification sheets. NAMA, unlike other industry trade associations, does not publish a directory of covered equipment. DOE seeks comment on the availability of energy efficiency information and the extent to which the information leads to informed choices, specifically given how such equipment is purchased.

To the extent there is potentially a substantial information problem, one could expect the energy efficiency for beverage vending machines to be more or less randomly distributed across key variables such as energy prices and usage levels. However, since data are not available on how such equipment is purchased, DOE seeks detailed data on the distribution of energy efficiency levels for both the new site owner and equipment operator markets. DOE plans to use these data to test the extent to which purchasers of this equipment behave as if they are unaware of the costs associated with their energy consumption. DOE requests data on, and suggestions for the existence and extent of potential market failures to complete an assessment of the significance of these failures and, thus, the net benefits of regulation.

A related issue is the problem of asymmetric information (one party to a transaction has more and better information than the other) and/or high transactions costs (costs of gathering information and effecting exchanges of goods and services). In the case of beverage vending machines, in most cases, the party responsible for the equipment purchase may not be the one who pays the cost to operate it. For example, in the case where the bottler or beverage vending machine operator owns the equipment and the site owner pays the utilities, the vending machine operator may make the purchasing decision about the beverage vending machine without input from the site owner and may not offer options to the site owner to upgrade them.

In addition, this rulemaking is likely to yield certain ''external'' benefits resulting from improved energy efficiency of beverage vending machines that are not captured by the users of such equipment. These include both environmental and energy security-related externalities that are not reflected in energy prices, such as reduced emissions of greenhouse gases and reduced use of natural gas and oil for electricity generation. DOE invites comments on the weight that should be given to these factors in DOE's determination of the maximum energy efficiency level at which the total benefits are likely to exceed the total costs resulting from a DOE standard.

In addition, various other analyses and procedures may apply to such future rulemaking action, including those required by the National Environmental Policy Act (Pub. L. 91–190, 42 U.S.C. 4321 et seq.); the Unfunded Mandates Reform Act of 1995 (Pub. L. 104–4); the Paperwork Reduction Act (44 U.S.C. 3501 et seq.); the Regulatory Flexibility Act (5 U.S.C. 601 et seq.); and certain Executive Orders.

The draft of today's action and any other documents submitted to OMB for review are part of the rulemaking record and are available for public review at the U.S. Department of Energy, Resource Room of the Building Technologies Program, 950 L'Enfant Plaza, Suite 600, SW., Washington, DC 20024, (202) 586–2945, between 9:00 a.m. and 4:00 p.m., Monday through Friday, except Federal holidays.

VI. Approval of the Office of the Secretary

The Secretary of Energy has approved publication of today's ANOPR.

Issued in Washington, DC, on June 9, 2008.

Alexander A. Karsner,

Assistant Secretary, Energy Efficiency and Renewable Energy.

[FR Doc. E8–13345 Filed 6–13–08; 8:45 am]

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