Rulemaking Framework for Refrigerated Bottled or Canned Beverage Vending Machines

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LIST OF ACRONYMS

ABA	American Beverage Association
AEO	Annual Energy Outlook
AHAM	Association of Home Appliance Manufacturers
ANOPR	advance notice of proposed rulemaking
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
BT	Building Technologies Program
BVM	beverage vending machine
CAIR	Clean Air Interstate Rule
CFC	chlorofluorocarbon
CFR	Code of Federal Regulations
CO_2	carbon dioxide
CSL	candidate standard level
CSAPR	Cross-State Air Pollution Rule
DOE	U.S. Department of Energy
DOJ	U.S. Department of Justice
ECM	electronically commutated motor
EGU	electric generating unit
EIA	U.S. Energy Information Administration
EPA	U.S. Environmental Protection Agency
EPCA	Energy Policy and Conservation Act of 1975
FFC	full-fuel-cycle
GHG	greenhouse gas
GRIM	Government Regulatory Impact Model
HAP	hazardous air pollutants
HC	hydrocarbon
HCFC	hydrochlorofluorocarbon
HFC	hydrofluorocarbon
Hg	mercury
ImSET	Impact of Sector Energy Technologies
LCC	life-cycle cost
MATS	Mercury and Air Toxics Standards
MIA	manufacturer impact analysis
MSP	manufacturer selling price
NAMA	National Automatic Merchandising Association
NEMS	National Energy Modeling System
NES	national energy savings
NIA	national impact analysis
NOPR	notice of proposed rulemaking
NO_X	nitrogen oxides
NPV	net present value
OIRA	Office of Information and Regulatory Affairs
OMB	Office of Management and Budget
PBP	payback period

PM	particulate matter
R&D	research and development
RIA	regulatory impact analysis
SCC	Social Cost of Carbon
SO_2	sulfur dioxide
TSD	technical support document
TSL	trial standard level
WACC	weighted-average cost of capital

Rulemaking Framework for Beverage Vending Machines

1. INTRODUCTION

The U.S. Department of Energy (DOE) develops and promulgates test procedures and energy conservation standards for certain consumer appliances and commercial equipment. The process for developing standards involves analysis, public notice and comment, and consultation with interested parties. Interested parties, also referred to as stakeholders, include manufacturers, customers, energy conservation and environmental advocates, State and Federal agencies, and any other groups or individuals with an interest in these standards and test procedures.

This Framework document provides an overview of the procedural and analytical approaches DOE anticipates using to determine whether to amend the existing energy conservation standards for refrigerated bottled or canned beverage vending machines, herein referred to as beverage vending machines (BVM) (see section 1.1 for a discussion of the statutory authority for this rulemaking). The existing energy conservation standards for beverage vending machines can be found at 10 CFR 431.296 and are applicable to BVM units manufactured on or after August 31, 2012, as mandated by the Energy Policy and Conservation Act of 1975 (EPCA), as amended. (42 U.S.C. 6295(v))

This document is intended to inform stakeholders of the procedural and analytical approaches for the energy conservation standards and test procedure rulemakings for covered beverage vending machines, and to encourage and facilitate stakeholder input during the rulemaking. This document is the starting point for determining whether to amend the existing energy conservation standards, and if so, for developing such standards, and is not a definitive statement with respect to any issue to be determined in the rulemaking.

Section 1 provides an overview of the rulemaking process. Sections 2 through 17 discuss analyses DOE intends to conduct to fulfill the statutory requirements and guidance for this energy conservation standards rulemaking for beverage vending machines. DOE is required, as part of this rulemaking, to determine whether to amend existing energy conservation standards for this equipment. These analyses will support DOE's determination of whether to amend the standards, and, if the determination is positive, its establishment of any amended energy conservation standards. Information regarding this rulemaking will be maintained on the DOE website at http://www1.eere.energy.gov/buildings/appliance_standards/rulemaking.aspx/ruleid/73.

While DOE invites comment on all aspects of the material presented in this Framework document, several specific issues on which DOE seeks comment are set out in comment boxes like this one. DOE uses these comment boxes to highlight issues and ask specific questions on the approaches DOE is proposing to follow in conducting the analyses required for the energy conservation standards rulemaking. Such requests for stakeholder feedback are numbered according to the section in which they appear.

1.1 The Appliances and Commercial Equipment Standards Program

Title III of EPCA sets forth a variety of provisions designed to improve the energy efficiency of various products and equipment. Part B of Title III provides for the "Energy

Conservation Program for Consumer Products Other Than Automobiles." (42 U.S.C. 6291–6309) As part of this program, EPCA directed DOE to prescribe energy conservation standards for beverage vending machines. (42 U.S.C. 6295(v))[1]

Under 42 U.S.C. 6295(m)(1), within 6 years after issuance of any final rule establishing or amending a standard, DOE is required to publish:

(A) A notice of the determination of the Secretary of Energy (Secretary) that energy conservation standards for the product do not need to be amended, based on the criteria established under subsection (n)(2); or

(B) A notice of proposed rulemaking including new proposed energy conservation standards based on the criteria established under subsection (o) and the procedures established under subsection (p).

DOE is undertaking this rulemaking, including the publication of this Framework document, to meet this EPCA requirement.

1.2 Rulemaking History

EPCA directed the Secretary to issue by rule, no later than August 8, 2009, energy conservation standards for refrigerated bottled or canned beverage vending machines. DOE undertook a rulemaking process beginning in 2006, when it published the *Rulemaking Framework for Refrigerated Bottled or Canned Beverage Vending Machines* (henceforth referred to as the 2006 BVM Framework document). This document is available at: http://www.regulations.gov/#!documentDetail;D=EERE-2006-STD-0125-0002. The 2006 BVM Framework document described the procedural and analytical approaches DOE anticipated using to evaluate the establishment of energy conservation standards for beverage vending machines.

DOE held a public meeting on July 11, 2006 (henceforth referred to as the 2006 BVM Framework public meeting) to discuss procedural and analytical approaches to the rulemaking, and to inform and facilitate the involvement of interested parties in the rulemaking process. The analytical framework presented at the public meeting described different analyses, such as the engineering analysis and the life-cycle cost (LCC) analysis, the methods proposed for conducting them, and the relationships among the various analyses.

After the 2006 BVM Framework public meeting, as part of the information gathering process for the preliminary manufacturer impact analysis (MIA), DOE held interviews with BVM manufacturers. DOE selected manufacturers that represented production of a wide range of equipment covered by the rulemaking, including both small and large manufacturers. DOE had

[1] Because of its placement in Part B of Title III of EPCA, the provisions of Part B apply to the rulemaking for BVM energy conservation standards. Because beverage vending machines are commonly referred to as commercial equipment, however, DOE places the requirements for beverage vending machines in Title 10 of the Code of Federal Regulations (CFR), part 431, "Energy Efficiency Program for Certain Commercial and Industrial Equipment." The location of the provisions within the CFR does not affect either their substance or applicable procedure; DOE is placing them in the commercial CFR part as a matter of administrative convenience based on their nature or type. DOE will refer to beverage vending machines as "equipment" throughout the document because of their placement in 10 CFR part 431.

four objectives for these interviews: (1) solicit feedback on the draft engineering analysis (including methodology, production costs, manufacturing processes, and findings); (2) solicit feedback on topics related to the preliminary MIA; (3) provide an opportunity, early in the rulemaking process, for these manufacturers to express specific concerns to DOE; and (4) foster cooperation between the manufacturers and DOE.

DOE developed a preliminary engineering analysis to estimate the cost of manufacturing equipment at efficiencies above the baseline levels.[2] DOE also developed spreadsheets to conduct the LCC analysis and national impact analysis (NIA). The LCC spreadsheet calculates national distributions of LCC savings at various energy efficiency levels above the baseline. It can also provide LCC savings based on typical input values for several business types that use beverage vending machines. The NIA spreadsheet calculates the national energy savings (NES) and national net present values (NPVs) at various energy efficiency levels. It also includes a model that forecasts shipments for the various equipment classes of beverage vending machines at different efficiency levels.

In June 2008, DOE published an advance notice of proposed rulemaking and notice of public meeting (ANOPR) for refrigerated bottled or canned beverage vending machines (henceforth referred to as the 2008 BVM ANOPR). 73 FR 34094 (June 16, 2008). This document is available at http://www.regulations.gov/#!documentDetail;D=EERE-2006-STD-0125-0003. In that ANOPR, DOE considered establishing energy conservation standards for beverage vending machines and announced a public meeting to receive comments on a variety of issues.

DOE held a public meeting on June 26, 2008 to provide interested parties the opportunity to comment on the proposed equipment classes DOE was considering; the analytical framework, models, and tools (*e.g.*, LCC and NES spreadsheets) that DOE had developed to perform analyses of the impacts of potential energy conservation standards; the results of the preliminary analyses; and the candidate energy conservation standard levels.

After the publication of the 2008 BVM ANOPR and the presentation of the ANOPR to interested parties at the public meeting, DOE conducted additional interviews with BVM manufacturers as part of its development of the MIA for the notice of proposed rulemaking (NOPR). There were 13 topics discussed during each of the interviews: (1) general key issues; (2) company overview and organizational characteristics; (3) company financial parameters; (4) production cost breakdown; (5) shipment projections and market shares; (6) equipment mixes; (7) conversion costs; (8) markups and profitability; (9) cumulative regulatory burden; (10) exports, foreign competition, and outsourcing; (11) direct employment impact assessment; (12) market consolidation; and (13) baseline products and different design options. Based on findings from the preliminary engineering, analyses (LCC, NES, and NIA), and public comments provided in response to the ANOPR, DOE updated the analyses.

[2] The baseline level (*i.e.*, the minimum level) typically represents the energy efficiency of equipment with the lowest energy efficiency level available on the market for a given category. For equipment categories where minimum energy conservation standards already exist, the baseline efficiency level is typically defined by the existing energy conservation standards.

In May 2009, DOE published a NOPR for refrigerated bottled or canned beverage vending machines (henceforth referred to as the 2009 BVM NOPR) to propose energy conservation standards for refrigerated beverage vending machines, and to announce a public meeting to receive comments on a variety of issues. 74 FR 26020 (May 29, 2009). This document is available at http://www.regulations.gov/#!documentDetail;D=EERE-2006-STD-0125-0003.

DOE held a public meeting on June 17, 2009 (henceforth referred to as the 2009 BVM NOPR public meeting) to provide interested parties the opportunity to comment on the proposed standards, results of the analyses, and the trial standard levels (TSLs).

After the publication of the 2009 BVM NOPR and the public meeting, DOE received comments from a diverse set of parties, including manufacturers and their representatives, customers, energy conservation advocates, state officials and agencies, and electric utilities. DOE considered these comments and in August 2009 published a final rule for beverage vending machines (henceforth referred to as the 2009 BVM final rule). 74 FR 44914 (Aug. 31, 2009). The entire rulemaking process that culminated with the publication of the 2009 BVM final rule will be referred to as the 2009 BVM rulemaking. The 2009 BVM final rule established energy conservation standards for beverage vending machines, with a compliance date of August 31, 2012. The 2009 BVM final rule document is currently available at http://www.regulations.gov/#!documentDetail;D=EERE-2006-STD-0125-0005.

1.3 Definitions

EPCA defines a beverage vending machine as follows:

> The term 'refrigerated bottled or canned beverage vending machine' means a commercial refrigerator[3] that cools bottled or canned beverages and dispenses the bottled or canned beverages on payment.
>
> (42 U.S.C. 6291(40))

In the 2009 BVM final rule, DOE added the following definitions to 10 CFR 431.292, "Definitions concerning refrigerated bottled or canned vending machines":

> *Bottled or canned beverage* means a beverage in a sealed container.

[3] 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." (42 U.S.C. 6311(9)(A)) 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.

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

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

Combination vending machine means a refrigerated bottled or canned beverage vending machine that also has nonrefrigerated volumes for the purpose of vending other, non-"sealed beverage" merchandise.

V means the refrigerated volume (ft^3) of the refrigerated bottled or canned beverage vending machine, as measured by ANSI/AHAM HRF–1–2004.

1.4 Current Energy Conservation Standards

Table 1.4.1 shows the current standards for beverage vending machines at 10 CFR 431.296, as prescribed by the 2009 BVM final rule. 74 FR at 44968 (Aug. 31, 2009).

Table 1.4.1 Energy Conservation Standards for Beverage Vending Machines, Prescribed by 2009 BVM Final Rule – Compliance Date August 31, 2012

Class	Definition	Maximum Daily Energy Consumption *kWh/day*
A	a refrigerated bottled or canned beverage vending machine that is fully cooled, and is not a combination vending machine	0.055 × V + 2.56
B	any refrigerated bottled or canned beverage vending machine not considered to be Class A, and is not a combination vending machine	0.073 × V + 3.16
Combination	a refrigerated bottled or canned beverage vending machine that also has nonrefrigerated volumes for the purpose of vending other, non-"sealed beverage" merchandise	[reserved]

1.5 Standby Mode and Off Mode Standards

EPCA requires any new or amended energy conservation standards adopted after July 1, 2010 to incorporate standby mode and off mode energy use. (42 U.S.C. 6295(gg)(3)(A))

EPCA also defines the terms "active mode," "off mode," and "standby mode." "Active mode" is defined as the condition in which an energy-using product is connected to a main power source, has been activated, and provides one or more main functions. "Off mode" is defined as the condition in which an energy-using product is connected to a main power source, and is not providing any standby or active mode function. "Standby mode" is defined as the condition in which an energy-using product is connected to a main power source and offers one or more of the following user-oriented or protective functions: facilitating the activation or deactivation of other functions (including active mode) by remote switch (including remote control), internal sensor, or timer; or providing continuous functions, including information or status displays (including clocks) or sensor-based functions. (42 U.S.C. 6295(gg)(1)(A)) DOE may by rule amend these definitions after considering the most current versions of certain industry standards. (42 U.S.C. 6295(gg)(1)(B))

When connected to a power source, beverage vending machines always actively provide one of the main functions—refrigeration. Therefore, DOE believes that beverage vending machines do not operate under standby and off mode conditions as defined in EPCA, and that the energy use of a beverage vending machine would be captured in any standard established for

active mode energy use. (42 U.S.C. 6295(gg)(1)(A)) DOE does not plan to include standards regulating standby and off mode energy consumption for the equipment.

1.6 Overview of the Rulemaking Process

1.6.1 General Rulemaking Process and Participation of Interested Parties

EPCA requires that any new or amended standards achieve the maximum energy efficiency or water efficiency that is technologically feasible and economically justified. To determine whether a standard is economically justified, EPCA requires that DOE determine whether the benefits of the standard exceed its burdens by considering, to the greatest extent practicable, the following:

i. the economic impact of the standard on the manufacturers and consumers of the affected products;
ii. the savings in operating costs throughout the estimated average life of the product compared to any increases in the initial cost or maintenance expense;
iii. the total projected amount of energy savings likely to result directly from the imposition of the standard;
iv. any lessening of the utility or the performance of the products likely to result from the imposition of the standard;
v. the impact of any lessening of competition, as determined in writing by the Attorney General, that is likely to result from the imposition of the standard;
vi. the need for national energy conservation; and
vii. other factors the Secretary considers relevant.

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

As discussed in further detail below, the standards rulemaking process typically involves four public notices that are published in the *Federal Register*. Publication of the Framework document, preliminary analysis, and NOPR are typically accompanied by public meetings and comment periods to solicit comment from interested parties to enhance the rulemaking process.

DOE also encourages interested parties to develop and submit joint recommendations and will carefully consider such recommendations in its decision making. DOE believes that the analyses accompanying these notices will support DOE's determination whether to amend the standards, and, if the determination is positive, to establish any amended standards.

In this Framework document, DOE presents the procedural and analytical approaches it expects to use to determine whether the establishment of amended energy conservation standards for beverage vending machines is justified and, if so, to set new, amended standards. DOE also presents several issues regarding the regulation of beverage vending machines and requesting feedback from interested parties. Following publication of the Framework document, DOE will publish a preliminary analysis, a NOPR, and a final rule. These rulemaking stages are summarized below and described more fully in subsequent sections.

- *Preliminary analysis* (section 1.7). The preliminary analysis is designed to publicly vet the models and tools that DOE intends to use in the rulemaking, and to facilitate public participation before the proposed rule stage. Using these models and tools,

DOE performs preliminary analyses to assess candidate standard levels (CSLs), which span the range of efficiencies from baseline equipment to the most efficient technology.

- *Notice of proposed rulemaking* (section 1.8). The NOPR presents a discussion of comments received in response to the preliminary analysis; DOE's analysis of the impacts of potential standards on customers, manufacturers, and the nation; DOE's weighting of these impacts; and any proposed standard levels for public comment.

- *Final rule* (section 1.9). The final rule presents a discussion of comments received in response to the NOPR, revised analysis, as appropriate, of the impacts of any standards, DOE's weighting of those impacts, and the standard levels, if any, that DOE is adopting. The final rule also establishes the date for compliance with any standards.

1.6.2 Test Procedure

In December 2006, DOE published a final rule establishing a test procedure for beverage vending machines (the 2006 BVM test procedure final rule). 71 FR 71340, 71355 (Dec. 8, 2006). In that final rule, consistent with 42 U.S.C. 6293(b)(15), DOE adopted 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," as the DOE test procedure. ANSI/ASHRAE Standard 32.1-2004 contains rating temperature specifications of 36 °F (±1 °F) average for beverages in the next-to-vend position. In the 2006 BVM test procedure final rule, DOE also adopted a modification to test equipment with dual nameplate voltages at the lower of the two voltages only, and adopted section 5.2, "Refrigerated Volume Calculation," of ANSI/Association of Home Appliance Manufacturers (AHAM) HRF-1-2004 to calculate the refrigerated volume of beverage vending machines in lieu of vendible capacity. DOE recognized that section 5.2 of ANSI/AHAM HRF-1-2004 addresses the measurement of refrigerated volume in household freezers, but determined that the methodology described includes methods for the measurement of volumes that are applicable to beverage vending machines and is more appropriate than the language in section 4.2 for household refrigerators. 71 FR 58308 (Oct. 3, 2006).

Since the publication of the 2006 BVM test procedure final rule, ASHRAE has updated its test procedure. The most recent version is ANSI/ASHRAE Standard 32.1-2010, which includes changes aligning it with the nomenclature and methodology used in the 2006 BVM test procedure final rule and 2009 BVM final rule. ANSI/ASHRAE 32.1-2010 removes the definitions of "bottled" and "canned" and the includes the portions of ANSI/AHAM HRF-1-2004 incorporated by reference in the 2006 BVM test procedure final rule in a new appendix C. DOE believes that the aforementioned changes were largely editorial, and would not affect the method of test or other technical aspects of the DOE test procedure. AHAM has also updated its test standard since the publication of the 2006 BVM test procedure final rule. The most recent version is ANSI/AHAM HRF-1-2008, which includes minor editorial changes to the refrigerated volume measurement portion of the standard, including reorganizing some of the sections for simplicity and usability.

EPCA requires DOE to periodically review test procedures for covered equipment to determine if amendments are necessary:

(A) Amendment.— At least once every 7 years, the Secretary shall review test procedures for all covered products and—

(i) amend test procedures with respect to any covered product, if the Secretary determines that amended test procedures would more accurately or fully comply with the requirements of paragraph (3); or
(ii) publish notice in the Federal Register of any determination not to amend a test procedure.

(42 U.S.C. 6293(b)(1))

Consistent with this requirement, DOE will conduct a test procedure rulemaking concurrently with the current energy conservation standards rulemaking.

DOE is considering updates to its test procedure, both for clarity and to better represent the energy use of the various beverage vending machines. DOE is considering the following modifications:

(1) Updating the referenced method of test: As discussed above, DOE incorporated by reference ANSI/ASHRAE Standard 32.1-2004, an industry standard for determining the daily energy consumption of beverage vending machines. Since the incorporation of the 2004 version of ANSI/ASHRAE Standard 32.1 as part of the 2006 BVM test procedure final rule, ANSI/ASHRAE Standard 32.1 has been updated to ANSI/ASHRAE Standard 32.1-2010. This version includes adjustments in the rating metric and nomenclature to align with the DOE test procedure but makes no changes that are expected to affect tested daily energy consumption values. DOE is considering amendments to its test procedure to reference ANSI/ASHRAE Standard 32.1-2010.

(2) Clarifying the next-to-vend beverage temperature test condition: DOE is considering amendments to the test procedure to clarify that the average of all next-to-vend product temperatures be maintained within 36 °F (±1 °F) at all times for the duration of the test, which is DOE's understanding of the intent of the ANSI/ASHRAE Standard 32.1 committee. DOE believes that such a procedure is more appropriate than one in which the temperature of next-to-vend beverages is averaged across all selections and over the entire time of the test resulting in a single value of 36 °F (±1 °F) because it ensures that next-to-vend beverages remain at the vending temperature at all time points during the test. This clarification is consistent with the performance in the field, where vending temperature must be held at all times that a purchase may be made.

(3) Testing at a 90 °F ambient test condition: DOE is considering amendments to the test procedure that would eliminate the methodology used to derive performance of the beverage vending machine at the 90 °F ambient as described in the test method incorporated by reference into the DOE test procedure, ANSI/ASHRAE Standard 32.1-2004, and the updated ANSI/ASHRAE Standard 32.1-2010. DOE understands that this test is used primarily to represent and evaluate the performance of units when

installed outdoors; however, the performance of a beverage vending machine at 90 °F ambient is not currently used for DOE regulatory purposes.

(4) Lowest application product temperature: DOE is considering amendments to the test procedure to allow covered beverage vending machines that cannot achieve an average temperature of next-to-vend products of 36 °F (± 1 °F) to instead be tested at their lowest application product temperature. This provision would be consistent with DOE's 2012 test procedure final rule for commercial refrigeration equipment. 77 FR 10292 (Feb. 21, 2012). In this context, the lowest application product temperature would describe the lowest temperature at which the beverage vending machine is capable of operating and is often indicated by the lowest setting on a unit's thermostat. The lowest application product temperature provision would specify a revised average beverage temperature for beverages in the next-to-vend position, but would not modify any other requirements of the DOE test procedure for beverage vending machines.

(5) Product temperature measurements: DOE is considering amendments to the test procedure to require additional temperature data. The current DOE equipment class distinction is based on whether a machine is fully cooled, which manufacturers determine and report based on machine design, Test data gathered using the current test procedure does not include any information to show whether a given machine is fully cooled. This is because the test procedure requires beverage temperature data only from the next-to-vend positions and no other areas of the machine, and thus does not quantify the extent to which products in other parts of the machine are cooled. DOE is considering requiring temperature measurements of standard test packages at locations other than the next-to-vend position as part of this test procedure rulemaking. These measurements could be used in verifying the equipment class (Class A or Class B) of the machine should a question arise.

(6) Expanded range of lighting and control settings: The current DOE test procedure requires that the vending machine be operated with normal lighting and control settings, using only those energy management controls that are permanently operational and not capable of being adjusted by a machine operator. (ANSI/ASHRAE 32.1-2004 7.1.1(d)). It does not specify how to test equipment that has permanently operational controls that can be adjusted, such as beverage vending machines that have multiple lighting and control options to select for use in machine operation, without an option to disable the controls. DOE is considering amendments to the test procedure to indicate what settings are to be used for the testing of machines with controls that are permanently operational (cannot be disabled) but can be adjusted by the operator.

(7) Creating a provision to measure the impact of low-power modes of operation: DOE is considering amendments to the test procedure that include provisions for measuring the energy consumption impact of certain low-power modes with which beverage vending machines may be equipped. The features of these modes may include (but are not limited to) switching off or dimming lights and raising the temperature set point (to which the unit cools the products) to a value higher than the temperature set point associated with the unit's normal operation mode. These low-power modes are typically activated during off hours or periods of low customer traffic. The current

test procedure requires that the vending machine be operated with normal lighting and control settings, using only those energy management controls that are permanently operational and not capable of being adjusted by a machine operator. It is likely that the current test procedure does not capture the energy savings of all types of energy management systems in a representative manner. For the revised test procedure, DOE is considering specifying test requirements to account for the potential reduction in energy consumption associated with the use of certain energy management systems that may not be accounted for in the current test procedure. One amendment under consideration is to include a fixed period of time during which a low-power mode could be utilized during the test, if the low-power mode is available on the unit as shipped from the factory.

DOE encourages input on how low-power modes or other new technologies could best be addressed in a test procedure rulemaking.

Item 1-1	*DOE requests comment regarding adoption of updated test procedure for the beverage vending machines covered under this rulemaking.*
Item 1-2	*DOE requests comment on the possible elimination of the requirement to test units at 90 °F.*
Item 1-3	*DOE requests comment regarding a requirement of measurement of product temperatures at other than the next-to-vend positions.*
Item 1-4	*DOE requests comment on the current utilization of low-power modes in certification testing. Do any current models meet the requirements of the current test procedure regarding energy management controls and utilize a low-power mode during the test?*
Item 1-5	*DOE requests comment on the testing of low-power modes in a revised test procedure. What are the typical functions of low-power mode in beverage vending machines? Are these low-power modes triggered by scheduled timers, activity, motion sensors, or other environment or state changes? What lengths of time should DOE consider for the full-power mode and low-power mode?*
Item 1-6	*DOE requests comment on the applicability of the current test procedure, and all test procedure modifications under consideration, to combination vending machines.*
Item 1-7	*DOE requests comment on its proposal to consider modifications to the test procedure to account for energy management systems.*

Manufacturers must use the new or amended procedure to certify compliance with any new or amended standards no later than the compliance date of those standards. Manufacturers may also certify their products to DOE using the test procedure and any revised energy conservation standards prior to the compliance date of any amended standards.

1.7 Preliminary Analysis

As part of its initial rulemaking activity, DOE typically identifies equipment technology options and makes a preliminary determination on whether to retain each option for detailed analysis or to eliminate it from further consideration. This process includes a market and technology assessment (section 3) and a screening analysis (section 4). DOE applies four screening criteria in the screening analysis to determine if any technology options should be eliminated from further consideration: (1) technological feasibility; (2) practicability to manufacture, install, and service; (3) adverse impacts on utility or availability; and (4) adverse impacts on health or safety. Technologies that pass the screening analysis are evaluated, and referred to as design options, in the engineering analysis.

DOE consults with interested parties and independent technical experts, and conducts research into industry literature to identify the key issues and design options or efficiency levels that DOE will consider in the rulemaking. DOE initiates dialogue with interested parties with this Framework document, the public meeting following its publication, and the request for public comment. This dialogue also provides an opportunity for input into the structural and analytical approach planned for this energy conservation standards rulemaking.

At the start of any preliminary analysis, DOE considers design options or efficiency levels for each equipment class. DOE uses these design options or efficiency levels to collect manufacturer cost data, historical shipment data, shipment-weighted average efficiency data, and preliminary manufacturer impact data (*e.g.*, capital conversion expenditures, marketing costs, and research and development costs). As part of any preliminary analysis, DOE also conducts other principal analyses, including (1) the engineering analysis (section 5); (2) the customer LCC analysis (section 8); (3) the NIA, which considers NES and customer NPV (section 10); and (4) a preliminary MIA (section 12). DOE presents the results of these analyses in the preliminary analysis technical support document (TSD).

DOE selects efficiency levels from the energy efficiency or energy use levels considered as CSLs in any preliminary analysis. Discussion of various CSLs will help interested parties review the data that underpin the analyses. DOE will use interested parties' comments to refine the models for the next stage of the rulemaking analyses. In addition to the efficiency corresponding to the maximum technologically feasible ("max-tech") design and the efficiency corresponding to the minimum LCC point, DOE generally considers CSLs or design options that span the full range of technologically achievable efficiencies. The range of levels DOE typically analyzes includes the following:

- the baseline efficiency level (*i.e.*, the minimum level), which typically represents the energy efficiency of equipment with the lowest energy efficiency level on the market for a given category; for equipment categories where minimum energy conservation standards already exist, the baseline efficiency level is typically defined by the existing energy conservation standard;
- the level with the minimum LCC or greatest LCC savings;
- the level with the greatest NPV;
- the highest energy efficiency level or lowest energy consumption level that is technologically feasible (*i.e.*, max-tech); and
- levels that incorporate noteworthy technologies or fill large gaps between other efficiency levels considered.

At the preliminary analysis stage, DOE uses analytical models and tools to assess the different equipment classes at each efficiency or energy use level analyzed. Many of these analytical models and tools are in the form of spreadsheets, which are used to conduct the LCC analysis and to determine the NES and NPV.

DOE makes the results of any preliminary analysis available on its website for review.[4] When it publishes a preliminary analysis, DOE also makes available a preliminary TSD that contains the details of all the analyses performed to date. After publication of any preliminary analysis, DOE provides a public comment period and hold a public meeting.

1.8 Notice of Proposed Rulemaking (NOPR)

In developing a NOPR, DOE considers all the comments it received after publication of the preliminary analysis. This process may result in revisions to the preliminary analysis, including the engineering and LCC analyses. At this point, DOE conducts additional economic and environmental impact analyses. These analyses generally include a customer subgroup analysis (section 11), a complete MIA (section 12), an employment impact analysis (section 13), a utility impact analysis (section 14), an emissions analysis (section 15), monetization of selected environmental emissions (section 16), and a regulatory impact analysis (section 17).

DOE describes the methodology used and makes the results of all the analyses available on its website for review. Based on comments from interested parties, DOE may revise the analyses further. This analytical process ends with the selection of proposed standard levels, if any, that DOE will present in the NOPR. DOE selects the proposed standard levels from the TSLs analyzed during the NOPR phase of the rulemaking. The NOPR, published in the *Federal Register*, documents the evaluation and selection of any proposed TSLs, along with a discussion of other TSLs considered but not selected and the reasons DOE did not select them.

For each equipment class, DOE identifies the max-tech efficiency level. If DOE proposes a less stringent level than the max-tech level, DOE sequentially explains the reasons for eliminating higher levels, beginning with the highest level considered. DOE presents the analytical results in the NOPR, and provides the details of the analysis in an accompanying TSD.

When DOE publishes a NOPR, it provides the U.S. Department of Justice (DOJ) with copies of the NOPR and TSD to solicit feedback on the impact of any proposed standard levels on competition in the BVM industry. DOJ reviews standard levels in light of any lessening of competition likely to result from the imposition of such standards. (42 U.S.C. 6295(o)(2)(B)(i)(V) and (B)(ii)) Publication of a NOPR is followed by a public comment period that includes a public meeting.

1.9 Final Rule

After publication of a NOPR, DOE considers public comments it receives on the proposal and accompanying analyses. DOE reviews the engineering and economic impact analyses and any proposed standards based on these comments and considers modifications where necessary.

[4] All materials associated with the rulemakings for BVM test procedures and energy conservation standards will be available on DOE's website at: http://www1.eere.energy.gov/buildings/appliance_standards/rulemaking.aspx/ruleid/73

Before any final rule is issued, DOE also considers DOJ comments on the NOPR relating to the impacts of any proposed standard levels on competition to determine whether changes to these standard levels are needed. DOE publishes the DOJ comments and DOE's response as part of any final rule.

In any final rule, DOE determines whether to amend the standards, and if such determination is positive, selects the final standard level based on the complete record of the energy conservation standards rulemaking. Any final rule establishes any final standard levels and the compliance date, and also explains the basis for the selection of any final energy conservation standard levels. A final rule is accompanied by a final rule TSD.

2. ANALYSES FOR ENERGY CONSERVATION STANDARDS RULEMAKING

The purpose of the analyses in this rulemaking is to support DOE's determination whether to amend the energy conservation standards for beverage vending machines. If the energy conservation standards are amended, these analyses ensure that DOE selects standards that achieve the maximum improvement in energy efficiency that is technologically feasible and economically justified and will result in significant energy savings, as required by EPCA. Economic justification includes the consideration of the seven factors set forth in EPCA (see section 1.6.1 of this Framework document), which encompasses economic impacts on domestic manufacturers and customers, national benefits including environmental impacts, issues of consumer utility, and impacts from any lessening of competition.

Figure 2.1 summarizes the analytical components of the standards-setting process. The analyses are presented in the center column. Each analysis has a set of key inputs, which are data and information required for the analysis. "Approaches" are the methods that DOE will use to obtain key inputs and methods of analysis, which may vary depending on the information and analysis step in question. Some key inputs exist in public databases. DOE will also collect information from interested parties or others with special knowledge and develop information independently in support of the rulemaking. The results of each analysis are key outputs, which feed directly into the rulemaking. Arrows indicate the flow of information between various analyses. DOE ensures a consistent approach to its analyses throughout the rulemaking by considering each analysis as a part of the overall standards-setting framework.

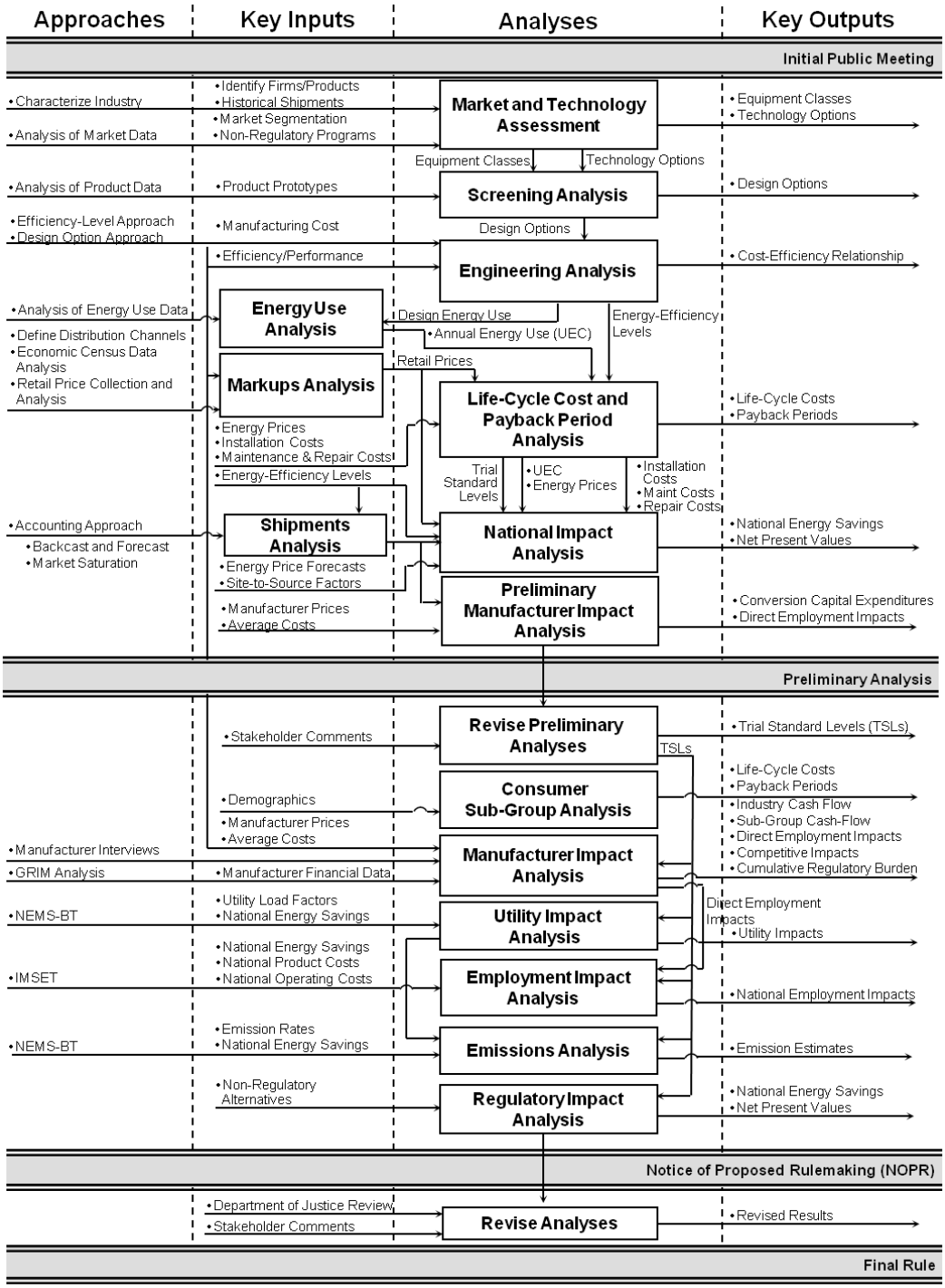

Figure 2.1 Flow Diagram of Analyses for the BVM Standards Rulemaking

3. MARKET AND TECHNOLOGY ASSESSMENT

The market and technology assessment will provide information about the BVM industry that DOE will use throughout the rulemaking. This assessment is particularly important at the outset of the rulemaking to determine equipment classes and to identify potential design options or efficiency (or energy consumption) levels for each equipment class.

3.1 Market Assessment

DOE will qualitatively and quantitatively characterize the structure of the BVM industry and market. In the market assessment, DOE will identify and characterize the manufacturers of this equipment; estimate market shares and trends in the market; address regulatory and non-regulatory initiatives intended to improve the energy efficiency or reduce the energy consumption of the beverage vending machines covered under this rulemaking; and explore the potential for technological improvements in the design and manufacturing of such equipment.

This market assessment will establish the context for this rulemaking, and it will serve as a resource to guide the analyses that follow. For example, DOE may use historical shipments and prices as indicators of future shipments and prices. Similarly, DOE plans to use market structure data for the MIA, data that will be particularly useful for assessing competitive impacts. This phase also allows DOE to start updating design options by reviewing equipment literature and industry publications. The National Automatic Merchandising Association (NAMA) is the trade association for manufacturers of equipment covered under this rulemaking, and the American Beverage Association (ABA) is the trade association for the bottlers and syrup companies in the beverage industry. DOE expects that NAMA and ABA could play a critical role in providing market information, including input on characterizing current and historical trends in equipment shipments and energy efficiency. This type of data is an important input for analyses that determine whether any amended energy conservation standards are economically justified and will result in significant energy savings.

DOE encourages interested parties to submit data that will improve DOE's understanding of the beverage vending machine market. DOE aggregates data provided by manufacturers and other organizations for use in its analyses.

Item 3-1	*DOE seeks information that would contribute to the market assessment (e.g., the manufacturers of this equipment in the United States and the equipment they sell, by equipment class). It is particularly important that DOE be aware of the major and small/niche manufacturers.*
Item 3-2	*DOE seeks information on historical annual equipment shipments (both domestic and imports) by equipment class and the corresponding efficiency distributions of these shipments.*
Item 3-3	*DOE seeks information on the proportion of new equipment shipped annually that replaces existing equipment, for each equipment class.*

3.2 Overview of Beverage Vending Machines

Refrigerated bottled or canned beverage vending machines can be divided into categories in several ways: physical divisions based on door type (opaque or transparent) or beverage storage system (stack or shelves), machine-use designation (indoor/outdoor use or indoor-use-only), cooling mechanism (zone-cooled or fully cooled), and the types of products dispensed. In the 2009 BVM final rule, DOE established three equipment classes: Class A, Class B, and combination beverage vending machines. While equipment in the combination vending machine class by definition contains separate refrigerated and non-refrigerated volumes, Class A and Class B equipment do not contain separate, non-refrigerated volumes. In Class A beverage

vending machine machines, all items are fully cooled to the same temperature at which they will be dispensed. Class B equipment consists of machines in which not all the items are fully cooled to the vending temperature. 74 FR at 44924 (Aug. 31, 2009). Combination vending machines are equipment that also has non-refrigerated volumes for the purpose of vending other, non-"sealed beverage" merchandise. 74 FR at 44920 (Aug. 31, 2009). The criteria, detailed definitions, and corresponding applicable standards for these equipment classes are further discussed in section 3.3.

Another method of classifying beverage vending machines, aside from the cooling-method distinction used in the 2009 BVM final rule, is by the nature of their fronts—transparent or opaque. Transparent-front vending machines store items on shelves, allowing products contained within to be visible to the consumer. Some models have the capacity to display dozens of varieties of products. Product packaging is not limited to cans and bottles, but may also include cartons, juice packs, and non-standard bottle and can shapes. With the market increasing for non-carbonated soft drinks such as energy drinks, fruit juices, and water (which come in a variety of packaging types and sizes), the design of transparent-front machines provides more flexibility than stack-style opaque-front machines (described later in this section). Products are dispensed mechanically, with many machines using a mechanism to move the product to the door gently rather than dropping it from the upper shelves.

Most transparent-front machines are intended to be used indoors because their transparent fronts make them vulnerable to vandalism. In addition, transparent-front machines could experience additional heat flux through the transparent front due to solar heat gain and solar radiation if placed outdoors. However, some transparent-front machines have been made to withstand outdoor conditions. All transparent-front machines that DOE is currently aware of in the U.S. market are "fully cooled" such that all products contained within them are at the vending temperature, and are, therefore, considered Class A.

Unlike transparent-front beverage vending machines, opaque-front beverage vending machines hold standard-sized sealed containers, usually 12-ounce cans or 20-ounce bottles, stored in stacks. Capacity varies, with larger machines holding up to 800 cans split between up to 12 varieties of beverage (through 12 distinct beverage stacks or columns) internally and featuring up to 30 cubic feet of refrigerated volume. Opaque-front machines comprise the majority of vending machines placed outdoors, and many are placed indoors as well. The products contained are typically advertised on the front via signage or a backlit panel and the actual machine contents are not visible to the user. Some opaque-door models feature a "live display" door type, where a sample of the product that may or may not be refrigerated is visible to the consumer through a small window. These "live-display" machines represent a small fraction of the total market.

Zone-cooled machines, which belong to the Class B equipment class, typically have opaque fronts and feature "stack-style" vending mechanism. In this type of equipment, refrigerated air is directed at a fraction (or zone) of the refrigerated volume. This cooling method is used to ensure that some beverages in the lower part of the machine, which will be vended sooner, are fully cooled to the vending temperature, while maintaining beverages in other areas of the machine at higher temperatures. This reduces the refrigeration power needed and thus lessens the energy consumption of the unit.

Combination vending machines, which belong to the third equipment class defined in the 2009 BVM final rule, are refrigerated beverage vending machines that also have non-refrigerated volumes to hold other, non-"sealed beverage" merchandise. Combination vending machines were determined in the 2009 BVM final rule to have much lower shipment volumes than either Class A or Class B machines. Though combination machines are a class of beverage vending machines, DOE did not have the data needed to estimate either the energy efficiency improvement potential or the cost of more-efficient designs of combination vending machines. As a result, no standard was set for combination vending machines in the 2009 BVM final rule. 74 FR at 44919−20 (Aug. 31, 2009). As part of the current rulemaking, DOE is considering performing an analysis of the energy savings potential of combination vending machines.

Item 3-4	*DOE requests comment on whether all transparent-front beverage vending machines currently available on the market are fully cooled.*
Item 3-5	*DOE requests comment on whether all opaque-front beverage vending machines currently available on the market are zone cooled.*
Item 3-6	*DOE requests information on perishable items in beverage vending machines. Do machines that sell perishable and non-perishable items (in addition to or including beverages) ship with different software or controls? Are they rated differently, such as to food safety specifications? What portion of the BVM market is composed of machines that sell perishable items?*

3.3 Equipment Classes

When evaluating and establishing energy conservation standards, DOE creates equipment classes based on the type of energy used, capacity, or other performance-related features that affect efficiency. Additionally, DOE must consider such factors as utility to the consumer or others deemed appropriate in setting standards for separate equipment classes. (42 U.S.C. 6295(q))

In the 2009 BVM final rule, DOE determined that the most significant criterion affecting beverage vending machine energy use is the method used to cool beverages. Using this criterion, DOE divided covered equipment into two equipment classes:

Class A: a refrigerated bottled or canned beverage vending machine that is fully cooled, and is not a combination vending machine.

Class B: any refrigerated bottled or canned beverage vending machine not considered to be Class A, and is not a combination vending machine.

In addition, DOE interprets EPCA's definition in 42 U.S.C. 6291(40) for beverage vending machines to cover any vending machine that dispenses at least one type of refrigerated bottled or canned beverage, regardless of the other types of vended products (some of which may not be refrigerated). In the 2009 BVM final rule, DOE concluded that combination vending machines have a distinct utility and, accordingly, established a third equipment class to cover combination vending machines. As noted above, however, DOE did not establish standards for this equipment class in that rule. 74 FR at 44919–20 (Aug. 31, 2009). So that interested parties

understand what constitutes a combination vending machine, DOE established the following definition:

> *Combination vending machine*: a refrigerated bottled or canned beverage vending machine that also has non-refrigerated volumes for the purpose of vending other, non-"sealed beverage" merchandise.

As part of the current rulemaking, DOE will evaluate the three equipment classes established in the 2009 BVM final rule and determine whether modifications should be made to the classes in conjunction with any potential new or amended standards.

In the 2009 BVM final rule, DOE did not provide a definition for the term "fully-cooled." In the current rulemaking DOE is considering the following definition:

> *Fully-cooled beverage vending machine*: a refrigerated bottled or canned beverage vending machine within which each item in the beverage vending machine is brought to and stored at temperatures that fall within plus or minus 2 °F of the average beverage temperature, which is the average of the temperatures of all the items in the next-to-be-vended position for each selection.

DOE is aware that certain beverage vending machines feature low-power modes in which the machines maintain the refrigerated product at a higher temperature than they would during normal-mode operation. Such low-power modes are typically meant to be activated during off hours when customer traffic is expected to be negligible and when the product being refrigerated is non-perishable. If such low-power modes are taken into consideration and accounted for in the DOE test procedure (as described in section 1.6.2), a distinction may need to be made between beverage vending machines that vend only non-perishable items (including or in addition to beverages) and those that also vend perishable items (including or in addition to beverages). This is because machines vending perishable goods could not utilize a mode allowing product temperatures to rise above levels required for food safety purposes. Because of this, DOE may choose to treat beverage vending machines designed to vend perishable products as a separate equipment class.

DOE notes that equipment designed for vending perishable items could modulate the temperature of the non-perishable beverage portion of the equipment, while not increasing the temperature of the section of the equipment designed to hold perishable items. DOE could consider test procedures for beverage vending machines that vend some perishable products that account for the "perishable product volume" and "non-perishable product volume" separately.

Item 3-7	*DOE seeks comment on the equipment classes for beverage vending machines, and on the criteria used in creating the classes. Are the equipment classes appropriate? Are there other factors that should be considered in equipment class distinctions and definitions?*
Item 3-8	*DOE seeks comment regarding the possible use of alternative equipment classes in this rulemaking. Specifically, are there other equipment characteristics that should be considered for equipment class distinctions and definitions?*

Item 3-9	*DOE seeks comment on the proposed definition of "fully cooled vending machine." Does the current language reflect what is used in industry?*
Item 3-10	*DOE requests comment on the creation of a new equipment class for machines that are manufactured and sold to vend perishable items (including or in addition to beverages). How should DOE define equipment sold to vend perishable items? Does this equipment obtain other certifications for vending perishable items? Is it common for beverage vending machines to vend both perishable and non-perishable items? Is the same beverage vending machine offered to vend both perishable and non-perishable items (i.e., the equipment is not currently differentiated in the marketplace)?*

3.4 Technology Assessment

The technology assessment centers on understanding how equipment uses energy and what measures can reduce energy consumption of beverage vending machines. Measures that could potentially improve the energy efficiency of equipment are called "technology options," and they are based on existing technologies as well as working prototypes. In consultation with interested parties, DOE intends to develop a list of technology options that should be considered in the analysis.

In recent years, new technological developments have emerged that are applicable to beverage vending machines. DOE is aware of, for example, a move away from hydrofluorocarbon (HFC) refrigerants toward natural refrigerants such as hydrocarbons (HCs) and carbon dioxide (CO_2), the incorporation of touch-screen interfaces, increasing inclusion of low-power modes of operation by equipment manufacturers, reduced cost of electronic components, and greater use of variable-speed compressor and permanent magnet motors.

DOE could consider various low-power modes as design options. Low-power modes could include lighting low-power modes in which lights are dimmed or turned off, refrigeration low-power modes in which beverage temperatures are allowed to rise to 40 °F or higher, and whole machine low-power modes where both features are employed. Refrigeration and whole machine low-power modes may not be options for beverage vending machines that sell perishable products such as milk and fresh juices due to food safety requirements. If low-power modes incorporating increased product temperatures are considered as a design option, DOE could consider creation of a new equipment class for equipment that is sold to vend perishable items (in addition to or including beverages), to acknowledge the fact that these units' maximum temperatures are dictated by food safety requirements and they may not be able to take advantage of a low-power refrigeration mode of operation.

DOE is studying technology options by reviewing manufacturer catalogs, recent trade publications, technical journals, and patent filings. DOE also intends to consult with technical experts within the field and to conduct manufacturer interviews about these technology options. For the preliminary analysis, DOE is currently considering the specific technologies and designs listed below.

The following technologies and designs are relevant to all of the equipment classes listed above:

- higher efficiency signage lighting (*e.g.*, light-emitting diodes);

- higher efficiency lighting ballasts (*e.g.*, electronic ballasts);
- remote lighting ballast location (*i.e.*, outside the refrigerated space);
- higher efficiency expansion valves (*e.g.*, dual-port thermostatic expansion valves and electronic expansion valves);
- higher efficiency evaporator fan motors (*e.g.*, electronically commutated motors (ECMs));
- increased evaporator surface area or efficiency to achieve lower machine-evaporator temperature differential (with a possible increase in fan energy);
- evaporator-fan-motor controllers;
- higher efficiency evaporator fan blades;
- low-pressure-differential evaporators;
- anti-sweat heater controls;
- machine-insulation thickness increases or improved insulating materials, such as vacuum insulated panels or aerogels;
- defrost mechanism (*e.g.*, hot-gas defrost);
- defrost-cycle control (*e.g.*, partially or fully demand-based defrost rather than partially or fully time-based defrost);
- higher efficiency compressors;
- variable-speed compressors;
- suction line heat exchangers (subcool liquid refrigerant with suction line);
- increased condenser surface area or efficiency to achieve lower ambient-condenser temperature differential;
- higher efficiency condenser fan motors (*e.g.*, ECMs);
- condenser-fan-motor controllers;
- higher efficiency condenser fan blades;
- lighting controls, timers, and/or sensors; and
- low-power modes incorporating refrigeration controls, timers, and/or sensors.

Item 3-11	*DOE requests comment on whether any technologies or designs should be added to or removed from the above list. For example, do any of the technologies above raise issues with proprietary designs or issues where testing pursuant to the DOE test procedure does not reflect a change in measured energy efficiency?*
Item 3-12	*DOE requests comments, recommendations, and data on max-tech levels for Class A equipment, Class B equipment, and combination vending machines.*
Item 3-13	*DOE requests comment on whether max-tech levels can only be achieved using proprietary designs or whether there are alternative design paths available that can achieve the same energy use level?*
Item 3-14	*DOE requests comment on whether any technologies or designs should be treated individually, or be incorporated into a few standard "design packages." If "design packages" are possible, how should the packages be assembled? DOE would develop potential standard levels based on these packages, but manufacturers could meet any established standards through the use of any design options.*

Item 3-15	*DOE requests comment on low-power modes. What types of low-power modes are currently used in the BVM market? Are there other types of energy management systems about which DOE should be aware that are applicable to beverage vending machines?*
Item 3-16	*DOE requests comment on whether transparent-front machines could be designed with zone cooling.*

3.5 Baseline Units

Once DOE has established equipment classes, it will select baseline models as reference points for each equipment class, against which it can measure changes resulting from energy conservation standards. The baseline models in each equipment class represent the characteristics of equipment in that class. Typically, a baseline model would be a model that just meets current required energy conservation standards. For equipment covered by conservation standards in the 2009 BVM final rule, DOE will select baseline models that are minimally compliant with the required energy conservation standards set forth in that final rule. If DOE determines it necessary to develop standards for equipment for which standards were not set in the 2009 BVM final rule, or for classes other than those specified in the 2009 BVM final rule, DOE will select baseline models using a different method (*e.g.*, the unit with the highest energy consumption or a typical unit). DOE proposes to use information provided by stakeholders, as well as information available through the DOE's Compliance Certification Management System (CCMS) in selecting appropriate baseline models.

Item 3-17	*DOE seeks comment on how to select baseline efficiency levels for equipment classes without a previous energy conservation standard (e.g., combination machines).*
Item 3-18	*What machine sizes and capacities (cubic feet, vendible capacity) should be used as analysis points for each equipment class?*
Item 3-19	*DOE seeks information on what particular components and features characterize the baseline model in each equipment class (materials, dimensions, insulation, refrigerant type, compressors, evaporators, condensers, expansion devices, fans, motors, anti-condensate devices and controls, defrost mechanisms and controls, lighting, etc.).*

4. SCREENING ANALYSIS

The purpose of the screening analysis is to screen out technology options that will not be further analyzed in the engineering analysis. DOE will follow the process set forth below to screen out technology options.

DOE will use the list of technology options (developed through its own research and in consultation with interested parties in the technology assessment) for consideration in the engineering analysis (section 5). DOE will review each technology option or best available technology in light of the following four criteria:

1. *Technological feasibility.* DOE will screen out technologies that are not incorporated in commercially available equipment or working prototypes.

2. *Practicability to manufacture, install, and service.* If DOE determines that mass production of a technology in commercial equipment and reliable installation and servicing of the technology cannot be achieved on the scale necessary to serve the relevant market at the time of the effective date of the standard, it will not consider that technology further.

3. *Adverse impacts on product or equipment utility or availability.* If DOE determines a technology will have significant adverse impact on the utility of the equipment to significant customer subgroups, or would result in the unavailability of any covered equipment type with performance characteristics (including reliability), features, size, 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 DOE determines that a technology will have significant adverse impacts on health or safety, it will not be considered further.

DOE will fully document its reasons for eliminating or retaining any technology options during the screening analysis and will publish this documentation for interested parties to review as part of the preliminary analysis. Those technology options not screened out by the above four criteria will be considered design options in the development of cost-efficiency curves in the engineering analysis.

Item 4-1	*DOE welcomes comments on how the above four screening criteria might apply to any additional technology option(s) that an interested party recommends to DOE.*
Item 4-2	*DOE welcomes comments on the applicability of the four screening criteria to the technologies listed in section 3.4.*

5. ENGINEERING ANALYSIS

After conducting the screening analysis, DOE performs an engineering analysis based on the remaining design options. The engineering analysis consists of estimating the costs of equipment at various levels of increased energy efficiency or reduced energy consumption. This section provides an overview of the engineering analysis (section 5.1), and includes discussion of (1) the approach for determining the cost-efficiency relationship (section 5.2); (2) manufacturer prices (section 5.3); (3) proprietary designs (section 5.4); and (4) regulatory requirements outside the realm of DOE's energy conservation standards program (section 5.6).

5.1 Engineering Analysis Overview

The purpose of the engineering analysis is to determine the relationship between manufacturer selling price (MSP) and energy efficiency (energy use) for beverage vending machines. In determining this relationship, DOE will estimate the increase in MSP associated with design changes that increase the efficiency (decrease energy use) of the baseline models.

DOE will obtain cost estimates for the engineering analysis (which it will also use in the MIA) from detailed incremental cost data disaggregated into the cost of incremental material, labor, and overhead. DOE will create an industry-wide analysis based primarily on cost estimates of specific design options.

DOE seeks design and cost information to determine the cost of increasing energy efficiency (reducing the energy consumption) of the baseline models. In addition, DOE must identify the model with the highest energy efficiency (lowest energy consumption) that is technologically feasible within each equipment class (*i.e.*, the "max-tech" model).

Item 5-1	*Within each equipment class, for energy consumption levels below the current standards' baseline, DOE seeks information on daily energy consumption and on incremental manufacturing costs and components (differentiation in components from the baseline, material costs,[5] labor costs,[6] factory overhead costs[7] (excluding depreciation), building conversion capital expenditures, tooling/equipment conversion capital expenditures, research and development (R&D) expenses, marketing expenses, etc.).*
Item 5-2	*DOE is also interested in any equipment test data that stakeholders can provide (including equipment parameters, test results, etc., and, in the case that a test procedure other than the DOE test procedure was used, the test procedures used and rating conditions). Test data for the baseline model in each equipment class is particularly important.*

5.2 Proposed Approach for Determining the Cost-Efficiency Relationship

DOE performs an engineering analysis as part of its rulemaking efforts in order to determine the cost-efficiency relationship for each type or class of equipment for which standards are being considered. This cost-efficiency relationship is a quantification of the fact that, in most cases, higher equipment efficiency inherently incurs a higher cost to the manufacturer (due to more sophisticated components or processes). Generally, this relationship is depicted as an output of the engineering analysis in the form of curves plotting cost as a function of energy efficiency for the given equipment class. DOE typically structures its engineering analysis using one of three approaches: (1) design-option; (2) efficiency-level; or (3) reverse-engineering (or cost-assessment). A design-option approach uses individual design options, or combinations of design options, to identify increases in efficiency. Under this approach, cost estimates are based on manufacturer or component supplier data or engineering

[5] This consists of costs of raw materials including scrap that can be traced to final or end products. Direct material costs do not include indirect material costs that are attributed to supplies that may be used in the production process but not incorporated into final products (*e.g.*, lubricating oil for production machinery).

[6] This refers to earnings of workers who assemble parts into a finished good or operate machines in the production process. Direct labor includes the fringe benefits of direct laborers such as group health care, as well as overtime pay. Direct labor does not include indirect labor, which is defined as the earnings of employees who do not work directly in assembling a product such as supervisors, janitors, stockroom personnel, inspectors, and forklift operators.

[7] Factory overhead includes indirect labor, downtime, set-up costs, indirect material, expendable tools, maintenance, property taxes, insurance on assets, and utility costs. Factory overhead does not include depreciation, selling, general, and administrative costs, R&D, interest, or profit (accounted for by DOE separately).

computer simulation models focused on design options. Individual design options, or combinations of design options, are added to the baseline model in ascending order of cost-effectiveness. An efficiency-level approach establishes the relationship between manufacturer cost and increased efficiency at predetermined efficiency levels above the baseline. Under this approach, manufacturers typically provide manufacturer cost data for incremental increases in efficiency, without identifying the technology or design options they would use to achieve such increases, or cost models are prepared based on procured equipment of a known efficiency level. A reverse-engineering or cost-assessment approach involves purchasing representative units of beverage vending machines, disassembling the units into their components, and evaluating the manufacturing costs based on a "bottoms-up" manufacturing cost assessment of the components and their assembly.

In the 2009 BVM rulemaking, DOE used a design-option approach for the engineering analysis. DOE plans to continue using this approach for this rulemaking. The design option approach will involve consultation with industry experts, review of publicly available cost and performance information, and modeling of equipment costs and energy consumption. DOE believes that the design option approach, where modeling is used to simulate implementation of specific energy-efficient features, lends itself best to this equipment type. This is due to the fact that much of the equipment is built at or near the current required performance levels, and there is not a large range of efficiencies within the equipment currently on the market from which to draw trends, as would be needed for an efficiency-level or pure reverse-engineering approach.

In the analyses for the 2009 BVM final rule, Class A beverage vending machines were modeled as having transparent fronts and Class B beverage vending machines were modeled as having opaque fronts.

For each equipment class, the engineering analysis will be used to estimate manufacturer production cost of equipment at each efficiency level considered. DOE plans to use a cost model to estimate the cost of the case, refrigeration system, lighting, and other system components. A cost model was developed for the 2009 BVM rulemaking and will be updated for the current rulemaking's engineering analysis.

Item 5-3	*DOE requests feedback on the use of the design-option approach to determining the relationship between manufacturer selling price and energy efficiency for beverage vending machines.*

5.3 Manufacturer Prices

DOE plans to apply markups to convert manufacturer production cost to MSPs. DOE will estimate manufacturer markups from publicly available financial information (*e.g.*, Securities and Exchange Commission 10-K reports). This information will be adjusted later based on information from manufacturer interviews.

Item 5-4	*DOE seeks comment on the markup approach proposed for developing estimates of manufacturer selling prices.*

5.4 Proprietary Designs

DOE considers in its engineering and economic analyses all design options that have not been screened out, including proprietary designs. DOE will consider proprietary designs in the subsequent analyses only if they are not part of a unique path to a given efficiency level. If the proprietary design is the only approach available to achieve a given efficiency level, DOE will reject that efficiency level from further analysis. Further, DOE is sensitive to manufacturer concerns regarding proprietary designs and will make provisions to maintain the confidentiality of any proprietary data submitted by manufacturers consistent with applicable law.

This information will provide input to the competitive impacts assessment and other economic analyses.

Item 5-5	*Are there proprietary designs that DOE should consider for any of the equipment under consideration by this rulemaking? If so, how should DOE acquire the cost data necessary for evaluating these designs?*
Item 5-6	*Are there alternative design paths that can achieve the same level of max-tech energy use (energy efficiency) as those using proprietary designs?*

5.5 Representative Sizes

In performing the engineering analysis, DOE will select equipment models from the range of available equipment with sizes that DOE believes best represent the most typical offerings within that specific equipment class. In the case where the standard level is an equation, *i.e.*, function of the capacity, DOE may select multiple sizes of equipment as representative models in order to determine the relationship between energy use characteristics and equipment size within a given product class. Proper selection of representative sizes will allow for the analyses to accurately model the majority of available equipment. DOE plans to select representative sizes for each equipment class, while considering the possible design constraints at very small and very large capacities. For those classes already subject to standards, DOE plans to use the representative sizes it used in developing the 2009 BVM final rule and included in the 2009 BVM final rule TSD, shown in Table 5.5.1, as starting values for the engineering analysis in this rulemaking. For any other analysis that DOE conducts, such as the complete analysis for combination vending machines that is under consideration, DOE will select representative equipment sizes that represent the most typical offerings from within that equipment class.

Table 5.5.1 Representative Sizes for Beverage Vending Machines in 2009 BVM Rulemaking

	Class A			Class B		
	Small	**Medium**	**Large**	**Small**	**Medium**	**Large**
Vendible Capacity *number of cans*	300	400	500	450	650	800
Refrigerated Volume ft^3	17	22	34	17	22	26

Item 5-7 *DOE requests feedback on representative sizes. Are the representative sizes used for the 2009 BVM final rule adequate, and should they be retained or modified?*

Item 5-8 *If DOE were to analyze a combination equipment class, perishables (including or in addition to beverages) equipment class, or other new equipment classes, what should be the relevant representative sizes for that class?*

5.6 Outside Regulatory Changes Affecting the Engineering Analysis

In conducting an engineering analysis, DOE must consider the effects of regulatory changes outside DOE's statutory energy conservation standards rulemaking process that can affect the energy efficiency or energy consumption of the covered equipment, and/or the cost of improving such efficiency or consumption. DOE will attempt to identify all such outside regulatory issues that could impact the engineering analysis. The consideration of these issues is closely related to the cumulative regulatory burden assessment that DOE will carry out as part of the MIA. Based on consideration of the comments received for the preliminary analysis, DOE will make the necessary changes to the analysis. These changes will be reflected in the documentation of the NOPR.

One issue that may be relevant to this equipment is alternative refrigerants. DOE did not consider chlorofluorocarbon (CFC) or hydrochlorofluorocarbon (HCFC) refrigerants in its analysis for the 2009 BVM final rule, instead using HFC R-134a as the refrigerant in all technical analyses. Although alternative refrigerants such as HCs, ammonia, and CO_2 are used in Europe and elsewhere, they were not used at the time of the analyses for the 2009 BVM rulemaking for BVM applications in the United States.

The majority of the U.S. BVM industry currently continues to use HFC refrigerants, specifically R-134a, in its equipment. However, DOE is aware that beverage vending machines using alternative refrigerants are now available in the U.S. and that this equipment represents a growing portion of the market. DOE requests information from interested parties regarding the prevalence, cost, and energy consumption of equipment using these refrigerants.

Item 5-9 *DOE requests information on the use of alternative refrigerants in beverage vending machines, including shipment, cost, and energy consumption information.*

Item 5-10 *Are there additional regulatory issues that DOE should consider in its analysis of beverage vending machines? Do the issues discussed in this section affect shipments, cost, or energy efficiency?*

6. ENERGY USE ANALYSIS

The purpose of the energy use analysis is to assess the energy- and peak-demand-savings potential of different equipment efficiencies for various building types and across a range of climate zones where the equipment is used. As part of the energy use analysis, DOE must make certain engineering assumptions regarding equipment application, including where the equipment is located (outdoor versus indoor). Although many beverage vending machines are located inside conditioned spaces, a relatively small number of machines are installed outdoors or outside the conditioned space of buildings, which affects the thermal load on the beverage vending machines. A small number of machines installed outdoors in cold climates are equipped with heater kits. Characterizing the energy use of beverage vending machines is a critical part of the standards rulemaking analysis, as it establishes the per-unit energy-savings potential achievable from energy efficiency standards.

Item 6-1	*How should DOE consider energy use in "heating mode" for outdoor machines in cold climates?*

7. MARKUPS ANALYSIS

DOE uses manufacturer-to-customer markups to convert the MSP values, obtained from the engineering analysis, to customer purchase prices, which are then used in the LCC analysis and the NIA. Customer purchase prices are needed for the baseline efficiency level and all other efficiency levels under consideration. To quantify these markups, DOE will attempt to collect data on existing prices in the market (*e.g.*, purchased data sets or distributor Internet sites), where collecting such data is possible and produces meaningful results.

Before it can develop markups, DOE must identify distribution channels. Once it identifies the major distribution channels for each equipment class, DOE will use available data to determine how equipment is marked up from the manufacturer to the customer.

During the 2009 BVM final rule analysis, DOE identified the following four distribution channels for beverage vending machines:

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

2. Equipment Manufacturer → Distributor → Vending Machine Operator

3. Equipment Manufacturer → Site Owner

4. Equipment Manufacturer → Distributor → Site Owner

In the first distribution channel scenario, the equipment manufacturer builds the equipment to meet the machine performance specifications provided by a beverage company and sells it directly to the vending machine operator, who is either a bottler or a beverage distributor. The vending machine operator owns the machine, places it on-site through a "location contract," maintains the machine and stocks it, and receives a certain percentage of the revenue. The site owner, in this case, allows the machine to be placed on-site, receives a percentage of revenue or other payment, and pays the electric bill. In the second scenario, the vending machine operator

purchases the equipment from a distributor instead of directly from the equipment manufacturer. In the third scenario, a site owner (*e.g.*, large retail store chain) may purchase the vending machines directly from the manufacturer. In the fourth scenario, a site owner (*e.g.*, gas stations) may purchase the vending machines from a distributor. In both the third and the fourth scenarios, the site owner maintains and stocks the machines and earns the entire revenue.

DOE intends to use the data gathered from stakeholders to develop both baseline markups and incremental markups. Baseline markups will be applied to the MSP of the baseline equipment to determine the customer purchase price of baseline equipment. Incremental markups will be applied only to the cost increments (difference between MSP of baseline equipment and equipment at higher efficiency levels). As a result, the customer purchase price of the equipment at higher efficiency levels will be equal to the sum of purchase price of baseline equipment and the product of cost increment and incremental markup. Incremental markups will be calculated by assuming that certain industry costs, such as labor and building occupancy expenses, do not increase with an increase in cost of goods sold. DOE will develop both baseline and incremental markups for use in the LCC analysis.

Item 7-1	*DOE requests information on the distribution channels described above for the beverage vending machines covered under this rulemaking. DOE also seeks information on other major distribution channels that DOE should be considering for markups analysis. DOE also requests information on the relative fractions of shipments expected for each channel.*
Item 7-2	*DOE requests information on how the overall markups for the beverage vending machines covered under this rulemaking may vary for each channel.*
Item 7-3	*DOE requests feedback on its proposal to use baseline and incremental markups.*
Item 7-4	*DOE requests comment on sources of relevant data that could be used to calculate markups for each distribution channel.*

8. LIFE-CYCLE COST AND PAYBACK PERIOD ANALYSIS

8.1 Overview

DOE will conduct an LCC analysis to evaluate the economic impacts of amended energy conservation standards developed for beverage vending machines on individual commercial customers. The effect of standards on customers includes a change in operating cost (usually decreased) and a change in purchase cost (usually increased). The LCC analysis uses two metrics to determine the effect of the standards on customers:

- **Life-cycle cost**. The total customer cost over the life of the equipment is the sum of installed costs (purchase and installation costs) and operating costs (maintenance, repair, and energy costs). Future operating costs are discounted to the time of purchase and summed over the lifetime of the equipment.

- **Payback period (PBP)**. Payback period is the estimated amount of time (in years) it would take customers to recover the higher purchase price of more-efficient equipment through lower operating costs.

For the LCC analysis, DOE will use the cost-efficiency relationships obtained from the engineering analysis and the energy consumption values obtained from the energy use analysis. Other inputs to the LCC analysis include the installation costs and operating expenses (energy, maintenance and repair costs).

Inputs for the LCC analysis are estimated from the best available data for the market. Where possible, DOE uses a range of values for each input (for example, the equipment lifetime, which can vary over a wide range).[8] In the NOPR stage of this rulemaking, DOE will perform the LCC analysis in the form of Monte Carlo simulations in which certain inputs are provided a range of values and probability distributions. The results of the LCC analysis are presented in the form of mean LCC savings; percentages of customers experiencing net savings, net cost, and no impact in LCC; and median PBP. For each equipment class, 10,000 Monte Carlo simulations will be carried out. The simulations will be conducted using Microsoft Excel and Crystal Ball, a commercially available Excel add-in for carrying out Monte Carlo simulations.

The following sections discuss the methodologies DOE plans to use in determining the inputs necessary for the LCC analysis.

8.2 Energy Prices

DOE will review the U.S. Energy Information Administration's (EIA) energy price data for the commercial sector as a means of establishing electricity prices. DOE typically relies on state-level average energy price data for the commercial sector. DOE will use projections of these energy prices for commercial customers to estimate future energy prices in its LCC analysis. DOE will use EIA's *Annual Energy Outlook* (*AEO*) as the default source of projections for future energy prices.

Item 8-1	*DOE seeks comment on the proposed approaches for estimating current and forecasted energy prices.*

8.3 Life-Cycle Cost Discount Rates

The calculation of customer LCC requires the use of an appropriate discount rate. For beverage vending machines, DOE intends to use the same approach that it used for developing discount rates for the 2009 BVM final rule. This approach involves deriving the discount rates for commercial customers, in this case, the bottling companies, the vending machine operators, or the site owners (including government entities), by estimating the cost of capital to the companies that purchase the beverage vending machines covered under this rulemaking. DOE typically uses the cost of capital to estimate the present value of cash flows to be derived from a typical company project or investment. Most companies use both debt and equity capital to fund

[8] DOE notes that in some cases, data are available for generally accepted representative values within the industry rather than a range of values. Calculations based on representative values yield average or representative values for the LCC and PBP outputs.

investments; therefore, the cost of capital to the firm is the weighted-average cost of equity and debt financing. For government entities, it is the rate on their debt. This corporate finance approach is referred to as the weighted-average cost of capital (WACC).

DOE will include for public comment in the preliminary analysis the discount rates and calculations associated with the LCC of beverage vending machines.

Item 8-2	*DOE seeks comment on the proposed approaches for estimating discount rates for customers using the equipment covered under this rulemaking.*
Item 8-3	*DOE recognizes that a large fraction of the customers of beverage vending machines are beverage bottlers. Which commercial sectors besides the bottlers should be considered in the evaluation of discount rates? In addition, do stakeholders believe that government direct purchases of this equipment are large enough to require that they be included in the evaluation of discount rates?*

8.4 Installation, Maintenance, and Repair Costs

Installation costs are the material and labor costs incurred by the customers to install the beverage vending machines. Maintenance costs are the costs incurred by the customers for preventative maintenance. Repair costs are the costs to repair and replace malfunctioning components of the beverage vending machines.

Installation cost is a one-time cost and is added to the customer equipment purchase price to obtain the equipment installed cost. The repair costs may and maintenance costs do occur several times during the lifetime of the equipment. Therefore, repair and maintenance costs are expressed in the form of annualized costs.

For the calculation of LCC savings and PBP values at each efficiency level, only the costs that are different from the baseline level are relevant. Therefore, for the calculation of the repair costs, DOE accounts for those repair costs related to the design options under consideration for each equipment class. DOE will request input from manufacturers and other stakeholders in developing appropriate incremental repair and maintenance costs for higher efficiency equipment if stakeholders feel such estimates are necessary.

Item 8-4	*DOE seeks feedback on what fraction of the installation, maintenance, and repairs involve efficiency improvements and what are the typical practices during the life cycle of an originally manufactured beverage vending machine (e.g., change lamps but not the compressor).*
Item 8-5	*What is a typical time period between the sale of a new BVM unit and the first maintenance or repairs? What are the typical cycles of maintenance and repairs?*
Item 8-6	*DOE seeks feedback on whether (and how) routine maintenance, repair, and installation costs will change for more-efficient equipment.*

Item 8-7	*DOE seeks feedback on appropriate methodologies for assessing changes to maintenance, repair, and installation costs.*

8.5 Equipment Lifetimes

DOE will use information from various published sources (*e.g.*, *Vending Times*) and input from manufacturers and other stakeholders to establish average equipment lifetimes for use in the LCC and subsequent analyses.

A typical vending machine may undergo periodic refurbishments during its lifetime. Depending on the frequency of the refurbishments and their nature with regard to improvements in energy performance, these refurbishments may change the useful lifetime of the equipment.

Item 8-8	*DOE seeks feedback on appropriate equipment lifetimes for the beverage vending machines covered under this rulemaking.*
Item 8-9	*DOE seeks comment on whether energy conservation standards will have an impact on lifetimes of beverage vending machines.*
Item 8-10	*Is there a suitable inventory model that could be used to estimate the fraction of new versus rebuilt/refurbished machines in the market? If no inventory model exists, what is the impact of refurbishment on the equipment lifetime? DOE also seeks feedback on the number of refurbishment cycles in the typical lifetime of the beverage vending machines. DOE also seeks information on the effect of refurbishments on equipment utility and energy consumption. In a typical refurbishment, for example, are features added to the beverage vending machine that affect its utility and/or are changes made that affect the energy consumption of the equipment?*

9. SHIPMENTS ANALYSIS

Shipment projections are required to calculate the national impacts of standards on energy consumption, NPV, and future manufacturer cash flows. DOE plans to develop shipment projections based on an analysis of key market drivers for beverage vending machines.

9.1 Base-Case Projections

To evaluate the various impacts of standards, DOE must develop a base-case projection against which to compare projections for higher efficiency levels. The base-case projection is designed to depict what will happen to energy consumption and energy costs over time if DOE does not adopt new or amended energy conservation standards for the equipment covered under this rulemaking. In determining the base-case projection, DOE will consider historical shipments, the mix of efficiencies sold in the absence of standards, and how that mix might change over time, for instance in response to known voluntary or incentive-based programs such as ENERGYSTAR® or utility customer rebate programs that encourage purchase of higher efficiency equipment. For these purposes, DOE needs data on historical shipments and the market shares of the different efficiency levels offered in each equipment class.

Vending Times reports historical shipments for beverage vending machines as an overall product group.[9] In addition, the U.S. Bureau of Census (Census Bureau) has also published limited statistics on the quantity and value of product shipments.[10] Census Bureau data is available online for the years 1995, 1996, 1999, and 2000 for refrigerated soft drink vending machines. These data are not broken down by equipment class. The data collection was discontinued after the 2000 data were published, so no additional data from the Census Bureau beyond 2000 is available.

DOE will attempt to collect shipment data and market-share efficiency data (*i.e.*, data on the distribution of product shipments by efficiency) for each equipment class. DOE recognizes that this information may be difficult to collect, and may therefore consider using other methods for estimating the efficiency distribution in the market. For example, when market-share efficiency data are not available, DOE may use efficiency distributions based on available models as a proxy. DOE may also request separate shipment information for equipment sold with specific design features (*e.g.*, ECM evaporator fan motors).

Item 9-1	*DOE requests data on, sources of data related to, or any information pertaining to historical shipments and the market shares of the different efficiency levels offered in each equipment class.*

9.2 Accounting Methodology

DOE proposes to determine annual shipments in the base case by accounting for new building construction and historical rates of ownership (saturation rates) in buildings. This method has the distinct advantage of separately accounting for units installed in new construction and existing buildings. More importantly, DOE can express equipment saturation rates as a function of customer price and operating cost to capture their impact on future shipments. DOE plans to rely on EIA's *AEO* to forecast new commercial construction. For equipment retirements, DOE will use the same equipment lifetimes and retirement functions that are used for the LCC analysis.

DOE will also consider any other input provided by stakeholders.

Item 9-2	*DOE seeks information on representative saturation rates for each equipment class covered under this rulemaking, as well as industry-trend data regarding relative growth in each equipment class.*
Item 9-3	*DOE seeks input on methods of projecting the markets for each equipment class and access to models or methods that could be used to estimate shipments.*

9.3 Standards Impacts on Shipments

For each equipment class, DOE will develop a set of shipment projections for each set of standards analyzed, also known as standards-case projections. These standards-case projections

[9] See http://www.vendingtimes.com/ME2/default.asp.
[10] See http://www.census.gov/.

will be used to evaluate the impacts of standards on shipments. Standards-case projections are derived using the same datasets as base-case projections; however, because the standards-case projections take into account the increase in purchase price and the decrease in operating costs caused by standards, projected shipments may deviate from the base case. The magnitude of the difference between the standards-case and base-case shipment projections depends on the estimated purchase price increase as well as the operating cost savings caused by the standard. Because the purchase price tends to have a larger impact than operating cost on equipment purchase decisions, standards-case projections may show a drop in shipments relative to the base case.

DOE's past standards analyses have attempted to quantify the sensitivity of shipments to purchase price and operating cost savings. Because the data required to develop these sensitivities are limited and often difficult to obtain, DOE will consider modeling standards-case shipments projections with scenarios (*i.e.*, specified impacts to shipments) rather than developing sensitivities to purchase price or operating cost savings.

Market-pull programs, such as customer rebate programs that encourage the purchase of more-efficient equipment, ENERGYSTAR®, and manufacturer tax credits that encourage the production of more-efficient equipment, also affect standards-case projections. When such programs exist, DOE will consider their impact on the projection of both standards-case and base-case shipments.

Item 9-4	*DOE seeks input on likely impacts on shipments due to new or amended standards for beverage vending machines. Please comment on what the possible scenarios are and the estimated quantitative impact of each scenario on the shipments numbers.*

10. NATIONAL IMPACT ANALYSIS

Section 8 discusses methods for estimating the LCC savings and PBP for individual customers. This section discusses DOE's assessment of the aggregate impacts at the national level. Measures of impact include NES and the NPV of total customer LCC savings.

10.1 Calculation of Energy Savings

DOE calculates the annual site-energy consumption of all the beverage vending machines covered under this rulemaking under the base-case scenario and the standards-case scenarios for each year in the analysis period. The difference in the annual site-energy consumption between base-case scenario and a standards-case scenario is the annual site-energy savings associated with that particular standards-case scenario. DOE will convert the site-energy savings into annual primary energy savings using a full-fuel-cycle (FFC) analysis. The sum of annual primary energy savings for each standards-case scenario over all the years in an analysis period gives the NES value for each standards-case scenario.

DOE carries out the NIA over a 30-year period starting in the compliance year of the new or amended standards, and the annual energy savings are summed over the lifetimes of the equipment installed in the 30-year period.

Item 10-1	*DOE seeks comment on the share of the market that is met by refurbished or rebuilt machines. In particular, DOE seeks comment on the impact of refurbishment/rebuilding on the energy consumption and lifetime of the existing fleet in the absence of standards, and the impact of new standards on refurbishment kits, the subsequent cost, and performance of the stock of existing equipment.*
Item 10-2	*DOE seeks comment on its plan to develop NES spreadsheet models for estimating national impacts of amended energy conservation standards.*

10.2 Net Present Value

DOE calculates the national NPV of the standards similar to the way in which it calculates the NES. DOE first calculates the annual increase in installed costs as the difference in installed cost of all the beverage vending machines (installed in the nation) in the base-case scenario and the standards-case scenarios. The annual operating cost savings are calculated in a similar manner. The difference between annual operating cost savings and the annual increases in installed costs gives the annual savings. The annual savings are calculated for each year in the analysis period. These savings are then discounted to the present year (year in which the analysis in conducted) to determine the present value of each of the future annual savings. The summation of these present values of future annual savings for each standards-case scenario gives the NPV for each standards-case scenario.

The increases in installed costs are calculated for the 30-year period starting with the compliance year of the new or amended standards. The operating cost savings are calculated over the entire lifetime of the beverage vending machines installed in the 30-year period.

DOE will take into account comments received in response to this Framework document.

11. CUSTOMER SUBGROUP ANALYSIS

This section describes how DOE analyzes customer impacts by dividing customers into subgroups and accounting for variations in key inputs to the LCC analysis. A customer subgroup comprises a subset of the customer population that is likely to be impacted disproportionately by new or amended energy conservation standards. The purpose of a subgroup analysis is to determine the extent of this disproportionate impact. DOE will work with stakeholders early in the rulemaking process to identify any subgroups for this consideration. However, DOE will not analyze the customer subgroups until the NOPR stage of the analysis.

In comparing potential impacts on the different customer subgroups, DOE will evaluate variations in regional energy prices, variations in energy use, and variations in installation costs that might affect the LCC savings and PBP of a standard to customer subgroups. To the extent possible, DOE may obtain estimates of the variability in each input variable and consider this variability in its calculation of customer impacts. It will discuss the variability in each input variable and likely sources of information with stakeholders.

Item 11-1	*DOE seeks input on which customer subgroups DOE should consider in the present rulemaking. Examples of possible subgroups DOE could consider appropriate for beverage vending machines are manufacturing facilities that own their own BVM units, which was the identified subgroup in the 2009 BVM final rule analysis, and site owners that pay the utilities but don't own or stock the equipment.*

12. MANUFACTURER IMPACT ANALYSIS

The manufacturer impact analysis will assess the potential impacts of energy conservation standards on manufacturers of beverage vending machines. A wide range of quantitative and qualitative effects may occur following the adoption of amended standards that may require changes to manufacturing practices. DOE will identify these potential effects through interviews with manufacturers and other experts.

For the NOPR, DOE will conduct an industry-wide cash-flow analysis using the Government Regulatory Impact Model (GRIM), identify and analyze subgroups of manufacturers whose businesses vary significantly from the industry as a whole, perform a competitive impacts assessment, and review the cumulative regulatory burden for the industry.

12.1 Sources of Information

Many of the analyses described earlier provide important information that DOE uses as inputs for the MIA. Such information includes financial parameters developed in the market assessment (section 3.1), cost data from the engineering analysis (sections 5.2 and 5.3), and shipments projections (section 9.1). DOE supplements this data with information gathered during manufacturer interviews. The interview process will play a key role in the MIA, as it provides an opportunity for interested parties to express their views on important issues.

Navigant Consulting, Inc. (Navigant), a DOE contractor for this rulemaking, will conduct detailed interviews with manufacturers to gain insight into the range of potential impacts of standards. During the interviews, Navigant will solicit information on the possible impacts of standards on manufacturing costs, equipment prices, sales, direct employment, capital assets, and industry competitiveness. Both qualitative and quantitative information are valuable. DOE, through Navigant, will schedule interviews well in advance to provide every opportunity for key individuals to be available. DOE prefers an interactive interview process because it helps clarify responses and provides the opportunity for additional issues to be identified.

DOE will ask that interview participants identify all confidential information provided, both in writing and orally. While it will consider information gathered, as appropriate, in its decision-making process, Navigant will protect confidential information from disclosure consistent with applicable law. DOE will also ask participants to identify all information that they want included in the public record, but that they do not want to have associated with their interview. DOE will incorporate this information into the public record, but will report it without attribution.

Materials provided to Navigant are generally subject to the terms of the applicable agreement under which those materials are submitted. In the case of materials provided to Navigant in the context of a DOE rulemaking and subject to a non-disclosure agreement, those

materials are generally not shared with DOE, apart from aggregated data that do not identify particular submitters. These materials may also be subject to a variety of laws and regulations governing the disclosure of Federal agency information. Information submitted to DOE through Navigant will be protected in accordance with all applicable federal laws, rules, or regulations, including but not limited to the Trade Secrets Act (18 U.S.C. 1905) and the Freedom of Information Act (FOIA; 5 U.S.C. 552), and DOE's implementing regulations at 10 CFR part 1004. DOE will prepare a summary of the major issues and outcomes identified during manufacturer interviews. This summary will become part of the technical support document produced for this rulemaking.

12.2 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 that manufactures the equipment covered by the standard.

The GRIM analysis uses a number of factors—annual expected revenues; costs of goods sold; selling, general, and administrative costs; taxes; and capital expenditures—to arrive at a series of annual cash flows beginning from the announcement of the standard and continuing through the analysis period. DOE compares the results against base-case projections that involve no amended standards. The financial impact of amended standards is then the difference between the two sets of discounted annual cash flows. Other performance metrics, such as return on invested capital, also are available from the GRIM.

DOE will gather inputs needed for the GRIM from two primary sources: (1) the analyses conducted to this point; and (2) interviews with manufacturers and other stakeholders. Information gathered from previous analyses will include financial parameters, manufacturing costs, price projections, and shipments projections. Interviews with manufacturers and other stakeholders will supplement this information.

12.3 Manufacturer Subgroup Analysis

Average industry cost values may not reveal differential impacts among BVM manufacturer subgroups. Smaller manufacturers, niche players, and manufacturers exhibiting a cost structure that differs significantly from the industry average may be affected differently by amended standards. Ideally, DOE would consider the impact on every firm individually. In highly concentrated industries, this may be possible. However, for industries that have numerous participants, DOE will use the results of the market and technology assessment to group manufacturers into subgroups, as appropriate. For beverage vending machines, DOE is interested in feedback about potential subgroups, including small businesses. DOE will conduct a Regulatory Flexibility Act analysis to determine the impacts of any amended standards on small businesses consistent with the Regulatory Flexibility Act.

Item 12-1	*DOE seeks comment on appropriate manufacturer subgroups, if any, that DOE should consider in the manufacturer subgroup analysis for beverage vending machines.*

Item 12-2	*DOE seeks comment on small businesses that could be impacted by amended energy conservation standards for beverage vending machines, and what those impacts might entail.*

12.4 Competitive Impacts Assessment

EPCA directs DOE to consider any lessening of competition that is likely to result from the imposition of standards. (42 U.S.C. 6295(o)(2)(B)(i)(V)) It further directs the Attorney General to determine in writing the impacts, if any, of any lessening of competition. (42 U.S.C. 6295(o)(2)(B)(ii))

DOE will make a determined effort to gather firm-specific financial information and impacts, and to report the anticipated aggregate impact of amended standards on manufacturers. The competitive impacts assessment will focus on assessing the impacts on smaller manufacturers. DOE will base the assessment on manufacturing cost data and on information collected from interviews with manufacturers. The manufacturer interviews will focus on gathering information that would help in assessing asymmetrical cost increases to some manufacturers, increased proportion of fixed costs potentially increasing business risks, and potential barriers to market entry (*e.g.,* proprietary technologies). DOE will provide the Attorney General with a copy of any NOPR for consideration in its evaluation of the impact of amended standards on the lessening of competition. DOE will publish the Attorney General's letter and address any related comments in the final rule.

12.5 Cumulative Regulatory Burden

DOE is aware that other regulations (Federal, State, local, or international) may apply to manufacturers of beverage vending machines covered under this rulemaking and to other equipment made by these manufacturers. Multiple regulations may result in a significant cumulative regulatory burden on these manufacturers. DOE will consider the impact of multiple, product-specific regulatory actions on these manufacturers.

Item 12-3	*DOE welcomes comments on other existing or pending regulations it should consider in its examination of cumulative regulatory burden.*

13. EMPLOYMENT IMPACT ANALYSIS

The imposition of standards can impact employment both directly and indirectly. Direct employment impacts are changes in the number of employees at the plants that produce the covered equipment. DOE will evaluate direct employment impacts in the MIA, as described in section 12.

Indirect employment impacts may result from expenditures shifting between goods (the substitution effect) and changes in income and overall expenditure levels (the income effect) that occur due to the imposition of standards. The short-term (5-year) combined direct and indirect employment impacts will be investigated in the employment-impact analysis using Pacific Northwest National Laboratory's Impact of Sector Energy Technologies (ImSET) model. The ImSET model was developed for DOE's Office of Planning, Budget, and Analysis, and estimates the employment and income effects of energy-saving technologies in buildings, industry, and

transportation. In comparison with simple economic multiplier approaches, ImSET allows for more complete and automated analysis of the economic impacts of energy conservation investments. DOE believes that the complexity of potential adjustments in the U.S. economy largely negates the value of long-term projections of indirect employment impacts.

Item 13-1	*DOE requests feedback on this approach to assessing employment impacts.*

14. UTILITY IMPACT ANALYSIS

The utility impact analysis will include an analysis of the impact of new and amended standards on electric utility industry. DOE will adapt the National Energy Modeling System (NEMS) produced by the EIA for this analysis. NEMS is a large, multi-sectoral, partial-equilibrium model of the United States energy sector that has been developed over the past decade by the EIA, primarily for the purpose of preparing DOE's *AEO*. In prior rulemakings, a variant of NEMS (currently identified as NEMS-BT, where BT refers to the DOE Building Technologies Program) was developed to better address the particular impacts of an energy efficiency standard for commercial equipment.

The NEMS produces a widely recognized baseline energy forecast for the United States through the year 2035, and is available in the public domain. The typical NEMS outputs include forecasts of electricity sales, price, and avoided capacity. DOE plans to conduct the utility impact analysis as a scenario departing from the latest *AEO* reference case. In other words, the energy savings impacts from amended energy conservation standards will be modeled using NEMS-BT to generate forecasts that deviate from the *AEO* reference case.

Item 14-1	*DOE seeks input on its proposed use of NEMS-BT to conduct the utility impact analysis.*
Item 14-2	*Should DOE consider using methods other than NEMS in the utility impact analysis?*

15. EMISSIONS ANALYSIS

In the emissions analysis, DOE will estimate the reduction in power sector emissions of CO_2, nitrogen oxides (NO_X), sulfur dioxide (SO_2), and mercury (Hg) from potential energy conservation standards for BVM equipment. In addition, DOE will estimate emissions impacts in production activities (extracting, processing, and transporting fuels) that provide the energy inputs to power plants. These are referred to as "upstream" emissions. Together, these emissions account for the FFC. In accordance with DOE's FFC Statement of Policy (76 FR 51282 (Aug. 18, 2011)), the FFC analysis includes impacts on emissions of methane (CH_4) and nitrous oxide (N_2O), both of which are recognized as greenhouse gases (GHGs).

DOE will conduct the emissions analysis using emissions factors derived from data in the latest version of EIA's *AEO*, supplemented by data from other sources. EIA prepares the *AEO* using NEMS. Each annual version of NEMS incorporates the projected impacts of existing air quality regulations on emissions. The text below refers to *AEO2012*.

SO_2 emissions from affected electric generating units (EGUs) are subject to nationwide and regional emissions cap and trading programs. Title IV of the Clean Air Act sets an annual emissions cap on SO_2 for affected EGUs in the 48 contiguous States and the District of Columbia (D.C.). SO_2 emissions from 28 eastern States and D.C. were also limited under the Clean Air Interstate Rule (CAIR), which created an allowance-based trading program that operates along with the Title IV program in those States and D.C. 70 FR 25162 (May 12, 2005). CAIR was remanded to the U.S. Environmental Protection Agency (EPA) by the U.S. Court of Appeals for the District of Columbia Circuit (D.C. Circuit), but it remains in effect. See *North Carolina v. EPA*, 550 F.3d 1176 (D.C. Cir. 2008); *North Carolina v. EPA*, 531 F.3d 896 (D.C. Cir. 2008). On July 6, 2011 EPA issued a replacement for CAIR, the Cross-State Air Pollution Rule (CSAPR; also known as the Transport Rule). 76 FR 48208 (Aug. 8, 2011). The *AEO2012* NEMS assumes the implementation of the CSAPR.[11]

The attainment of emissions caps is typically flexible among EGUs and is enforced through the use of emissions allowances and tradable permits. Under existing EPA regulations, any excess SO_2 emissions allowances resulting from the lower electricity demand caused by the adoption of an efficiency standard could be used to permit offsetting increases in SO_2 emissions by any regulated EGU. In past rulemakings, DOE recognized that there was uncertainty about the effects of efficiency standards on SO_2 emissions covered by the existing cap-and-trade system, but it concluded that no reductions in power sector emissions would occur for SO_2 as a result of standards.

Beginning in 2015, however, SO_2 emissions will fall as a result of the Mercury and Air Toxics Standards (MATS) for power plants, which were announced by EPA on December 21, 2011. 77 FR 9304 (Feb. 16, 2012). In the final MATS rule, EPA established a standard for hydrogen chloride as a surrogate for acid gas hazardous air pollutants (HAP), and also established a standard for SO_2 (a non-HAP acid gas) as an alternative equivalent surrogate standard for acid gas HAP. The same controls are used to reduce HAP and non-HAP acid gas; thus, SO_2 emissions will be reduced as a result of the control technologies installed on coal-fired power plants to comply with the MATS requirements for acid gas. *AEO2012* assumes that, in order to continue operating, coal plants must have either flue gas desulfurization or dry sorbent injection systems installed by 2015. Both technologies, which are used to reduce acid gas emissions, also reduce SO_2 emissions. Under the MATS, NEMS shows a reduction in SO_2 emissions when electricity demand decreases (*e.g.*, as a result of energy efficiency standards). Emissions will be far below the cap that would be established by CSAPR, so it is unlikely that excess SO_2 emissions allowances resulting from the lower electricity demand would be needed or used to permit offsetting increases in SO_2 emissions by any regulated EGU. Therefore, DOE believes that efficiency standards will reduce SO_2 emissions in 2015 and beyond.

CSAPR established a cap on NO_X emissions in eastern States and the District of Columbia. Energy conservation standards are expected to have little or no physical effect on

[11] On December 30, 2011, the D.C. Circuit stayed the new rules while a panel of judges reviews them, and told EPA to continue administering CAIR (see *EME Homer City Generation v. EPA*, No. 11-1302, Slip Op. at *2 (D.C. Cir. Dec. 30, 2011)). On August 21, 2012, the D.C. Circuit issued a decision to vacate CSAPR. See *EME Homer City Generation, LP v. EPA*, No. 11-1302, 2012 WL 3570721 at *24 (D.C. Cir. Aug. 21, 2012). The court again ordered EPA to continue administering CAIR. *AEO2012* had been finalized prior to this decision, however. DOE understands that CAIR and CSAPR are similar with respect to their effect on emissions impacts of energy efficiency standards.

these emissions in those States covered by CSAPR because excess NO_X emissions allowances resulting from the lower electricity demand could be used to permit offsetting increases in NO_X emissions. However, standards would be expected to reduce NO_X emissions in the States not affected by CSAPR. Therefore, DOE estimates NO_X emissions reductions from potential standards in the States where emissions are not capped.

The MATS limit mercury emissions from power plants, but they do not include emissions caps and, as such, DOE's energy conservation standards would likely reduce Hg emissions.

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

Item 15-1	*DOE seeks input on its approach to conduct the emissions analysis for the equipment covered by this rulemaking.*

16. MONETIZING REDUCED CO_2 AND OTHER EMISSIONS

DOE plans to consider the estimated monetary benefits likely to result from the reduced emissions of CO_2 and NO_X that are expected to result from each of the standard levels considered.

In order to estimate the monetary value of benefits resulting from reduced emissions of CO_2, DOE plans to use the most current Social Cost of Carbon (SCC) values developed and/or agreed to by an interagency process. The SCC is intended to be a monetary measure of the incremental damage resulting from GHG emissions, including, but not limited to, net agricultural productivity loss, human health effects, property damage from sea level rise, and changes in ecosystem services. Any effort to quantify and to monetize the harms associated with climate change will raise serious questions of science, economics, and ethics. But with full regard for the limits of both quantification and monetization, the SCC can be used to provide estimates of the social benefits of reductions in GHG emissions.

At the time of this Framework document, the most recent interagency estimates of the potential global benefits resulting from reduced CO_2 emissions in 2015, expressed in 2012$, were $6.2, $25.9, $41.7, and $79.1 per metric ton avoided. For emissions reductions that occur in later years, these values grow in real terms over time. Additionally, the interagency group determined that a range of values from 7 percent to 23 percent should be used to adjust the global SCC to calculate domestic effects, although DOE will give preference to consideration of the global benefits of reducing CO_2 emissions. To calculate a present value of the stream of monetary values, DOE will discount the values in each of the four cases using the discount rates that had been used to obtain the SCC values in each case.

DOE recognizes that scientific and economic knowledge continues to evolve rapidly as to the contribution of CO_2 and other GHG to changes in the future global climate and the potential resulting damages to the world economy. Thus, these values are subject to change.

DOE also estimates the potential monetary benefit of reduced NO_X emissions resulting from the standard levels it considers. For NO_X emissions, available estimates suggest a very wide range of monetary values, ranging from $468 to $4,809 per ton in 2012$.[12] In accordance with Office of Management and Budget (OMB) guidance, DOE conducts two calculations of the monetary benefits derived using each of the economic values used for NO_X, one using a real discount rate of 3 percent and another using a real discount rate of 7 percent.[13]

DOE is investigating appropriate valuation of Hg emissions. Whether monetization of reduced Hg emissions will occur in this rulemaking is not yet certain.

Item 16-1	*DOE requests comments on the approach it plans to use for estimating monetary values associated with emissions reductions.*

17. REGULATORY IMPACT ANALYSIS

Pursuant to section 6(a)(3) of Executive Order 12866, "Regulatory Planning and Review," 58 FR 51735 (Oct. 4, 1993), if DOE determines that amended energy conservation standards for beverage vending machines constitute a significant regulatory action, during the NOPR stage DOE will prepare and submit to OMB: (1) an assessment of the costs and benefits of the proposed regulation, and (2) if the proposed rule is also significant under section 3(f)(1) of the E.O. 12866, a Regulatory Impact Analysis (RIA) which is subject to review under the Executive Order by the Office of Information and Regulatory Affairs (OIRA) at the OMB. The RIA will address the potential for non-regulatory approaches to supplant or augment energy conservation standards to improve the energy efficiency or reduce the energy consumption of the beverage vending machines covered under this rulemaking in the market.

DOE recognizes that voluntary or other non-regulatory efforts by manufacturers, utilities, and other interested parties can result in substantial improvements to energy efficiency or reductions in energy consumption. DOE intends to consider the likely effects of non-regulatory initiatives such as the ENERGY STAR program on equipment energy use, customer utility, and LCC. DOE will base its assessment on the actual impacts of any such initiatives to date, but also will consider information presented regarding the impacts that any existing initiative might have in the future.

Item 17-1	*DOE is aware of the existing ENERGY STAR program for the beverage vending machine industry covered under this rulemaking. Are stakeholders aware of any other such programs that should be examined as optional, non-regulatory approaches?*

[12] For additional information, refer to U.S. Office of Management and Budget, Office of Information and Regulatory Affairs, *2006 Report to Congress on the Costs and Benefits of Federal Regulations and Unfunded Mandates on State, Local, and Tribal Entities*, Washington, DC.

[13] OMB, Circular A-4: Regulatory Analysis (Sept. 17, 2003).

Item 17-2	*Are there specific subgroups of end-users whom DOE should consider in its review of potential adverse impacts from standards developed under this rulemaking?*

APPENDIX A – LIST OF ITEMS FOR COMMENT