[6450-01-P]

DEPARTMENT OF ENERGY

10 CFR Part 430

[Docket No. EERE–2012–BT–STD–0047]

RIN: 1904-AC88

Energy Conservation Standards for Residential Boilers: Availability of Analytical Results and Modeling Tools

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

ACTION: Notice of data availability.

SUMMARY: The U.S. Department of Energy (DOE) has completed a provisional analysis that estimates the potential economic impacts and energy savings that could result from promulgating amended energy conservation standards for residential boilers. At this time, DOE is not proposing any amendments to the energy conservation standards for residential boilers. However, it is publishing this analysis so stakeholders can review the analytical output, the underlining assumptions, and the calculations that might

ultimately support amended standards. DOE encourages interested parties to provide any additional data or information that may improve the analysis.

DATES: Comments: DOE will accept comments, data, and information regarding this notice of data availability (NODA) no later than [**INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER**].

ADDRESSES: Any comments submitted must identify the NODA for Energy Conservation Standards for Residential Boilers, and provide docket number EERE–2012–BT–STD–0047 and/or regulatory information number (RIN) number 1904-AC88. Comments may be submitted using any of the following methods:

1. Federal Rulemaking Portal: www.regulations.gov. Follow the instructions for submitting comments.
2. E-mail: ResBoilers2012STD0047@ee.doe.gov. Include the docket number EERE-2012-BT-STD-0047 and/or RIN 1904-AC88 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.
3. Postal Mail: Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Office, Mailstop EE-2J, 1000 Independence Avenue, SW.,

Washington, DC, 20585-0121. If possible, please submit all items on a compact disc (CD), in which case it is not necessary to include printed copies.

4. Hand Delivery/Courier: Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Office, 950 L'Enfant Plaza, SW., Suite 600, Washington, DC, 20024. Telephone: (202) 586-2945. If possible, please submit all items on a CD, in which case it is not necessary to include printed copies.

No telefacsimilies (faxes) will be accepted.

Docket**:** The docket, EERE–2012–BT–STD–0047, is available for review at www.regulations.gov, including Federal Register notices, 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 web page can be found at: http://www.regulations.gov/#!docketDetail;D=EERE-2012-BT-STD-0047. The regulations.gov web page contains instructions on how to access all documents in the docket, including public comments.

For detailed instructions on submitting comments and additional information on the rulemaking process, see section IV, "Public Participation," of this document. For further information on how to submit a comment or review other public comments and

the docket, contact Ms. Brenda Edwards at (202) 586-2945 or by email: Brenda.Edwards@ee.doe.gov.

FOR FURTHER INFORMATION CONTACT: Mr. John Cymbalsky, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies, EE-2J, 1000 Independence Avenue, SW., Washington, DC 20585-0121. Telephone: (202) 286-1692. E-mail residential_furnaces_and_boilers@ee.doe.gov .

Mr. Eric Stas, U.S. Department of Energy, Office of the General Counsel, GC-71, 1000 Independence Avenue, SW., Washington, DC 20585-0121. Telephone: (202) 586-9507. E-mail: Eric.Stas@hq.doe.gov.

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A. Submission of Comments

I. History of Energy Conservation Standards Rulemaking for Residential Boilers

Title III, Part B[1] of the Energy Policy and Conservation Act of 1975 (EPCA), Pub. L. 94-163 (42 U.S.C. 6291-6309, as codified), sets forth a variety of provisions designed to improve energy efficiency and established the Energy Conservation Program for Consumer Products Other Than Automobiles, a program covering most major household appliances and certain industrial and commercial equipment.[2] The National Appliance Energy Conservation Act of 1987 (NAECA), Pub. L. 100-12, amended EPCA to establish energy conservation standards for residential furnaces and boilers, and set requirements to conduct two cycles of rulemaking to determine whether these standards should be amended. (42 U.S.C. 6295(f))

On November 19, 2007, DOE published a final rule in the Federal Register (hereafter referred to as the "November 2007 final rule") revising the energy conservation standards for furnaces and boilers, which addressed the first required review of minimum standards for boilers under 42 U.S.C. 6295(f)(4)(B). 72 FR 65136. Compliance with the standards in the November 2007 final rule would have been required by November 19, 2015. However, on December 19, 2007, the Energy Independence and Security Act of 2007 (EISA 2007), Pub. L. No. 110-140, was signed into law, which further revised the

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

energy conservation standards for residential boilers. More specifically, EISA 2007 revised the minimum annual fuel utilization efficiency (AFUE) requirements for residential boilers and set several design requirements for each product class (42 U.S.C. 6295(f)(3)). EISA 2007 required compliance with the amended energy conservation standards for residential boilers beginning on September 1, 2012.

Only July 15, 2008, DOE issued a final rule technical amendment to the 2007 furnaces and boilers final rule, which was published in the Federal Register on July 28, 2008, to codify the energy conservation standard levels, the design requirements, and compliance dates for residential boilers outlined EISA 2007. 73 FR 43611. For gas-fired hot water boilers, oil-fired hot water boilers, and electric hot water boilers, EISA 2007 requires that residential boilers manufactured after September 2012 have an automatic means for adjusting water temperature. 10 CFR 430.32(e)(2)(ii)-(iv). The automatic means for adjusting water temperature must automatically adjust the water temperature of the water supplied by the boiler to ensure that an incremental change in the inferred heat load produces a corresponding incremental change in the temperature of the water supplied. EISA 2007 also disallows the use of constant-burning pilot lights in gas-fired hot water boilers and gas-fired steam boilers.

DOE initiated this rulemaking pursuant to 42 U.S.C. 6295(f)(4)(C), which requires DOE to conduct a second round of amended standards rulemaking for residential boilers. EPCA, as amended by EISA 2007, also requires that not later than 6 years after

issuance of any final rule establishing or amending a standard, DOE must publish either a notice of the determination that standards for the product do not need to be amended, or a notice of proposed rulemaking including new proposed energy conservation standards. (42 U.S.C. 6295(m)(1)) As noted above, DOE's last final rule for residential boilers was issued on July 15, 2008, so DOE must act by July 15, 2014. This rulemaking will satisfy both statutory provisions.

Furthermore, EISA 2007 amended EPCA to require that any new or amended energy conservation standard adopted after July 1, 2010, shall address standby mode and off mode energy use pursuant to 42 U.S.C. 6295(o). (42 U.S.C. 6295(gg)(3)) DOE will consider standby mode and off mode energy use as part of this rulemaking for residential boilers.

II. Current Status

In initiating this rulemaking, DOE prepared a Framework Document, "Energy Conservation Standards Rulemaking Framework Document for Residential Boilers," which describes the procedural and analytical approaches DOE anticipates using to evaluate energy conservation standards for residential boilers. DOE published a notice that announced both the availability of the Framework Document and a public meeting to discuss the proposed analytical framework for the rulemaking. That notice also invited

written comments from the public. 78 FR 9631 (Feb. 11, 2013). This document is available at: http://www.regulations.gov/#!docketDetail;D=EERE-2012-BT-STD-0047.

DOE held a public meeting on March 13, 2013, at which time it described the various analyses DOE would conduct as part of the rulemaking, such as the engineering analysis, the life-cycle cost (LCC) and payback period (PBP) analyses, and the national impact analysis (NIA). Representatives for manufacturers, trade associations, environmental and energy efficiency advocates, and other interested parties attended the meeting.

Comments received since publication of the Framework Document have helped DOE identify and resolve issues related to the analyses performed for this NODA. A discussion of these comments and DOE's responses is available at: http://www.regulations.gov/#!docketDetail;D=EERE-2012-BT-STD-0047 (see chapter 2 of the supporting documentation).

At this time, DOE is not proposing any amended energy conservation standards for residential boilers. DOE encourages stakeholders to provide any additional data or information that may improve DOE's analysis. DOE may revise the analysis presented in today's notice based on any new or updated information or data it obtains between now and the publication of a notice of proposed rulemaking (NOPR).

III. Summary of the Analysis Performed by DOE

This section provides a description of the analytical framework that DOE is using to evaluate potential amended energy conservation standards for residential boilers. This section sets forth the methodology, analytical tools, and relationships among the various analyses that are part of this rulemaking.

The analyses performed in preparation for this NODA are listed below.

- A market and technology assessment to characterize the relevant products, their markets, and technology options for improving their energy efficiency, including prototype designs.
- A screening analysis to review each technology option and determine if it is technologically feasible; is practicable to manufacture, install, and service; would adversely affect product utility or product availability; or would have adverse impacts on health and safety.
- An engineering analysis to develop relationships that show the manufacturer's cost of achieving increased efficiency.
- A markups analysis to develop distribution channel markups that relate the manufacturer selling price to the cost to the consumer.
- An energy use analysis to determine the annual energy use of the considered products in a representative set of users.
- A LCC and PBP analysis to calculate the anticipated savings in operating costs at the consumer level throughout the life of the covered products compared with any

increase in the installed cost for the products likely to result directly from standards.

- A shipments analysis to forecast product shipments, which are then used to calculate the national impacts of standards on energy, net present value (NPV), and future manufacturer cash flows.
- A national impact analysis (NIA) to assess the aggregate impacts at the national level of potential amended energy conservation standards for the considered products, as measured by the NPV of total consumer economic impacts and the national energy savings (NES).
- A preliminary manufacturer impact analysis (MIA) to assess the potential impacts of amended energy conservation standards on manufacturers' capital conversion expenditures, marketing costs, shipments, and research and development costs.

The tools used in preparing several of the above analyses (life-cycle cost and national impacts) are available at: http://www.regulations.gov/#!docketDetail;D=EERE-2012-BT-STD-0047. Each individual spreadsheet includes an introduction describing the various inputs and outputs to the analysis, as well as operation instructions. Details regarding the methods and data used in the analyses may be found at the same website.

The sections below present an overview of the analyses DOE has conducted for residential boilers. Using the methods described in this NODA, DOE calculated results

pertaining to potential amended energy efficiency standard levels for residential boilers. The results may be found at the same website.

A. Market and Technology Assessment

When DOE begins an energy conservation standards rulemaking, it develops information that provides an overall picture of the market for the products considered, including the nature of the products, market characteristics, and industry structure. This activity consists of both quantitative and qualitative efforts based primarily on publicly-available information. The market assessment examined manufacturers, trade associations, and the quantities and types of products offered for sale.

DOE reviewed relevant literature and interviewed manufacturers to develop an overall picture of the residential boiler industry in the United States. Industry publications and trade journals, government agencies, and trade organizations provided the bulk of the information, including: (1) manufacturers and their approximate market shares; (2) shipments by product type (e.g., gas-fired hot water, oil-fired hot water); (3) product information; and (4) industry trends.

DOE developed a list of technologically feasible design options for the considered products through consultation with manufacturers of components and systems, and from trade publications and technical papers. Since many options for improving product efficiency are available in existing units, product literature and direct examination provided additional information.

B. Screening Analysis

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

The screening analysis examines whether various technologies: (1) are technologically feasible; (2) are practicable to manufacture, install, and service; (3) have an adverse impact on product utility or availability; and (4) have adverse impacts on health and safety. If an answer to the first two criteria is "no," or an answer to the second two criteria is "yes," DOE will not consider that technology further. In consultation with interested parties, DOE reviewed the list of residential boiler technologies according to these criteria. In the engineering analysis, DOE further considers the efficiency-enhancement technologies that it did not eliminate in the screening analysis.

C. Engineering Analysis

The engineering analysis establishes the relationship between manufacturing production cost and efficiency levels for each residential boiler product class. This relationship serves as the basis for cost-benefit calculations in terms of individual consumers, manufacturers, and the Nation. To determine the cost to consumers of

residential boilers at various efficiency levels, DOE estimated manufacturing costs, markups in the distribution chain, installation costs, and maintenance costs.

DOE typically structures its engineering analysis around one of three methodologies: (1) the design-option approach, which calculates the incremental costs of adding specific design options to a baseline model; (2) the efficiency-level approach, which calculates the relative costs of achieving increases in energy efficiency levels without regard to the particular design options used to achieve such increases; and/or (3) the reverse-engineering or cost-assessment approach, which involves a "bottom-up" manufacturing cost assessment based on a detailed bill of materials derived from tear-downs of the equipment being analyzed.

For this analysis, DOE conducted the engineering analysis for residential boilers using a combination of the efficiency level and cost-assessment approaches for analysis of various energy efficiency levels. More specifically, DOE identified the efficiency levels for analysis and then used the cost-assessment approach to determine the manufacturing costs at those levels. This approach involved physically disassembling commercially-available products, consulting with outside experts, reviewing publicly-available cost and performance information, and modeling equipment cost.

D. Markups Analysis

DOE uses manufacturer-to-customer markups (*e.g.*, manufacturer markups, retailer markups, distributors markups, contractor markups (where appropriate), and sales taxes) to convert the manufacturer selling price estimates from the engineering analysis to customer prices, which are then used in the LCC and PBP analysis and in the manufacturer impact analysis.

Before developing markups, DOE defines key market participants and identifies distribution channels. DOE used three types of distribution channels to describe how most residential boilers pass from the manufacturer to the consumer: (1) replacement market; (2) new construction, and (3) national accounts.[3]

After defining the participants and channels, DOE also determined the existence and magnitude of differences between markups for baseline products (baseline markups) and higher-efficiency products (incremental markups), in order to transform the manufacturer selling price into a consumer product price. The development of the markups relied on data from both government and industry sources. DOE uses the baseline markups, which cover all of a distributor's or contractor's costs, to determine the sales price of baseline models. Incremental markups are coefficients that DOE applies to the incremental cost of higher-efficiency models. Because companies mark up the price

[3] The national accounts channel is an exception to the usual distribution channel that is only applicable to those residential boilers installed in the small to mid-size commercial buildings where the on-site contractor staff purchase equipment directly from the wholesalers at lower prices due to the large volume of equipment purchased, and perform the installation themselves.

at each point in the distribution channel, both baseline and incremental markups are dependent on the particular distribution channel.

E. Energy Use Analysis

The energy use analysis determines the annual energy consumption of residential boilers used in representative U.S. single-family homes, multi-family residences, and commercial buildings, and assesses the energy savings potential of increased boiler efficiency. DOE estimated the annual energy consumption of residential boilers at specified energy efficiency levels across a range of climate zones, building characteristics, and heating applications. The annual energy consumption includes the natural gas, liquid petroleum gas (LPG), oil, and/or electricity use by the boiler for space and water heating. The annual energy consumption of residential boilers is used in subsequent analyses, including the LCC and PBP analysis and the NIA.

For the residential sector, DOE consulted the Energy Information Administration's (EIA) 2009 Residential Energy Consumption Survey (RECS 2009) to establish a sample of households using residential boilers for each boiler product class.[4] The RECS data provide information on the vintage of the home, as well as heating energy use in each household. DOE used the household samples not only to determine boiler annual energy consumption, but also as the basis for conducting the LCC and PBP analysis. DOE

[4] U.S. Department of Energy: Energy Information Administration, Residential Energy Consumption Survey: 2009 RECS Survey Data (2013) (Available at: <http://www.eia.gov/consumption/residential/data/2009/>) (Last accessed March, 2013).

projected household weights and household characteristics in 2020, the expected compliance date of any amended energy conservation standards for residential boilers.

DOE accounted for applications of residential boilers in multi-family housing and commercial buildings because the intent of the analysis of consumer impacts is to capture the full range of usage conditions for these products. DOE considered that the definition of "residential boiler" is limited only by its capacity and not by the application type. DOE determined that these applications represent about 14 percent of the residential gas-fired boiler market and 11 percent of the residential oil-fired boiler market.

For the commercial building sample, DOE used the EIA's 2003 Commercial Building Energy Consumption Survey[5] (CBECS 2003) to establish a sample of commercial buildings using residential boilers for each boiler product class. Criteria were developed to help size these boilers using several variables, including building square footage and estimated supply water temperature. For boilers used in multi-family housing, DOE used the RECS 2009 sample discussed above, accounting for situations where more than one residential boiler is used to heat a building.

To estimate the annual energy consumption of boilers meeting higher efficiency levels, DOE first calculated the heating load based on the RECS and CBECS estimates of

[5] U.S. Department of Energy: Energy Information Administration, Commercial Buildings Energy Consumption Survey (2003) (Available at: <http://www.eia.gov/consumption/commercial/data/2003/index.cfm?view=microdata>) (Last accessed November, 2013).

the annual energy consumption of the boiler for each household. DOE estimated the house heating load by reference to the existing boiler's characteristics, specifically its capacity and efficiency (AFUE), as well as by the heat generated from the electrical components. The AFUE of the existing boilers was determined using the boiler vintage (the year of installation of the equipment) from RECS and historical data on the market share of boilers by AFUE. DOE then used the house heating load to determine the burner operating hours, which are needed to calculate the fossil fuel consumption and electricity consumption based on the DOE residential furnace and boiler test procedure. To calculate pump and other auxiliary components' electricity consumption, DOE utilized data from manufacturer product literature.

Additionally, DOE adjusted the energy use to normalize for weather by using long-term heating degree-day data for each geographical region.[6] DOE also accounted for change in building shell characteristics between 2009 and 2020 by applying the building shell efficiency indexes in the National Energy Modeling System (NEMS) based on EIA's Annual Energy Outlook 2013 (AEO 2013).[7]

DOE is aware that some residential boilers have the ability to provide both space heating and domestic water heating and that these products are widely available and may vary greatly in design. For these applications, DOE accounted for the boiler energy used

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[6] National Oceanic and Atmospheric Administration, NNDC Climate Data Online (Available at: http://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp) (Last accessed March 15, 2013).

[7] U.S. Department of Energy-Energy Information Administration, Annual Energy Outlook 2013 with Projections to 2040 (Available at: <http://www.eia.gov/forecasts/aeo/>).

for domestic water heating, which is part of the total annual boiler energy use. To accomplish this, DOE used the RECS 2009 and/or CBECS data to identify those boiler households or buildings that use the same fuel type for space and water heating and then assumed that a fraction of these identified households/buildings used the boiler for both applications.

To calculate the annual water-heating energy use for each boiler efficiency level, DOE first calculated the water-heating load by multiplying the annual fuel consumption for water heating (derived from RECS or CBECS) by the AFUE of the existing boiler, adjusted for the difference between AFUE and recovery efficiency for water heating. DOE then calculated the boiler energy use for each efficiency level by multiplying the water-heating load by the AFUE of the selected efficiency level, adjusted for the difference between AFUE and recovery efficiency for water heating.

The Department calculated boiler electricity consumption for the circulating pump, the draft inducer,[8] and the ignition system. If a household required a condensate pump, which is sometimes installed with higher-efficiency equipment, DOE assumed that the pump consumes 60 watts and operated at the same time as the burner. For single-stage boilers, the Department calculated the electricity consumption as the sum of the electrical energy used during boiler operation for both space heating, water heating, and standby

[8] In the case of modulating condensing boilers, to accommodate lower firing rates, the inducer will provide lower combustion airflow to regulate the excess air in the combustion process. DOE assumed that modulating condensing boilers are equipped with inducer fans with PSC motors and two-stage controls. The inducers are assumed to run at a 70-percent airflow rate when the modulating unit operates at low-fire.

energy consumption. For two-stage and modulating equipment, this formula includes parameters for the operation at full, modulating, and reduced load.

The Department calculated boiler standby mode and off mode electricity consumption for times when the boiler is not in use.

A rebound effect occurs when a more-efficient piece of equipment is used more intensively, such that the expected energy savings from the efficiency improvement may not be fully realized. DOE conducted a review of information that included a 2009 study examining empirical estimates of the rebound effect for various energy-using products.[9] Based on this review, DOE has tentatively concluded that the inclusion of a rebound effect of 20 percent for residential boilers is warranted for this analysis. DOE incorporates this effect in the NIA.

F. Life-Cycle Cost and Payback Period Analysis

In determining whether an energy efficiency standard is economically justified, DOE considers the economic impact of potential standards on consumers. The effect of new or amended standards on individual consumers usually includes a reduction in operating cost and an increase in purchase cost. DOE used the following two metrics to measure consumer impacts:

[9] S. Sorrell, J. D., and M. Sommerville, "Empirical estimates of the direct rebound effect: a review," Energy Policy (2009) 37: pp. 1356–71.

- LCC (life-cycle cost) is the total consumer cost of an appliance or product, generally over the life of the appliance or product, including purchase and operating costs. The latter consist of maintenance, repair, and energy costs. Future operating costs are discounted to the time of purchase and summed over the lifetime of the appliance or product.
- PBP (payback period) measures the amount of time it takes consumers to recover the assumed higher purchase price of a more energy-efficient product through reduced operating costs.

DOE analyzed the net effect of potential amended boiler standards on consumers by calculating the LCC and PBP using the engineering performance data, the energy-use data, and the markups. Inputs to the LCC calculation include the installed cost to the consumer (purchase price, including sales tax where appropriate, plus installation cost), operating expenses (energy expenses, repair costs, and maintenance costs), the lifetime of the product, and a discount rate. Inputs to the payback period calculation include the installed cost to the consumer and first-year operating costs.

DOE performed the LCC and PBP analyses using a spreadsheet model combined with Crystal Ball (a commercially-available software program used to conduct stochastic analysis using Monte Carlo simulation and probability distributions) to account for uncertainty and variability among the input variables. Each Monte Carlo simulation consists of 10,000 LCC and PBP calculations using input values that are either sampled from probability distributions and household samples or characterized with single point

values. The analytical results include a distribution of 10,000 data points showing the range of LCC savings and PBPs for a given efficiency level relative to the base case efficiency forecast. In performing an iteration of the Monte Carlo simulation for a given consumer, product efficiency is chosen based on its probability. If the chosen product efficiency is greater than or equal to the efficiency of the standard level under consideration, the LCC and PBP calculation reveals that a consumer is not impacted by the standard level. By accounting for consumers who already purchase more-efficient products, DOE avoids overstating the potential benefits from increasing product efficiency.

1. Inputs to Installed Cost

The total installed cost to the consumer is the sum of the product price, including sales tax where appropriate, and installation cost (labor and materials cost).

DOE estimated the costs associated with installing a boiler in a new housing unit or as a replacement for an existing boiler. Installation costs account for labor and material costs and any additional costs, such as venting and piping modifications and condensate disposal that might be required when installing equipment at various efficiency levels.

For replacement installations, DOE included a number of additional costs ("adders") for a fraction of the sample households. For non-condensing boilers, these additional costs may account for updating of flue vent connectors, vent resizing, chimney

relining, and, for a fraction of installations, the costs for a stainless steel vent. For condensing boilers, these additional costs included adding a new flue vent (polyvinylchloride (PVC)), combustion air venting for direct vent installations (PVC), concealing vent pipes for indoor installations, addressing an orphaned water heater (by updating flue vent connectors, vent resizing, or chimney relining), and condensate removal.

DOE also included installation adders for new construction installations. For non-condensing boilers, the only adder is a new flue vent (metal, including a fraction with stainless steel venting). For condensing gas boilers, the adders include a new flue vent (PVC), combustion air venting for direct vent installations (PVC), accounting for a commonly vented water heater, and condensate removal.

With regards to all near-condensing boiler installations, DOE has accounted for the installation costs of the "near-condensing" products by considering the additional cost of using stainless steel venting.

2. Inputs to Operating Cost

The calculation of energy costs at each considered efficiency level makes use of the annual energy use derived in the energy use analysis, along with appropriate energy prices. DOE assigned an appropriate energy price to each household or commercial building in the sample, depending on its location. For future prices, DOE used the

projected annual changes in average residential and commercial natural gas, LPG, electricity, and fuel oil prices in AEO 2013.[10]

DOE estimated maintenance and repair costs for residential boilers at each considered efficiency level using a variety of sources, including 2013 RS Means,[11] manufacturer literature, and information from expert consultants. DOE estimated the frequency of annual maintenance using data from a proprietary consumer survey.[12] DOE also accounted for the difference in the maintenance practices for the oil boiler market and the gas boiler market.

Product lifetime is the age at which an appliance is retired from service. DOE conducted an analysis of boiler lifetimes using a combination of shipments data, the boiler stock, and RECS data on the age of the boilers in the homes. The data allowed DOE to develop a survival function, which provides an average and a median appliance lifetime. In addition, DOE reviewed a number of sources to validate the derived boiler lifetime, including research studies (from the U.S. and Europe) and field data reports.

DOE used discount rates to determine the present value of lifetime operating expenses. The discount rate used in the LCC analysis represents the rate from an individual consumer's perspective. Much of the data used for determining consumer

[10] DOE plans to use the Annual Energy Outlook 2014 when it becomes available.
[11] RS Means Company Inc., RS Means Facilities Maintenance & Repair Cost Data (2013).
[12] Decision Analysts, *2008 American Home Comfort Study: Online Database Tool* (2009) (Available at: <http://www.decisionanalyst.com/Syndicated/HomeComfort.dai>).

discount rates comes from the Federal Reserve Board's triennial Survey of Consumer Finances.[13]

3. Base-Case Distributions by Efficiency Levels

To estimate the share of consumers affected by a potential standard at a particular efficiency level, DOE's LCC and PBP analysis considers the projected distribution (i.e., market shares) of product efficiencies that consumers will purchase in the first compliance year under the base case (the case without amended energy conservation standards).

DOE accounted for the increasing market share of condensing residential gas boilers in its base-case projection. DOE's projection used available data on recent market trends in boiler efficiency and takes into account the potential impacts of the ENERGY STAR program and other policies that may affect the demand for more-efficient boilers. DOE estimated the market shares of the efficiency levels in each product class in 2020 using data on the share of models in each product class that are of different designs, based on the AHRI certification directory.[14]

G. Shipments Analysis

DOE used forecasts of product shipments to calculate the national impacts of

[13] Available at www.federalreserve.gov/econresdata/scf/scfindex.htm.
[14] Air Conditioning Heating and Refrigeration Institute, Consumer's Directory of Certified Efficiency Ratings for Heating and Water Heating Equipment (AHRI Directory September 2013) (Available at: http://www.ahridirectory.org/ahridirectory/pages/home.aspx) (Last accessed September, 2013).

potential amended energy conservation standards on energy use, NPV, and future manufacturer cash flows. A discussion of the shipments forecast methodology and the sources used is available at: http://www.regulations.gov/#!docketDetail;D=EERE-2012-BT-STD-0047 (see chapter 9 of the supporting documentation). DOE estimated boiler shipments by projecting shipments in three market segments: (1) replacements; (2) new housing; and (3) new owners in buildings that did not previously have a boiler. DOE also considered whether standards that require more-efficient boilers would have an impact on boiler shipments.

To project boiler replacement shipments, DOE developed retirement functions for boilers from the lifetime estimates and applied them to the existing products in the housing stock. The existing stock of products is tracked by vintage and developed from historical shipments data.[15,16]

To project shipments to the new housing market, DOE utilized a forecast of new housing construction and historic saturation rates of boiler product types in new housing. DOE used AEO 2013 for forecasts of new housing. Boiler saturation rates in new housing are provided by the U.S. Census Bureau's Characteristics of New Housing.[17]

[15] U.S. Appliance Industry Statistical Review, *Appliance Magazine*, various years.
[16] Air-Conditioning, Heating, and Refrigeration Institute (AHRI), Confidential Shipment data for 2003-2012.
[17] Available at: http://www.census.gov/const/www/charindex.html.

To estimate future shipments to new owners, DOE determined that a fraction of residential boiler shipments are to new owners with no previous boiler based on a proprietary consumer survey.[18] DOE also accounted for potential switching between different boiler product classes (steam to hot water and oil to gas).

To estimate the impact of the projected price increase for the considered efficiency levels, DOE used a relative price elasticity approach. This approach gives some weight to the operating cost savings from higher-efficiency products. The impact of higher boiler prices (at higher efficiency levels) is expressed as a percentage drop in market share for each year during the analysis period.

Additional details regarding the shipments analysis can be found in worksheet "NODA Results" of the NIA Spreadsheet.

H. National Impact Analysis

The NIA assesses the national energy savings (NES) and the net present value (NPV) from a national perspective of total consumer costs and savings expected to result from new or amended energy conservation standards at specific efficiency levels. DOE determined the NPV and NES for the efficiency levels considered for the boiler product classes analyzed. To make the analysis more accessible and transparent to all interested

[18] Decision Analysts, *2008 American Home Comfort Study: Online Database Tool* (2009) (Available at: <http://www.decisionanalyst.com/Syndicated/HomeComfort.dai>).

parties, DOE prepared a computer spreadsheet that uses typical values (as opposed to probability distributions) as inputs.

Analyzing impacts of potential energy conservation standards for residential boilers requires comparing projections of U.S. energy consumption with amended energy conservation standards against projections of energy consumption without amended standards. The forecasts include projections of annual appliance shipments, the annual energy consumption of new appliances, and the purchase price of new appliances.

A key component of DOE's NIA is the energy efficiencies forecasted over time for the base case (without new standards) and each of the standards cases. DOE developed a distribution of efficiencies in the base case for 2020 (the year of anticipated compliance with an amended standard) for each residential boiler product class. Details can be found in worksheet "NODA Results" of the NIA spreadsheet. In each standards case, a "roll-up" scenario approach was applied to establish the efficiency distribution for 2020. Under the "roll-up" scenario, DOE assumed that product efficiencies in the base case that do not meet the standard level under consideration would "roll-up" to meet the new standard level, and product efficiencies above the standard level under consideration would not be affected.

Regarding the efficiency trend in the years after compliance, for the base case, DOE estimated that the overall market share of condensing gas-fired and oil-fired hot

water boilers would grow. DOE assumed a similar trend for the standards cases. Details on these efficiency trends are in worksheet "NODA Results" of the NIA spreadsheet.

The inputs for determining the national energy savings for each product analyzed are: (1) annual energy consumption per unit; (2) shipments; (3) product stock; (4) national energy consumption; and (5) site-to-source conversion factors. DOE calculated the annual national energy consumption by multiplying the number of units (stock) of each product (by vintage or age) by the unit energy consumption (also by vintage). DOE calculated annual NES based on the difference in national energy consumption under the base case (without new or amended efficiency standards) and under each higher efficiency standard. DOE estimated energy consumption and savings based on site energy and converted the electricity consumption and savings to source (primary) energy using annual conversion factors derived from the most recent version of NEMS. Cumulative energy savings are the sum of annual NES over the timeframe of the analysis.

DOE has historically presented NES in terms of primary energy savings. In response to the recommendations of a committee on "Point-of-Use and Full-Fuel-Cycle Measurement Approaches to Energy Efficiency Standards" appointed by the National Academy of Science, DOE announced its intention to use full-fuel-cycle (FFC) measures of energy use and greenhouse gas and other emissions in the national impact analyses and emissions analyses included in future energy conservation standards rulemakings. 76 FR

51281 (August 18, 2011). After evaluating the approaches discussed in the August 18, 2011 notice, DOE published a statement of amended policy in the Federal Register in which DOE explained its determination that NEMS is the most appropriate tool for its FFC analysis and its intention to use NEMS for that purpose. 77 FR 49701 (August 17, 2012). For this analysis, DOE calculated FFC energy savings using a NEMS-based methodology.

The inputs for determining NPV are: (1) total annual installed cost; (2) total annual savings in operating costs; (3) a discount factor to calculate the present value of costs and savings; (4) present value of costs; and (5) present value of savings. DOE determined the net savings for each year as the difference between the base case and each standards case in terms of the total savings in operating costs and total increases in installed costs. DOE calculated NPV as the difference between the present value of operating cost savings and the present value of total installed costs over the lifetime of products shipped in the forecast period. DOE estimates the NPV of consumer benefits using both a 3-percent and a 7-percent real discount rate. DOE uses these discount rates in accordance with guidance provided by the Office of Management and Budget (OMB) to Federal agencies on the development of regulatory analysis. (OMB Circular A-4 (Sept. 17, 2003), section E, "Identifying and Measuring Benefits and Costs")

DOE used EIA's Annual Energy Outlook (AEO 2013) as the source of projections for future energy prices.

I. Preliminary Manufacturer Impact Analysis

In the NOPR phase, DOE will perform a manufacturer impact analysis (MIA) to estimate the financial impact of potential amended energy conservation standards on residential boiler manufacturers, as well as to calculate the impact of such standards on employment and manufacturing capacity.

DOE recognizes that while any one regulation may not impose a significant burden on manufacturers, the combined effects of several impending regulations may have serious consequences for some manufacturers, groups of manufacturers, or an entire industry. Assessing the impact of a single regulation may overlook this cumulative regulatory burden. As a preliminary step to conducting the MIA, as part of this NODA analysis, DOE assessed the cumulative regulatory burden by identifying and characterizing other significant product-specific regulations that could affect residential boiler manufacturers. DOE identified the following regulations relevant to residential boiler manufactures including: DOE energy efficiency standards, ENERGY STAR, and local (State and regional) NO_X requirements.

IV. Public Participation

DOE is interested in receiving comments on all aspects of the data and analysis presented in the NODA and supporting documentation that can be found at: http://www.regulations.gov/#!docketDetail;D=EERE-2012-BT-STD-0047

A. Submission of Comments

DOE will accept comments, data, and information regarding this notice no later than the date provided in the **DATES** section at the beginning of this notice. Interested parties may submit comments, data, and other information using any of the methods described in the **ADDRESSES** section at the beginning of this notice.

Submitting comments via www.regulations.gov. The www.regulations.gov webpage will require you to provide your name and contact information. Your contact information will be viewable to DOE Building Technologies staff only. Your contact information will not be publicly viewable except for your first and last names, organization name (if any), and submitter representative name (if any). If your comment is not processed properly because of technical difficulties, DOE will use this information to contact you. If DOE cannot read your comment due to technical difficulties and cannot contact you for clarification, DOE may not be able to consider your comment.

However, your contact information will be publicly viewable if you include it in the comment itself or in any documents attached to your comment. Any information that you do not want to be publicly viewable should not be included in your comment, nor in any document attached to your comment. Otherwise, persons viewing comments will see only first and last names, organization names, correspondence containing comments, and any documents submitted with the comments.

Do not submit to www.regulations.gov information for which disclosure is restricted by statute, such as trade secrets and commercial or financial information (hereinafter referred to as Confidential Business Information (CBI)). Comments submitted through www.regulations.gov cannot be claimed as CBI. Comments received through the website will waive any CBI claims for the information submitted. For information on submitting CBI, see the Confidential Business Information section below.

DOE processes submissions made through www.regulations.gov before posting. Normally, comments will be posted within a few days of being submitted. However, if large volumes of comments are being processed simultaneously, your comment may not be viewable for up to several weeks. Please keep the comment tracking number that www.regulations.gov provides after you have successfully uploaded your comment.

Submitting comments via email, hand delivery/courier, or mail. Comments and documents submitted via email, hand delivery, or mail also will be posted to www.regulations.gov. If you do not want your personal contact information to be publicly viewable, do not include it in your comment or any accompanying documents. Instead, provide your contact information in a cover letter. Include your first and last names, email address, telephone number, and optional mailing address. The cover letter will not be publicly viewable as long as it does not include any comments

Include contact information each time you submit comments, data, documents, and other information to DOE. If you submit via mail or hand delivery/courier, please

provide all items on a CD, if feasible, in which case it is not necessary to submit printed copies. No facsimiles (faxes) will be accepted.

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

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

Confidential Business Information. Pursuant to 10 CFR 1004.11, any person submitting information that he or she believes to be confidential and exempt by law from public disclosure should submit two well-marked copies: one copy of the document marked "confidential" including all the information believed to be confidential, and one copy of the document marked "non-confidential" with the information believed to be confidential deleted. DOE will make its own determination about the confidential status of the information and treat it according to its determination.

Factors of interest to DOE when evaluating requests to treat submitted information as confidential include: (1) A description of the items; (2) whether and why such items are customarily treated as confidential within the industry; (3) whether the information is generally known by or available from other sources; (4) whether the information has previously been made available to others without obligation concerning its confidentiality; (5) an explanation of the competitive injury to the submitting person which would result from public disclosure; (6) when such information might lose its confidential character due to the passage of time; and (7) why disclosure of the information would be contrary to the public interest.

It is DOE's policy that all comments may be included in the public docket, without change and as received, including any personal information provided in the comments (except information deemed to be exempt from public disclosure).

Issued in Washington, DC, on January 31, 2014.

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