[6450-01-P]

DEPARTMENT OF ENERGY

10 CFR Part 431

[Docket Number EERE–2014–BT–STD–0042]

RIN: 1904-AD34

Energy Conservation Program for Certain Industrial Equipment: Energy Conservation Standards for Commercial Water Heating Equipment

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

ACTION: Request for information (RFI).

SUMMARY: The U.S. Department of Energy (DOE) is initiating a rulemaking to consider amended energy conservation standards for commercial water heaters, hot water supply boilers, and unfired hot water storage tanks (commercial water heating equipment). Once completed, this rulemaking will fulfill DOE's statutory obligation to either propose amended energy conservation standards for commercial water heating equipment or to determine that the existing standards do not need to be amended. This notice seeks to solicit information to help DOE determine whether national standards more stringent than those currently in place would result in a significant amount of additional energy savings and whether such amended national standards would be technologically feasible and economically justified. In overview, this document presents a brief description of the analysis DOE plans to perform for this rulemaking and

requests comment on various issues relating to each of the analyses (*e.g.*, market assessment, engineering analysis, energy use analysis, life-cycle cost and payback period analysis, and national impact analysis). Although this document contains several specific topics on which DOE is particularly interested in receiving written comment, DOE welcomes suggestions and information from the public on any subject within the scope of this rulemaking, including topics not raised in this RFI.

DATES: Written comments and information are requested on or before **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**.

ADDRESSES: Interested parties are encouraged to submit comments electronically. However, interested persons may submit comments, identified by docket number EERE-2014-BT-STD-0042 and/or regulatory identification number (RIN) 1904-AD34 by any of the following methods:

- Federal eRulemaking Portal: www.regulations.gov. Follow the instructions for submitting comments.
- E-mail: ComWaterHeating2014STD0042@ee.doe.gov. Include docket number EERE-2014-BT-STD-0042 and/or RIN 1904-AD34 in the subject line of the message. Submit electronic comments in WordPerfect, Microsoft Word, PDF, or ASCII file format, and avoid the use of special characters or any form of encryption.
- Postal Mail: Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Program, Mailstop EE-5B, 1000 Independence Avenue, SW., Washington, DC 20585-0121. If possible, please submit all items on a compact disc (CD), in which case it is not

necessary to include printed copies.

- Hand Delivery/Courier: Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Program, 6th Floor, 950 L'Enfant Plaza, SW., Washington, DC 20024. Telephone: (202) 586-2945. If possible, please submit all items on a CD, in which case it is not necessary to include printed copies.

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

FOR FURTHER INFORMATION CONTACT: Requests for additional information may be sent to Mr. Ron Majette, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Program, EE–5B, 1000 Independence Avenue, SW., Washington, DC 20585–0121. Telephone: (202) 586-7935. E-mail: Ronald.Majette@ee.doe.gov.

Ms. Sarah Butler, U.S. Department of Energy, Office of the General Counsel, GC–71, 1000 Independence Avenue, SW, Washington, DC 20585-0121. Telephone: (202) 586-1777. E-mail: Sarah.Butler@hq.doe.gov.

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

SUPPLEMENTARY INFORMATION:

Table of Contents

I. Introduction

A. Authority

Title III, Part C[1] of the Energy Policy and Conservation Act of 1975 (EPCA or the Act), Pub. L. 94-163 (42 U.S.C. 6311-6317, as codified), added by Pub. L. 95-619, Title IV, §441(a), established the Energy Conservation Program for Certain Industrial Equipment, which includes provisions covering the commercial water heating equipment that are the subject of this notice.[2] In general, this program addresses the energy efficiency of certain types of commercial and industrial equipment. Relevant provisions of the Act include definitions (42 U.S.C. 6311), energy conservation standards (42 U.S.C. 6313), test procedures (42 U.S.C. 6314), labeling provisions (42 U.S.C. 6315), and the authority to require information and reports from manufacturers (42 U.S.C. 6316).

[1] For editorial reasons, upon codification in the U.S. Code, Part C was re-designated Part A-1.
[2] All references to EPCA in this document refer to the statute as amended through the American Energy Manufacturing Technical Corrections Act of 2012, Pub. L. 112-210 (Dec. 18, 2012).

The initial Federal energy conservation standards and test procedures for commercial water heating equipment were added to EPCA as an amendment made by the Energy Policy Act of 1992 (EPACT). (42 U.S.C. 6313(a)(5)) These initial energy conservation standards corresponded to the efficiency levels contained in the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 90.1 (ASHRAE Standard 90.1) in effect on October 24, 1992. The statute provided that if the efficiency levels in ASHRAE Standard 90.1 were amended after October 24, 1992, the Secretary must establish an amended uniform national standard at new minimum levels for each equipment type specified in ASHRAE Standard 90.1, unless DOE determines, through a rulemaking supported by clear and convincing evidence, that national standards more stringent than the new minimum levels would result in significant additional energy savings and be technologically feasible and economically justified. (42 U.S.C. 6313(a)(6)(A)(ii)(II)) In deciding whether a proposed amended standard is economically justified, DOE must, after receiving comments on the proposed standard, determine whether the benefits of the proposed standard exceed its burdens by, to the greatest extent practicable, considering the following seven factors:

1. The economic impact of the standard on manufacturers and consumers of the equipment subject to the standard;

2. The savings in operating costs throughout the estimated average life of the covered equipment in the type (or class) compared to any increase in the price, initial charges, or maintenance expenses for the covered products that are likely to result from the standard;

3. The total projected amount of energy savings, or as applicable, water savings, likely to result directly from the standard;

4. Any lessening of the utility or the performance of the covered equipment likely to result from the standard;

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

6. The need for national energy and water conservation; and

7. Other factors the Secretary of Energy (Secretary) considers relevant. (42 U.S.C. 6313(a)(6)(B)(ii))

Section 5(b) of the American Energy Manufacturing Technical Corrections Act (AEMTCA), Pub. L. No. 112-210 (Dec. 18, 2012), amended EPCA to include a requirement for DOE to conduct an evaluation of whether to amend the standards for certain types of commercial and industrial equipment[3] every six years. (42 U.S.C. 6313(a)(6)(C)(i)) AEMTCA also mandated that DOE must publish the first document of an expedited rulemaking within 1 year of the date of AEMTCA's enactment (i.e., December 18, 2012) to consider amended energy conservation standards for any covered equipment of those types as to which more than six years had elapsed since the issuance of the most recent final rule establishing or amending a standard for the equipment. (42 U.S.C. 6313(a)(6)(C) (vi))[4]

DOE issued the most recent final rule for commercial water heating equipment on January 12, 2001 (hereinafter, the "January 2001 final rule"), which adopted the amended energy

[3] This equipment includes small, large, and very large commercial package air conditioning and heating equipment, packaged terminal air conditioners and heat pumps, warm-air furnaces, packaged boilers, storage water heaters, instantaneous water heaters, and unfired hot water storage tanks. (42 U.S.C. 6313(a)(6))

[4] It is noted that AEMTCA inadvertently assigned two separate provisions to 42 U.S.C. 6313(a)(6)(C)(vi). The provision cited above is the one most relevant to this RFI.

conservation standards at levels equivalent to efficiency levels in ASHRAE Standard 90.1, as it was revised in October 1999. 66 FR 3336. Because more than six years has passed since issuance of the last final rule for commercial water heating equipment, DOE is required to publish either a notice of determination that the current standards for these equipment types do not need to be amended, or a notice of proposed rulemaking proposing amended energy conservation standards for these equipment types. In addition, the energy conservation standards for commercial oil-fired storage water heaters were increased to a level beyond the current federal standards in ASHRAE Standard 90.1-2013. Therefore DOE is required to adopt these new standards unless there is clear evidence that adopting stricter standards would produce significant additional energy savings while being both technologically feasible and economically justified.

To meet the requirements under AEMTCA, DOE is reviewing its existing energy conservation standards for the equipment types listed in 42 U.S.C. 6313(a) for which at least six years have elapsed since the issuance of the most recent final rule, including the commercial water heating equipment that is the subject of this notice. This notice represents the initiation of the mandatory review process required by AEMTCA. DOE seeks input from the public to assist with its determination on whether to amend the current standards for commercial water heating equipment.

B. Background

On October 29, 1999, ASHRAE released an updated Standard 90.1–1999, which included amended efficiency levels for numerous categories of commercial water heaters, hot water supply boilers, and unfired hot water storage tanks. DOE evaluated these efficiency levels

and subsequently adopted energy conservation standards affecting eight different water heating equipment categories in a final rule published in the January 2001 final rule. 66 FR 3336. However, DOE did not adopt the efficiency level contained in ASHRAE Standard 90.1-1999 for commercial electric storage water heaters, since the ASHRAE Standard 90.1-1999 level was less stringent than the standard in EPCA and would have increased energy consumption, and under those circumstances, DOE could not adopt the new efficiency level. 66 FR at 3350. The current Federal energy conservation standards for this equipment including those adopted in the January 2001 final rule are shown in Table 1.

Table 1. Minimum Efficiency Levels for Commercial Water Heating Equipment

Equipment	Size	Energy Conservation Standard[a,b]	
		Minimum Thermal Efficiency	Maximum Standby Loss[c]
Electric storage water heaters	All	N/A	$0.30 + 27/V_m$ (%/hr)
Gas-fired storage water heaters	≤155,000 Btu/hr	80%	$Q/800+110(V_r)^{1/2}$ (Btu/hr)
	>155,000 Btu/hr	80%	$Q/800+110(V_r)^{1/2}$ (Btu/hr)
Oil-fired storage water heaters	≤155,000 Btu/hr	78%	$Q/800+110(V_r)^{1/2}$ (Btu/hr)
	>155,000 Btu/hr	78%	$Q/800+110(V_r)^{1/2}$ (Btu/hr)
Gas-fired instantaneous water heaters and hot water supply boilers	<10 gal	80%	N/A
	≥10 gal	80%	$Q/800+110(V_r)^{1/2}$ (Btu/hr)
Oil-fired instantaneous water heaters and hot water supply boilers	<10 gal	80%	N/A
	≥10 gal	78%	$Q/800+110(V_r)^{1/2}$ (Btu/hr)
Equipment	**Size**	**Minimum Thermal Insulation**	
Unfired hot water storage tank	All	R-12.5	

[a] V_m is the measured storage volume and V_r is the rated volume, both in gallons. Q is the nameplate input rate in Btu/hr.

[b] For hot water supply boilers with a capacity of less than 10 gallons: (1) the standards are mandatory for

products manufactured on and after October 21, 2005, and (2) products manufactured prior to that date, and on or after October 23, 2003, must meet either the standards listed in this table or the applicable standards in subpart E of this part for a ''commercial packaged boiler.''

[c] Water heaters and hot water supply boilers having more than 140 gallons of storage capacity need not meet the standby loss requirement if (1) the tank surface area is thermally insulated to R–12.5 or more, (2) a standing pilot light is not used and (3) for gas or oil-fired storage water heaters, they have a fire damper or fan assisted combustion.

DOE reviewed and adopted amended test procedures for commercial water heating equipment in a direct final rule published on October 21, 2004. 69 FR 61974. These test procedure amendments incorporated by reference certain sections of the American National Standards Institute Standard (ANSI) Z21.10.3-1998 (ANSI Z21.10.3-1998), "Gas Water Heaters Volume III Storage Water Heaters, with Input Ratings Above 75,000 Btu per Hour, Circulating and Instantaneous." *Id*. On May 16, 2012, DOE published a final rule in the Federal Register to update the test procedures for certain commercial water heating equipment by adopting and incorporating by reference the most recent version of the relevant industry test procedure, ANSI Z21.10.3-2011. 77 FR 28928. These updates did not materially alter the procedure.

The divisions between residential and commercial water heaters were first established in EPCA. The current specifications for residential water heaters are shown below in Table 2, as specified in 10 CFR 430.2. A water heater exceeding any of the limits expressed below for input, volume, input/volume, or max temperature is classified as commercial water heating equipment.

Table 2. Classification of Residential Water Heating Equipment

Type	Input	Volume	Input/Volume (BTU/(h*gal))	Max Temp
Gas Storage	< 75,000 BTU/h	20-100 gal	< 4,000	< 180 °F
Oil Storage	< 105,000 BTU/h	< 50 gal	< 4,000	< 180 °F
Electric Storage	< 12 kW	20-120 gal	< 4,000	< 180 °F
Gas Instantaneous	50,000-200,000 BTU/h	< 2 gal	≥ 4,000	< 180 °F
Oil Instantaneous	<210,000 BTU/h		≥ 4,000	< 180 °F
Electric Instantaneous	< 12 kW		≥ 4,000	< 180 °F

Heat Pump[a]	<12 kW	< 120 gal		< 180 °F

[a] To be classified as residential, heat pump water heaters must also not exceed a current rating 24 A or 250 V.

C. Rulemaking Process

In addition to the specific statutory criteria discussed in section I.A that DOE must follow in prescribing amended standards for covered equipment, DOE uses a specific process to assess the appropriateness of amending the standards that are currently in place for a given type of equipment. For commercial water heating equipment, DOE plans to conduct its analyses in stages, with a positive result leading to a subsequent stage of the analysis. Under this approach, DOE will first evaluate whether more-stringent standards are technologically feasible and whether such standards would result in significant additional energy savings. If either of these criteria is not met, DOE will conduct no further analysis, because the statutory criteria for adoption of the more-stringent standard could not be met. However, if this initial assessment is positive, DOE will conduct in-depth technical analyses of the costs and benefits of the potential amended standards to determine whether such amended standards would be economically justified. The analyses undertaken at this stage would include: (1) engineering analysis; (2) energy use analysis; (3) markups analysis; (4) life-cycle cost and payback period analysis; and (5) national impacts analysis. If, after conducting those analyses, DOE determines that there is a high likelihood that more-stringent standards would be economically justified, DOE will conduct downstream analyses including: (1) manufacturer impacts analysis; (2) emission impacts analysis; (3) utility impacts analysis; (4) employment impacts analysis; and (5) regulatory impacts analysis. DOE will also conduct several other analyses that support those previously listed, including the market and technology assessment, the screening analysis (which contributes to the engineering analysis), and the shipments analysis (which contributes to the

national impact analysis). As detailed throughout this RFI, DOE is publishing this notice as the first step in the analytical process and is requesting input and data from interested parties to aid in the development of the technical analyses.

DOE anticipates moving from this RFI directly to publication of either a determination that the commercial water heating equipment standards do not need to be amended or a notice of proposed rulemaking for amended standards.

II. Planned Rulemaking Analyses

In this section, DOE summarizes the rulemaking analyses and identifies a number of issues on which it seeks input and data in order to aid in the development of the technical and economic analyses to determine whether amended energy conservation standards may be warranted. In addition, DOE welcomes comments on other issues relevant to the conduct of this rulemaking that may not specifically be identified in this notice.

A. Test Procedures

DOE's existing test procedures for commercial water heating equipment are specified at 10 CFR 431.106, and reference ANSI Z21.10.3-2011. The test procedures provide methods for determining the thermal efficiency and standby loss of gas-fired, oil-fired, and electric storage and instantaneous water heaters. AEMTCA amended EPCA to require that DOE publish a final rule establishing a uniform efficiency descriptor and accompanying test methods for covered residential water heaters and commercial water heating equipment by December 18, 2013 (i.e., within one year of the enactment of AEMTCA). (42 U.S.C. 6295(e)(5)(B)) The final rule must

replace the current energy factor (for residential water heaters) and thermal efficiency and standby loss (for commercial water heaters) metrics with a uniform efficiency descriptor. (42 U.S.C. 6295(e)(5)(C)) AEMTCA allowed DOE to provide an exclusion from the uniform efficiency descriptor for specific categories of otherwise covered water heaters that do not have residential uses, that can be clearly described, and that are effectively rated using the current thermal efficiency and standby loss descriptors. (42 U.S.C. 6295(e)(5)(F))

DOE published a final rule for test procedures for residential water heaters and certain commercial water heaters on July 11, 2014 that, among other things, established the Uniform Energy Factor (UEF), a revised version of the current residential Energy Factor metric, as the uniform efficiency descriptor required by AEMTCA. 79 FR 40542. The uniform efficiency descriptor only applies to commercial water heaters that meet the definition of "residential-duty commercial water heater," which is defined as any gas-fired, electric, or oil storage or instantaneous commercial water heater that meets the following conditions:

(1) For models requiring electricity, uses single-phase external power supply;

(2) Is not designed to provide outlet hot water at temperatures greater than 180 °F; and

(3) Is not excluded by any of the specified limitations regarding rated input and storage volume established in Table 3 (below). *Id.* at 40546

The input and volume limitations for the definition of a residential-duty commercial water heater are shown below by equipment class.

Table 3. Classification of Residential-Duty Commercial Water Heating Equipment

Water heater Type	Indicator of non-residential application
Gas-fired Storage	Rated input >105 kBtu/h; Rated storage volume >120 gallons

Oil-fired Storage	Rated input >140 kBtu/h; Rated storage volume >120 gallons
Electric Storage	Rated input >12 kW; Rated storage volume >120 gallons
Heat Pump with Storage	Rated input >12 kW; Rated current >24 A at a rated voltage of not greater than 250 V; Rated storage volume >120 gallons
Gas-fired Instantaneous	Rated input >200 kBtu/h; Rated storage volume >2 gallons
Electric Instantaneous	Rated input >58.6 kW; Rated storage volume >2 gallons
Oil-fired Instantaneous	Rated input >210 kBtu/h; Rated storage volume >2 gallons

Commercial water heaters not meeting the definition of residential-duty commercial water heater were deemed to be sufficiently characterized by the current thermal efficiency and standby loss metrics.

This rulemaking, therefore, includes commercial water heating equipment covered by the uniform efficiency descriptor, as well as water heaters that will continue to be covered by the existing thermal efficiency and standby loss metrics. DOE plans to conduct analyses for this rulemaking using the UEF for residential-duty commercial water heaters. For residential-duty commercial water heaters, DOE will develop a conversion factor (as required by AEMTCA) that will be used to translate the existing thermal efficiency and standby loss ratings into UEF for its analyses. The conversion factor will be developed as part of a separate rulemaking. DOE plans to conduct analyses for all other types of commercial water heaters (i.e., other than the residential-duty commercial water heaters) using the existing thermal efficiency and standby loss metrics.

DOE notes that for unfired storage tanks, the Federal energy conservation standard is expressed as an R-value requirement for the tank thermal insulation. In an RFI published on February 27, 2014 that addresses commercial water heater test procedures (February 2014 RFI), DOE sought comment on whether a single test method for R-value should be used (and if so, which industry method is most appropriate), or whether replacing R-value with standby loss or

some other metric as the energy efficiency metric for unfired storage tanks would be appropriate. 79 FR 10999. Any amended standards for unfired storage tanks for this rulemaking will be established in the metric chosen in the noted test procedure rulemaking.

Lastly, DOE may consider including commercial heat pump water heaters within the scope of coverage of this rulemaking, as discussed below in Section II.B. DOE does not currently have a test procedure for determining the energy efficiency of commercial heat pump water heaters, but may develop a procedure as described in the February 2014 RFI. If DOE ultimately adopts a test method for commercial heat pump water heaters, then DOE would consider those products in the analyses for this rulemaking.

B. Market Assessment

The market and technology assessment provides information about the commercial water heating equipment industry that will be used throughout the rulemaking process. For example, this information will be used to determine whether the existing equipment class structure requires modification based on the statutory criteria for setting such classes and to explore the potential for technological improvements in the design and manufacturing of such equipment. DOE uses qualitative and quantitative information to assess the past and present industry structure and market characteristics. DOE will use existing market materials and literature from a variety of sources, including industry publications, trade journals, government agencies, and trade organizations. DOE will also consider conducting interviews with manufacturers to assess the overall market for commercial water heating equipment.

The current equipment classes as established in the Code of Federal Regulations (CFR) for commercial water heaters are characterized by energy source, equipment type (i.e., storage vs. instantaneous and hot water supply boilers), and size (i.e., input capacity rating and rated storage volume). Unfired hot water storage tanks are also included in a separate equipment class. As a starting point, DOE plans to use the existing equipment class structure which divides commercial water heating equipment into the equipment classes as shown in the table in 10 CFR 431.110 and summarized below in Table 4.

Table 4. Equipment Classes for Commercial Water Heating Equipment

Equipment	Size
Electric storage water heaters	All
Gas-fired storage water heaters	≤155,000 Btu/h
	>155,000 Btu/h
Oil-fired storage water heaters	≤155,000 Btu/h
	>155,000 Btu/h
Gas-fired instantaneous water heaters and hot water supply boilers	<10 gal
	≥10 gal
Oil-fired instantaneous water heaters and hot water supply boilers	<10 gal
	≥10 gal
Unfired hot water storage tank	All

DOE plans to create separate equipment classes for residential-duty commercial water heaters, as residential-duty commercial water heaters will use a different metric for energy conservation standards (see section II.A). DOE will consider additional equipment classes for capacities or other performance-related features which inherently affect efficiency and justify the establishment of a different energy conservation standard. DOE will also consider consolidating equipment classes, if warranted. DOE notes that both gas-fired and oil-fired storage water heaters are divided into equipment classes for equipment with an input capacity at or below 155,000 Btu/h and equipment with an input capacity above 155,000 Btu/h. However, as shown in

Table 1, the current energy conservation standard levels are identical for both equipment classes. DOE may consider consolidating these equipment classes to remove the input capacity designations, if appropriate.

DOE may also expand the scope of this rulemaking to include covered equipment that is not currently regulated, such as electric instantaneous water heaters or commercial heat pump water heaters, and may consider separate product classes for such equipment. DOE notes that EPCA defines "commercial instantaneous water heaters" as water heaters with an input rating of at least 4,000 Btu/h per gallon of stored water. (42 U.S.C. 6311(12)(B)) DOE believes this definition could include both commercial electric instantaneous water heaters and commercial electric add-on heat pump water heaters. Commercial electric heat pump water heaters may include both units that do not contain any storage volume and can be externally connected to a storage tank or tank water heater (i.e., add-on type) and units that contain an integrated heat pump and storage tank (i.e., integrated type). DOE is not aware of any integrated type commercial heat pump water heaters currently on the market but may consider their inclusion due to their possible development in the future.[5] However, any such units would be classified as commercial electric storage water heaters. Commercial add-on electric heat pump water heaters may also extract heat for water heating from either air (air-source) or water (water-source), both of which DOE could consider for new efficiency standards.

If appropriate, DOE may also consider establishing efficiency standards separately for

[5] A commercial integrated heat pump water heater is an integrated heat pump water heater that surpasses any of the limitations for heat pump water heaters expressed in Table 2.

electric instantaneous water heaters using electric resistance heat. However, DOE notes that the thermal efficiency of electric instantaneous water heaters is already nearly 100 percent due to the high efficiency of electric resistance heating elements, and that a thermal efficiency standard may be unnecessary.

Issue 1: DOE requests feedback on the current equipment classes and seeks information regarding other equipment classes it should consider for inclusion in its analysis.

Issue 2: DOE requests comment on whether the 155,000 Btu/h input capacity divisions in the current equipment classes for gas-fired and oil-fired storage water heaters are necessary.

Issue 3: DOE seeks comment on whether to include commercial electric instantaneous water heaters and/or commercial heat pump water heaters in the scope of this rulemaking.

Issue 4: DOE seeks comment on whether to include both add-on and integrated commercial heat pump water heater types in the scope of this rulemaking.

Issue 5: DOE seeks comment on whether to include both air-source and water-source commercial heat pump water heater types in the scope of this rulemaking.

C. Technology Options for Consideration

DOE uses information about existing and past technology options and prototype designs to help identify technologies that manufacturers could use to meet and/or exceed energy

conservation standards. In consultation with interested parties, DOE intends to develop a list of technologies to consider in its analysis. Initially, this list will include all those technologies considered to be technologically feasible and will serve to establish the maximum technologically feasible design. DOE is currently considering the specific technologies and design options listed below.

- Heat traps
- Improved insulation[6]
- Power and direct venting
- Fully condensing technology[7]
- Improved flue design[8]
- Sidearm heating and two-phase thermosiphon technology
- Electronic ignition systems
- Improved heat pump water heaters[9]
- Thermophotovoltaic and thermoelectric generators
- Improved controls[10]
- Self-cleaning
- Improved burners[11]

[6] This includes increasing jacket insulation, insulating the tank bottom or using a plastic tank (electric only), advanced insulation types, foam insulation, and pipe and fitting insulation.
[7] This includes storage, instantaneous, and hybrid heaters, as well as pulse combustion
[8] This includes using high-efficiency flue baffles, multiple flues, submerged combustion chambers, and optimized flue geometry.
[9] This includes absorption heat pump water heaters, carbon dioxide heat pump water heaters, advanced compressors, and using centrifugal fans.
[10] This includes incorporating timer controls, modulating controls, and intelligent and wireless controls and communication.
[11] This includes incorporating variable firing-rate burners, low-stage firing burners, and modulating burners.

Issue 6: DOE seeks information related to these or other efficiency-improving technologies. Specifically, DOE is interested in comments regarding their applicability to the current market and how these technologies improve efficiency of commercial water heating equipment.

D. Engineering Analysis

The engineering analysis estimates the cost-efficiency relationship of equipment at different levels of increased energy efficiency. This relationship serves as the basis for the cost-benefit calculations for commercial customers, manufacturers, and the nation. In determining the cost-efficiency relationship, DOE will estimate the increase in manufacturer cost associated with increasing the efficiency of equipment above the baseline to the maximum technologically feasible ("max-tech") efficiency level for each equipment class. The baseline model is used as a reference point for each equipment class in the engineering analysis and the life-cycle cost and payback-period analyses. DOE considers equipment that just meets the current minimum energy conservation standard as baseline equipment. For equipment that does not have an existing minimum energy conservation standard, DOE considers the least efficient equipment on the market as baseline equipment. DOE will establish a baseline for each equipment class using the applicable metric(s): Thermal Efficiency and Standby Loss, or Uniform Energy Factor.

Issue 7: DOE requests comment on approaches that it should consider when determining a baseline for equipment classes being transitioned to the uniform descriptor, including information regarding the merits and/or deficiencies of such approaches.

Issue 8: DOE requests information on max-tech efficiency levels achievable in the current market and associated technologies.

In order to create the cost-efficiency relationship, DOE anticipates that it will structure its engineering analysis using both a reverse-engineering (or cost-assessment) and catalog teardown approach. A reverse-engineering or cost-assessment approach relies on a teardown analysis of representative units at the baseline efficiency level and higher efficiency levels up to the maximum technologically feasible designs. A teardown analysis (or physical teardown) determines the production cost of a piece of equipment by disassembling the equipment "piece-by-piece" and estimating the material and labor cost of each component. A catalog teardown approach uses published manufacturer catalogs and supplementary component data to estimate the major physical differences between a piece of equipment that has been physically disassembled and another piece of similar equipment. These two methods would be used together to help DOE estimate the manufacturer production cost of equipment at various efficiency levels.

Issue 9: DOE requests feedback on the planned approach for the engineering analysis and on the appropriate representative capacities and characteristics for each equipment class.

1. Analyzing Standby Loss Standards

For each equipment class examined, the baseline, or current standard is determined, and then several intermediate efficiency levels are analyzed incrementally up to the max-tech level, which corresponds to the most efficient unit on the market. For the analysis of amended thermal

efficiency standards and uniform efficiency descriptor standards, DOE expects this will be a straightforward process. However, selecting efficiency levels for analysis of amended standby loss (SL) standards for gas and oil storage heaters is more complex for several reasons.

First, the standard for standby loss (BTU/hr) oil and gas storage water heaters is a multivariable equation depending upon both rated input (Q, BTU/hr) and volume (V, gal), as shown below.

$$SL = \frac{Q}{800} + 110\sqrt{V}$$

As discussed later in this section, DOE plans to analyze representative units for the engineering analysis that have the most common attributes of a given equipment class. As a result, DOE will select equipment for analysis with storage volumes and input ratings at discrete representative values within the range of products available on the market. DOE will then need to expand its analysis of efficiency levels at the representative volume(s) and input(s) for the market, and these levels must be extrapolated to apply to the range of volumes and inputs covered by the standard. Because the current standard depends on both volume and input without an intercept, it is only possible to change the slopes for each variable when modifying the standard to fit the analyzed efficiency levels. This could be undesirable if shifting the standard up or down (maintaining the slopes) would better fit the distribution of units outside the representative input and volume. Analysis performed thus far by DOE using an approach of varying the volume slope to change the relationship between SL and input for units at the representative volume appears to yield viable results.

One method to avoid issues stemming from adjusting a multi-variable standard is to

remove one of the variables from the equation and establish discrete bins for that variable. Within each of these bins, the SL standard would be a single-variable equation, allowing for manipulation of either the slope or intercept. While bins could be created for input or volume, preliminary analysis indicates that creating bins for volume with standards based on input within each bin would yield better trends for establishing new standard levels.

Issue 10: DOE requests comment on approaches to selecting efficiency levels for its analysis of amended SL energy conservation standards for gas and oil storage heaters, including the possibility of establishing discrete bins for one of the variables and establishing SL standards based on one instead of two variables.

The second issue is that the SL is calculated using the amount of fuel consumed over a given time period, and therefore the heat loss as measured in the SL is partially dependent on the thermal efficiency (TE) of the water heater. Because TE for commercial gas storage heaters can vary from 80-99%, TE can account for a difference of up to 19% of SL values (only 4% for oil storage heaters). Removing this dependency on TE would allow more accurate and representative standards for non-condensing and condensing water heaters. DOE notes that preliminary analysis has shown a large discrepancy in SL range for non-condensing and condensing water heaters; condensing water heater have units with values in a similar range to non-condensing models, but the range also extends to much lower SL values. Further analysis is required to determine to what degree the technologies that allow these significantly lower values are inherent to condensing heaters (i.e. less heat lost in flue due to condensation), as otherwise these technologies could be considered for non-condensing units as well. One possible way to

mitigate the impact of TE on SL would be to incorporate the thermal efficiency into the standby loss standard, as a third variable. Another approach would be to analyze SL levels for condensing (92-99% TE) and non-condensing (80-84% TE) gas storage models separately, so that non-condensing models have a proportionately less strict standard, accounting for the lower average TE.

Issue 11: DOE requests comment whether to account for the impact of thermal efficiency on standby loss and on approaches to separate the effect of thermal efficiency from standby loss for gas storage heaters. This includes the possibility of separate standards for non-condensing and condensing units, as well as adding thermal efficiency to the current SL standard.

E. Markups Analysis

To carry out the life-cycle cost (LCC) and payback period (PBP) calculations, DOE needs to determine the cost to the commercial customer of baseline equipment that satisfies the currently applicable standards, and the cost of the more-efficient unit the customer would purchase under potential amended standards. This is done by applying a markup multiplier to the manufacturer's selling price to estimate the commercial customer's price.

Markups depends on the distribution channels for a product (i.e., how the equipment passes from the manufacturer to the customer). For commercial water heating equipment, various distribution channels are characterized.

Two different markets exist for commercial water heating systems: (1) new construction

and (2) replacements. DOE plans to characterize the replacement distribution channels for commercial water heating systems as follows:

Manufacturer → Wholesaler → Mechanical contractor → Customer

In the case of new construction, DOE plans to characterize the distribution channel as follows:

Manufacturer → Wholesaler → Mechanical contractor → General contractor → Customer

In addition, DOE plans to consider distribution channels where the manufacturer sells the equipment directly to a commercial consumer through a national account or the commercial consumer purchases the equipment directly through a wholesaler as follows:

Manufacturer → Wholesaler → Customer

or

Manufacturer → Customer

The latter channels reflect those cases where the installation can be accomplished by site personnel.

DOE also plans to consider cases when the contractor's sale of the equipment includes a start-up/check-out contract, in which cases the equipment markup is included in the contract costs.

Issue 12: DOE seeks input from stakeholders on whether the distribution channels described above are appropriate for commercial water heaters and are sufficient to describe the distribution market.

Issue 13: DOE seeks input on the percentage of equipment being distributed through the different distribution channels, and whether the share of equipment through each channel varies based on equipment capacity or water heater class.

To develop markups for the parties involved in the distribution of the equipment, DOE would utilize several sources including: (1) the Heating, Air-Conditioning & Refrigeration Distributors International (HARDI) 2013 Profit Report[12] to develop wholesaler markups, (2) the 2005 Air Conditioning Contractors of America's (ACCA) financial analysis for the heating, ventilation, air-conditioning, and refrigeration (HVACR) contracting industry[13] to develop mechanical contractor markups, and (3) U.S. Census Bureau's 2007 Economic Census data[14] for the commercial and institutional building construction industry to develop general contractor markups.

Issue 14: DOE seeks recent data and recommendations regarding data sources to establish the markups for the parties involved with the distribution of the equipment.

[12] Heating, Air Conditioning & Refrigeration Distributors International 2013 Profit Report, (Available at:http://www.hardinet.org/Profit-Report) (Last accessed July 8. 2014).
[13] Air Conditioning Contractors of America (ACCA), Financial Analysis for the HVACR Contracting Industry: 2005, (Available at: https://http://www.acca.org/store/product.php?pid=142) (Last accessed April 10, 2013).
[14] U.S. Census Bureau, 2007 Economic Census Data. (2007) (Available at: http://www.census.gov/econ/) (Last accessed April 10, 2013).

F. Energy Use Analysis

The purpose of the energy use analysis is to assess the energy requirements of commercial water heating products described in the engineering analysis for a representative sample of building types that utilize the product, and to assess the energy-savings potential of increased product efficiencies. DOE uses the annual energy consumption and energy-savings potential in the LCC and PBP analysis to establish the operating costs savings at various product efficiency levels. DOE will estimate the annual energy consumption of commercial water heaters at specified energy efficiency levels across a range of applications, building types, and climate zones. The annual energy consumption includes use of natural gas, liquefied petroleum gas (LPG), oil, or electricity for hot water production, as well as use of electricity for the auxiliary components.

DOE intends to base the energy use analysis on building characteristics from the Energy Information Administration's (EIA) 2003 Commercial Building Energy Consumption Survey (CBECS)[15] for the subset of building types that use the type of commercial water heating equipment covered by the standards. DOE also plans to look at the use of commercial water heaters in residential applications, such as multi-family buildings. Therefore, DOE plans to include characteristics from EIA's 2009 Residential Energy Consumption Survey (RECS)[16] for the subset of building types in RECS that use commercial water heating equipment covered by

[15] Energy Information Administration (EIA). 2003 Commercial Building Energy Consumption Survey (CBECS). (Available at: http://www.eia.gov/consumption/commercial/) (Last accessed April 10, 2013). Note CBECS 2012 building characteristics have been released in preliminary form by EIA and will be reviewed for possible incorporation into this analysis, however, the full release of CBECS 2012 data is not expected until winter 2015.

[16] Energy Information Administration (EIA). 2009 Residential Energy Consumption Survey (RECS). (Available at: http://www.eia.gov/consumption/residential/) (Last accessed April 10, 2013).

this standard.

Both CBECS and RECS survey data include information on the physical characteristics of building units, water heating equipment used, fuels used, energy consumption and expenditures, and other building characteristics.[17] DOE will also consult the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)[18] and Electric Power Research Institute (EPRI)[19] handbooks, which contain data on the typical types and sizes (both input capacity and rated volume) of commercial water heaters used for different building types and applications, and can be used to compare to, supplement, and corroborate the CBECS and RECS data. Based on these data, DOE will develop a representative population of buildings for each commercial water heater equipment class.

Based on the data in the ASHRAE and EPRI Handbooks, as well as data from National Renewable Energy Laboratory (NREL),[20] and Lawrence Berkeley National Laboratory (LBNL)[21] regarding typical energy use profiles and other commercial building usage characteristics, DOE will develop representative hot water usage, water heating usage profile, water volumetric loads, and hot water usage temperatures for various applications for each

[17] Neither CBECS nor RECS provide data on whether the water heater used in the building is a commercial water heater covered in this rulemaking (i.e., water heating could also be provided by a commercial boiler, residential boiler, or residential water heater). Therefore, DOE intends to develop a methodology for adjusting its building sample to reflect buildings that use a commercial water heater covered in this rulemaking.

[18] American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE). ASHRAE Handbook of HVAC Applications: Chapter 50 (Service Water Heating) (2011) pgs. 50.1 to 50.32.

[19] Electric Power Research Institute (EPRI). Commercial Water Heating Applications Handbook. (1992) CU-6666.

[20] National Renewable Energy Laboratory (NREL). U.S. Department of Energy Commercial Reference Building Models of the National Building Stock. February 2011. (Available at: http://www.nrel.gov/docs/fy11osti/46861.pdf) (Last accessed April 10, 2013).

[21] Huang, J., Akbari, H., Rainer, L, Ritschard, R. 481 Prototypical Commercial Buildings for 20 Urban Market Areas, LBL-29798, April 1991(Available at: https://publications.lbl.gov/islandora/object/ir%3A94368) (Last accessed October 03, 2014).

commercial water heater and building type combination being analyzed. This approach will capture the variability in water heating use due to factors such as building activity, schedule, occupancy, water supply temperature, tank losses, cycling losses, and distribution system piping losses.

DOE plans to consider market changes or future efficiency standards in equipment technologies that reduce water heating loads in commercial applications, such as more efficient commercial dishwashers and commercial clothes washers. In addition, DOE intends to review other data sets (e.g., the technology penetration curves used in the National Energy Modeling System (NEMS),[22] data from the End-Use Load and Consumer Assessment Program (ELCAP),[23] and 2009 Commercial Building Stock Assessment for the Northwest[24]), to determine whether a significant fraction of the current building population is not represented by CBECS 2003.

Issue 15: DOE requests comment on the overall method to determine water heating energy use and if other factors should be considered in developing the energy use or energy use methodology.

Issue 16: DOE seeks input on the current distribution of equipment efficiencies in the

22 For more information on NEMS, refer to the U.S. Department of Energy, Energy Information Administration (EIA) documentation. A useful summary is *National Energy Modeling System: An Overview 2003*, DOE/EIA-0581(2003). Each year, EIA uses NEMS to produce an energy forecast for the United States, the Annual Energy Outlook (AEO). For this analysis, DOE intends to use the version of NEMS based on *AEO 2013.* (Available at: http://www.eia.gov/forecasts/aeo/).

23 Bonneville Power Administration. End-Use Load and Consumer Assessment Program (ELCAP) Data from 1986 to 1989. 2012. (Available at: http://rtf.nwcouncil.org/ELCAP/) (Last accessed April 10, 2013).

24 Northwest Energy Efficiency Alliance (NEEA). Commercial Building Stock Assessment. 2009. (Available at: http://neea.org/resource-center/regional-data-resources/commercial-building-stock-assessment) (Last accessed April 10, 2013).

building population for different equipment classes.

Issue 17: DOE seeks input on typical types and sizes (including fuel type, input capacity and rated volume) of commercial water heaters, including gas condensing and heat pump water heaters, used for different building types and applications.

Issue 18: DOE seeks input on representative hot water usage, water heating usage profile, water volumetric load profiles or aggregate loads, and representative hot water usage temperatures for various commercial water heater applications.

Issue 19: DOE seeks input and sources of data or recommendations for tools to support sizing of water heater typical commercial water heater and multifamily residential applications.

Issue 20: DOE seeks input on the fraction and types of buildings that use recirculation loops associated with commercial water heaters and the impact of recirculation loops on water heater performance.

Issue 21: DOE requests comment on the fraction of commercial or residential boilers used in commercial water heating applications.

Issue 22: DOE requests comment on the fraction and classes of commercial water heaters which are used in residential-duty applications as well as other commercial water heaters that may serve residential multi-family buildings. DOE also requests input on the fraction of

residential water heaters that are used for commercial applications.

G. Life-Cycle Cost and Payback Period Analysis

The purpose of the LCC and PBP analysis is to analyze the effects of potential amended energy conservation standards on customers of commercial water heater equipment by determining how a potential amended standard affects their operating expenses (usually decreased) and their total installed costs (usually increased).

DOE intends to analyze the potential for variability by performing the LCC and PBP calculations on a representative sample of individual commercial buildings. DOE plans to utilize the sample of buildings developed for the energy use analysis and the corresponding simulations results.[25] Within a given building, one or more commercial water heater units may serve the building's water heating needs, depending on the hot water requirements of the building. As a result, DOE intends to express the LCC and PBP results for each of the individual commercial water heaters installed in the building. DOE plans to model uncertainty in many of the inputs to the LCC and PBP analysis using Monte Carlo simulation and probability distributions. As a result, the LCC and PBP results will be displayed as distributions of impacts compared to the base case (without amended standards) conditions.

Issue 23: DOE requests comment on the overall method that it intends to use to conduct the LCC and PBP analysis for commercial water heaters.

[25] DOE plans to utilize the building types defined in CBECS 2003 as well as residential buildings that use commercial water heaters such as multi-family buildings. Definitions of CBECS building types can be found at http://www.eia.gov/emeu/cbecs/building_types.html.

Inputs to the LCC and PBP analysis are categorized as: (1) inputs for establishing the purchase expense, otherwise known as the total installed cost, and (2) inputs for calculating the operating expense.

The primary inputs for establishing the total installed cost are the baseline customer price, standard-level customer price increases, and installation costs. Baseline customer prices and standard-level customer price increases will be determined by applying markups to manufacturer selling price estimates. The installation cost is added to the customer price to arrive at a total installed cost. DOE intends to develop installation costs using the most recent RS Means data available.

Issue 24: DOE seeks input on the approach and data sources it intends to use to develop installation costs, specifically, its intention to use the most recent RS Means Mechanical Cost Data.[26]

The primary inputs for calculating the operating costs are equipment energy consumption and demand, equipment efficiency, energy prices and forecasts, maintenance and repair costs, equipment lifetime, and discount rates. Both equipment lifetime and discount rates are used to calculate the present value of future operating expenses.

[26] RS Means. 2014 Mechanical Cost Data. (Available at: http://rsmeans.reedconstructiondata.com/60023.aspx) (Last accessed April 10, 2014).

The equipment energy consumption is the site energy use associated with providing water heating to the building. DOE intends to utilize the energy use calculation methodology described in Section II.F to establish equipment energy use.

DOE will identify an approach to account for the gas, propane, oil and electricity prices paid by consumers for the purposes of calculating operating costs, savings, net present value, and payback period. DOE intends to consider determining gas, oil, and electricity prices based on geographically available fuel cost data such as state level data, with consideration for the variation in energy costs paid by different building types.. This approach calculates energy expenses based on actual energy prices that customers are paying in different geographical areas of the country. As a potential additional source, DOE may consider data to compare provided in EIA's Form 861 data[27] to calculate commercial electricity prices, EIA's Natural Gas Navigator[28] to calculate commercial natural gas prices, and EIA's State Energy Data Systems (SEDS)[29] to calculate liquefied petroleum gas (LPG) and fuel oil prices. Future energy prices will likely be projected using trends from the EIA's 2013 *Annual Energy Outlook* (*AEO*).[30]

Issue 25: DOE seeks comment and sources on its approach for developing gas, oil, and electricity prices.

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27 Energy Information Administration (EIA), Survey form EIA-861 -- Annual Electric Power Industry Report. (Available at: http://www.eia.gov/electricity/data/eia861/index.html) (Last accessed April 15, 2013).
28 Energy Information Administration (EIA), Natural Gas Navigator. (Available at: http://tonto.eia.doe.gov/dnav/ng/ng_pri_sum_dcu_nus_m.htm) (Last accessed April 15, 2013).
29 Energy Information Administration (EIA), State Energy Data System (SEDS). (Available at: http://www.eia.gov/state/seds/) (Last accessed April 15, 2013).
30 Energy Information Administration (EIA). 2013 Annual Energy Outlook (AEO) Full Version. (Available at: http://www.eia.gov/forecasts/aeo/). (Last accessed April 15, 2013).

Maintenance costs are expenses associated with ensuring continued operation of the covered equipment over time. DOE intends to develop maintenance costs for its analysis using the most recent RS Means data available.[31] DOE plans also to consider the cases when the equipment is covered by service and/or maintenance agreements.

Issue 26: DOE seeks input on the approach and data sources it intends to use to develop maintenance costs, specifically, its intention to use the most recent RS Means Facilities Maintenance & Repair Cost Data, as well as to consider the cost of service and/or maintenance agreements.

Repair costs are expenses associated with repairing or replacing components of the covered equipment that have failed. DOE intends to assess whether repair costs vary with equipment efficiency as part of its analysis.

Issue 27: DOE seeks comment as to whether repair costs vary as a function of equipment efficiency. DOE also requests any data or information on developing repair costs.

Equipment lifetime is the age at which a unit of covered equipment is retired from service. The average equipment lifetime for commercial water heaters is estimated by various sources to be between 7 and 25 years based on application and equipment type.[32,33,34,35,36,37,38]

[31] RS Means. 2013 Facilities Maintenance & Repair Cost Data. (Available at: http://rsmeans.reedconstructiondata.com/60303.aspx) (Last accessed April 10, 2013).
[32] National Renewable Energy Laboratory (NREL). U.S. Department of Energy Commercial Reference Building Models of the National Building Stock. February 2011. (Available at: http://www.nrel.gov/docs/fy11osti/46861.pdf)

Based on these data, DOE plans to determine average lifetime for each commercial water heater product class as the primary input for developing a Weibull probability distribution to characterize commercial water heater lifetime.[39]

Issue 28: DOE seeks comment on its approach of using a Weibull probability distribution to characterize equipment lifetime. DOE also requests equipment lifetime data and information on whether equipment lifetime varies based on equipment characteristics, equipment application, or efficiency level considerations.

The discount rate is the rate at which future expenditures are discounted to establish their present value. DOE intends to derive the discount rates by estimating the cost of capital of companies that purchase commercial water heater equipment.

(Last accessed April 10, 2013). Pg. 38.
[33] RS Means. 2013 Facilities Maintenance & Repair Cost Data. (Available at: http://rsmeans.reedconstructiondata.com/60303.aspx) (Last accessed April 10, 2013). pgs. 184-188.
[34] Mark Ellis & Associates. "National Appliance and Equipment Energy Efficiency Program, Analysis of Potential for Minimum Energy Performance Standards for Miscellaneous Water Heaters. Prepared for the Australian Greenhouse Office. (2001) (Available at: www.energyrating.com.au/library/pubs/tech-ewhmisc2001.pdf) (Last accessed April 18, 2013).
[35] Ryan Firestone and Danielle Gidding. "Energy Savings from Electric Water Heaters in Commercial Applications." Prepared for Bonneville Power Administration. Prepared by Navigant Consulting and Bonneville Power Administration. (Presented June 1, 2010) (Available at: rtf.nwcouncil.org/meetings/2010/0601/Water Heaters in Commercial Applications v05.ppt) (Last accessed: April 18. 2013). Slide 31.
[36] Gas Foodservice Equipment Network. "Straight Talk About Tankless Water Heaters, Can They Really Keep You in Hot Water?" Cooking for Profit. (December 15, 2007) (Available at: http://www.crescentcity-fl.com/Gas%20Documents/Dec%2007%20GFEN%20%20final_Tankless.pdf) (Last accessed: April 18, 2013).
[37] Federal Energy Management Program (FEMP). FEMP Designated Product: Commercial Gas Water Heaters. 2012. (Available at: http://www1.eere.energy.gov/femp/technologies/eep_com_gaswaterheaters.html) (Last accessed: April 18, 2013).
[38] Note that for some commercial water heaters the usage and application would be similar to a residential water heater. For these situations the Weibull distribution derived for DOE's 2010 residential water heater standards rulemaking could be applicable. (More information about the derivation the residential water heater lifetime is available at: http://www.regulations.gov/#!docketDetail;D=EERE-2006-STD-0129).
[39] If the data is available, DOE also plans to take into account differences in commercial water heater lifetime based on usage and application of the water heater.

DOE's analysis includes measures of LCC and PBP impacts of potential standard levels relative to a base case that reflects the likely market in the absence of amended standards. DOE plans to develop market-share efficiency data (*i.e.*, the distribution of equipment shipments by efficiency) for the equipment classes DOE is considering, for the year in which compliance with any amended standards would be required.

DOE also plans to assess the applicability of the "rebound effect" in the energy consumption for commercial water heaters. A rebound effect occurs when a piece of equipment that is made more efficient is used more intensively, so that the expected energy savings from the efficiency improvement may not fully materialize. However, at this time, DOE is not aware of any information about the rebound effect for this equipment type.

Issue 29: DOE requests data on current efficiency market shares (of shipments) by equipment class, and also input on similar historic data.

Issue 30: DOE also requests information on expected future trends in efficiency for commercial water heaters classes, including the relative market share of condensing versus non-condensing equipment in the market in the absence of new efficiency standards.

Issue 31: DOE seeks comments and data on any rebound effect that may be associated with more efficient commercial water heaters.

H. Shipment Analysis

DOE uses shipment projections by equipment class to calculate the national impacts of standards on energy consumption, net present value (NPV) of customer benefits, and future manufacturer cash flows.

DOE intends to develop a shipments model for commercial water heater equipment based on historical AHRI shipments data for commercial gas and electric storage water heaters.[40] DOE currently does not have any historical shipments information for other product classes described in the engineering analysis.

Issue 32: DOE seeks historical shipments data for commercial water heaters by product class, particularly for product classes other than commercial gas and electric storage water heaters.

The shipments model will consider three market segments: (1) new commercial buildings acquiring equipment; (2) existing buildings replacing old equipment; and (3) existing buildings acquiring new equipment for the first time. Two stock categories are also considered: (1) equipment that has received only normal maintenance repairs; and (2) equipment that has had its useful life extended through additional repairs. To determine whether a customer would choose to repair rather than replace their commercial water heater equipment, the shipments model explicitly accounts for the combined effects of changes in purchase price, annual operating cost,

[40] Air-Conditioning, Heating, and Refrigeration Institute (AHRI). Commercial Storage Water Heaters Historical Data: 1992-2011. (Available at: http://www.ahrinet.org/site/494/Resources/Statistics/Historical-Data/Commercial-Storage-Water-Heaters-Historical-Data) (Last accessed July 3, 2014).

and the value of commercial floor space on the purchase versus repair decision. Changes to the purchase price and operating costs due to amended energy conservation standards are the drivers for shipment estimates for the standards cases relative to the base case (*i.e.*, the case without amended standards).

DOE intends to utilize the U.S. Census Bureau data[41] to establish historical new construction floor space, as well as historical stock floor space. The *Annual Energy Outlook* will be used to forecast both new construction and stock floor space. Using these and historical equipment saturation data from CBECS, DOE will estimate shipments to the three market segments identified above. The utility function to estimate the repair versus replacement decision will be based on income per square foot data from the Building Owners and Managers Association (BOMA) Commercial Building Survey reports,[42] equipment purchase price index (PPI) data estimated from the Bureau of Labor Statistics,[43] and operating cost data derived from the LCC and PBP analysis.

Issue 33: DOE seeks input on the approach and data sources it intends to use in developing the shipments model and shipments forecasts for this analysis.

[41] U.S. Census Bureau. Statistical Abstract of the United States: 2011, Table No 933 - Construction Contracts-Value of Construction and Floor Space of Buildings by Class of Construction. (Available at: https://www.census.gov/compendia/statab/2011/cats/construction_housing/construction_indices_and_value.html) (Last accessed April 10, 2013).
[42] Building Owners and Managers Association International (BOMA). Experience Exchange Report (2013) (Available at: https://www.bomaeer.com/) (Last accessed April 10, 2013).
[43] U.S. Department of Labor, Bureau of Labor Statistics. Producers Price Index: Industry: Refrigeration and Heating Equipment (Available at: http://www.bls.gov/ppi/home.htm) (Last accessed April 10, 2013).

I. National Impact Analysis

The purpose of the national impact analysis (NIA) is to estimate aggregate impacts of potential energy conservation standards at the national level. Impacts that DOE reports include the national energy savings (NES) from potential standards and the net present value (NPV) of the total customer benefits.

To develop the NES, DOE calculates annual energy consumption for the base case and the standards cases. DOE calculates the annual energy consumption using per-unit annual energy use data multiplied by projected shipments.

To develop the NPV of customer benefits from potential energy conservation standards, DOE calculates annual energy expenditures and annual equipment expenditures for the base case and the standards cases. DOE calculates annual energy expenditures from annual energy consumption by incorporating projected energy prices. DOE calculates annual equipment expenditures by multiplying the price per unit times the projected shipments. The difference each year between energy bill savings, increased maintenance and repair costs, and increased equipment expenditures is the net savings or net costs.

A key component of DOE's estimates of NES and NPV are the equipment energy efficiencies forecasted over time for the base case and for each of the standards cases. For the base case trend, DOE will consider whether historical data show any trend and whether any trend can be reasonably extrapolated beyond current efficiency levels. In particular, DOE is interested in historical and future shipments of equipment with step changes in efficiency, such as

condensing gas equipment or HPWHs.

Issue 34: DOE requests comment and any available data on historical, current, and future market share of equipment with step changes in efficiency, such as gas condensing equipment and HPWHs, as compared to less efficient equipment, such as non-condensing gas water heaters and electric water heaters, respectively, for each equipment class.

For the various standards cases, to estimate the impact that amended energy conservation standards may have in the year compliance becomes required, DOE would likely use a "roll-up" scenario. Under the "roll-up" scenario, DOE assumes: (1) equipment efficiencies in the base case that do not meet the new or amended standard level under consideration would "roll up" to meet that standard level; and (2) equipment shipments at efficiencies above the standard level under consideration would not be affected. After DOE establishes the efficiency distribution for the assumed compliance date of a standard, it may consider future projected efficiency growth using available trend data.

DOE intends to determine whether there is a rebound effect associated with more efficient commercial water heaters. If data indicate that there is a rebound effect, DOE will account for the rebound effect in its calculation of NES.

III. Public Participation

DOE will accept comments, data, and information regarding this RFI and other matters relevant to DOE’s consideration of amended energy conservations standard for commercial

water heating equipment no later than the date provided in the **DATES** section at the beginning of this RFI. Interested parties may submit comments using any of the methods described in the **ADDRESSES** section at the beginning of this RFI. After the close of the comment period, DOE will begin collecting data, conducting the analyses, and reviewing the public comments. These actions will be taken to aid in the development of a NOPR for commercial water heating equipment if DOE decides to amend the standards for commercial water heaters.

Instructions: All submissions received must be identified by docket number EERE-2014-BT-STD-0042 and/or regulatory identification number (RIN) 1904-AD34. No telefacsimilies (faxes) will be accepted.

Docket: The docket is available for review at www.regulations.gov, including Federal Register notices, public meeting attendees' lists and transcripts, comments, and other supporting documents/materials. All documents in the docket are listed in the www.regulations.gov index. However, not all documents listed in the index may be publicly available, such as information that is exempt from public disclosure.

A link to the docket webpage can be found at: http://www.regulations.gov/#!docketDetail;D=EERE-2014-BT-STD-0042. This webpage contains a link to the docket for this notice on the www.regulations.gov website. The www.regulations.gov webpage contains simple instructions on how to access all documents, including public comments, in the docket.

For information on how to submit a comment, review other public comments and the docket, or participate in the public meeting, contact Ms. Brenda Edwards at (202) 586-2945 or by e-mail: Brenda.Edwards@ee.doe.gov.

DOE considers public participation to be a very important part of the process for developing test procedures. DOE actively encourages the participation and interaction of the public during the comment period in each stage of the rulemaking process. Interactions with and between members of the public provide a balanced discussion of the issues and assist DOE in the rulemaking process. Anyone who wishes to be added to the DOE mailing list to receive future notices and information about this rulemaking should contact Ms. Brenda Edwards at (202) 586–2945, or via e-mail at Brenda.Edwards@ee.doe.gov.

Issued in Washington, DC, on October 10, 2014

Kathleen B. Hogan
Deputy Assistant Secretary for Energy Efficiency
Energy Efficiency and Renewable Energy