DEPARTMENT OF ENERGY

10 CFR Part 431

[Docket No. EERE–2008–BT–STD–0013]

RIN 1904–AB83

Energy Conservation Program for Certain Industrial Equipment: Energy Conservation Standards and Test Procedures for Commercial Heating, Air-Conditioning, and Water-Heating Equipment

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

ACTION: Notice of proposed rulemaking and public meeting.

SUMMARY: The Energy Policy and Conservation Act of 1975 (EPCA), as amended, directs the U.S. Department of Energy (DOE) to establish energy conservation standards for certain commercial and industrial equipment, including commercial heating, air-conditioning, and water-heating equipment. Of particular relevance here, the statute also requires that each time the corresponding industry standard—the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE)/Illuminating Engineering Society of North America (IESNA) Standard 90.1—is amended, DOE must assess whether there is a need to update the uniform national energy conservation standards for the same equipment covered under EPCA. ASHRAE officially released an amended version of this industry standard (ASHRAE Standard 90.1–2007) on January 10, 2008, thereby triggering DOE's related obligations under EPCA. Specifically, pursuant to EPCA, DOE assessed whether the revised ASHRAE efficiency levels are more stringent than the existing Federal energy conservation standards; and for those equipment classes for which ASHRAE set more-stringent efficiency levels (*i.e.*, commercial packaged boilers), analyzed the economic and energy savings potential of amended national energy conservation standards (at both the new ASHRAE Standard 90.1 levels and more-stringent efficiency levels).

DOE has tentatively concluded that the statutory criteria have been met for commercial packaged boilers and water-cooled and evaporatively-cooled commercial package air conditioners and heat pumps with a cooling capacity at or above 240,000 Btu/h and less than 760,000 Btu/h, thereby justifying consideration of national energy conservation standards set at the revised levels in ASHRAE Standard 90.1–2007.

Furthermore, DOE has tentatively concluded that clear and convincing evidence does not exist, as would justify more-stringent standard levels than the efficiency levels in ASHRAE Standard 90.1–2007 for commercial packaged boilers. DOE has also tentatively concluded that there are no water-cooled and evaporatively-cooled commercial package air conditioners and heat pumps with a cooling capacity at or above 240,000 Btu/h and less than 760,000 Btu/h being currently manufactured, and therefore, it is not possible to assess the economic and energy savings potential for adopting efficiency levels at or above the ASHRAE Standard 90.1–2007 efficiency levels for such equipment. Accordingly, in this notice, DOE is proposing to amend the energy conservation standards for commercial packaged boilers and to adopt a new energy conservation standard for water-cooled and evaporatively-cooled commercial package air conditioners and heat pumps with a cooling capacity at or above 240,000 Btu/h and less than 760,000 Btu/h at the efficiency levels specified by ASHRAE Standard 90.1–2007. DOE is also proposing related amendments to its test procedures for commercial packaged boilers. In addition, DOE is announcing a public meeting to receive comment on its proposal and related issues.

DATES: DOE will hold a public meeting on April 7, 2009, from 9 a.m. to 4 p.m., in Washington, DC. DOE must receive requests to speak at the public meeting before 4 p.m., March 24, 2009. DOE must receive a signed original and an electronic copy of statements to be made at the public meeting before 4 p.m., March 31, 2009.

DOE will accept comments, data, and information regarding the notice of proposed rulemaking (NOPR) before and after the public meeting, but no later than June 3, 2009. See section VII, ''Public Participation,'' of this NOPR for details.

ADDRESSES: The public meeting will be held at the U.S. Department of Energy, Forrestal Building, Room 8E–089, 1000 Independence Avenue, SW., Washington, DC. Please note that foreign nationals visiting DOE Headquarters are subject to advance security screening procedures. If you are a foreign national and wish to participate in the public meeting, please inform DOE as soon as possible by contacting Ms. Brenda Edwards at (202) 586–2945 so that the necessary procedures can be completed.

Any comments submitted must identify the NOPR for Energy Conservation Standards and Test Procedures for ASHRAE Standard 90.1 Products, and provide the docket number EERE–2008–BT–STD–0013 and/or Regulatory Information Number (RIN) 1904–AB83. Comments may be submitted using any of the following methods:

- *Federal eRulemaking Portal: http://www.regulations.gov*. Follow the instructions for submitting comments.
- *E-mail: ASHRAE_90.1_rulemaking@ee.doe.gov*. Include the docket number EERE–2008–BT–STD–0013 and/or RIN 1904–AB83 in the subject line of the message.
- *Postal Mail:* Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Program, Mailstop EE–2J, 1000 Independence Avenue, SW., Washington, DC 20585–0121. Please submit one signed paper original.
- *Hand Delivery/Courier:* Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Program, 950 L'Enfant Plaza, 6th Floor, Washington, DC 20024. Telephone: (202) 586–2945. Please submit one signed paper original.

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

Docket: For access to the docket to read background documents or comments received, visit the U.S. Department of Energy, Resource Room of the Building Technologies Program, 950 L'Enfant Plaza, SW., 6th Floor, Washington, DC 20024, (202) 586–2945, between 9 a.m. and 4 p.m., Monday through Friday, except Federal holidays. Please call Ms. Brenda Edwards at the above telephone number for additional information regarding visiting the Resource Room.

FOR FURTHER INFORMATION CONTACT: Mr. Mohammed Khan, 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) 586–7892. E-mail: *Mohammed.Khan@ee.doe.gov*.

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

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I. Summary of Proposed Rule

The Energy Policy and Conservation Act (EPCA) (42 U.S.C. 6291 *et seq.*), as amended, requires DOE to consider amending the existing Federal energy conservation standard for each type of equipment listed (generally, commercial water heaters, commercial packaged boilers, commercial air conditioning and heating equipment, and packaged terminal air conditioners and heat pumps), each time ASHRAE Standard 90.1, *Energy Standard for Buildings Except Low-Rise Residential Buildings*, is amended with respect to such equipment. (42 U.S.C. 6313(a)(6)(A)) For each type of equipment, EPCA directs that if ASHRAE Standard 90.1 is amended,[1] DOE must adopt amended energy conservation standards at the new efficiency level in ASHRAE Standard 90.1, unless clear and convincing evidence supports a determination that adoption of a more-stringent efficiency level as a national

[1] Although EPCA does not explicitly define the term ''amended'' in the context of ASHRAE Standard 90.1, DOE provided its interpretation of what would constitute an ''amended standard'' in a final rule published in the **Federal Register** on March 7, 2007 (hereafter referred to as the March 2007 final rule). 72 FR 10038. In that rule, DOE stated that the statutory trigger requiring DOE to adopt uniform national standards based on ASHRAE action is for ASHRAE to change a standard for any of the equipment listed in EPCA section 342(a)(6)(A)(i) (42 U.S.C. 6313(a)(6)(A)(i)) by increasing the energy efficiency level for that equipment type. *Id.* at 10042. In other words, if the revised ASHRAE Standard 90.1 leaves the standard level unchanged or lowers the standard, as compared to the level specified by the national standard adopted pursuant to EPCA, DOE does not have the authority to conduct a rulemaking to consider a higher standard for that equipment pursuant to 42 U.S.C. 6313(a)(6)(A).

standard would produce significant additional energy savings and be technologically feasible and economically justified. (42 U.S.C. 6313(a)(6)(A)(ii)) If DOE decides to adopt as a national standard the efficiency levels specified in the amended ASHRAE Standard 90.1, DOE must establish such standard not later than 18 months after publication of the amended industry standard. (42 U.S.C. 6313(a)(6)(A)(ii)(I)) If DOE determines that a more-stringent standard is appropriate, DOE must establish an amended standard not later than 30 months after publication of the revised ASHRAE Standard 90.1. (42 U.S.C. 6313(a)(6)(B))

This NOPR sets forth DOE's determination of scope for consideration of amended energy conservation standards with respect to certain heating, ventilating, air-conditioning, and water-heating equipment addressed in ASHRAE Standard 90.1–2007. Such inquiry is necessary to ascertain whether the revised ASHRAE efficiency levels have become more stringent, thereby ensuring that any new amended national standard would not result in ''backsliding'' which is prohibited under 42 U.S.C. 6295(o)(1) and 42 U.S.C. 6316(a). For those equipment classes for which ASHRAE set more-stringent efficiency levels (*i.e.*, commercial packaged boilers), DOE analyzed the economic and energy savings potential of amended national energy conservation standards (at both the new ASHRAE Standard 90.1 efficiency levels and more-stringent efficiency levels). DOE also found that ASHRAE set a more-stringent efficiency level for water-cooled and evaporatively-cooled commercial package air conditioners and heat pumps with a cooling capacity at or above 240,000 Btu/h and less than 760,000 Btu/h. However, DOE did not analyze the economic and energy savings potential of amended national energy conservation standards because there is no equipment currently being manufactured in this equipment class.

In light of the above, DOE has tentatively concluded that for ten classes of commercial packaged boilers: (1) The revised efficiency levels in ASHRAE 90.1–2007 [2] are more stringent than current national standards; and (2) their adoption as national standards would result in significant energy savings. DOE has also tentatively concluded that there is not clear and convincing evidence as would justify adoption of more-stringent efficiency levels for this equipment.

Thus, in accordance with these criteria discussed in this notice, DOE is proposing to amend the energy conservation standards for ten equipment classes of commercial packaged boilers and to adopt a new energy conservation standard for water-cooled and evaporatively-cooled commercial package air conditioners and heat pumps with a cooling capacity at or above 240,000 Btu/h and less than 760,000 Btu/h by adopting the efficiency levels specified by ASHRAE Standard 90.1–2007. The proposed standards for commercial packaged boilers would apply to the ten equipment classes of commercial packaged boilers manufactured on or after the date two years after the effective date specified in ASHRAE Standard 90.1–2007. (42 U.S.C. 6313(a)(6)(D)(i)) The proposed standards for water-cooled and evaporatively-cooled commercial package air conditioners and heat pumps with a cooling capacity at or above 240,000 Btu/h and less than 760,000 Btu/h would apply to such equipment manufactured on or after the date three years after the effective date specified in ASHRAE Standard 90.1–2007. (42 U.S.C. 6313(a)(6)(D)(ii))

In addition, DOE is proposing amendments to its test procedures for commercial packaged boilers, which manufacturers are required to use to certify compliance with energy conservation standards mandated under EPCA. Specifically, these amendments would update the citations and references to the most recent version of the industry standards already referenced in DOE's test procedures. In addition, these amendments would specify a definition and methodology to test the thermal efficiency of these boilers, which is the metric DOE is proposing for eight of the ten equipment classes of commercial packaged boilers to conform with the new energy efficiency metric adopted in ASHRAE Standard 90.1–2007. Lastly, these amendments would make a small number of technical modifications to DOE's existing test procedure for commercial packaged boilers.

II. Introduction

A. Authority

Title III of EPCA, Public Law 94–163, as amended, sets forth a variety of provisions concerning energy efficiency. Part A–1 [3] of Title III created the energy conservation program for certain industrial equipment. (42 U.S.C. 6311–6317) In general, this program addresses the energy efficiency of certain types of commercial and industrial equipment. Part A–1 specifically includes definitions (42 U.S.C. 6311), energy conservation standards (42 U.S.C. 6313), test procedures (42 U.S.C. 6314), labelling provisions (42 U.S.C. 6315), and the authority to require information and reports from manufacturers (42 U.S.C. 6316).

EPCA contains mandatory energy conservation standards for commercial heating, air-conditioning, and water-heating equipment. (42 U.S.C. 6313(a)) Specifically, the statute sets standards for small, large, and very large commercial package air-conditioning and heating equipment, packaged terminal air conditioners (PTACs) and packaged terminal heat pumps (PTHPs), warm air furnaces, packaged boilers, storage water heaters, and unfired hot water storage tanks. *Id.* In doing so, EPCA established Federal energy conservation standards that generally correspond to the levels in ASHRAE Standard 90.1, as in effect on October 24, 1992 (*i.e.*, ASHRAE Standard 90.1–1989), for each type of covered equipment listed in 42 U.S.C. 6313(a).

In acknowledgement of technological changes that yield energy efficiency benefits, Congress further directed DOE through EPCA to consider amending the existing Federal energy conservation standard for each type of equipment listed, each time ASHRAE Standard 90.1 is amended with respect to such equipment. (42 U.S.C. 6313(a)(6)(A)) For each type of equipment, EPCA directs that if ASHRAE Standard 90.1 is amended, DOE must adopt amended standards at the new efficiency level in ASHRAE Standard 90.1, unless clear and convincing evidence supports a determination that adoption of a more stringent level would produce significant additional energy savings and be technologically feasible and economically justified. (42 U.S.C. 6313(a)(6)(A)(ii)) If DOE decides to adopt as a national standard the efficiency levels specified in the amended ASHRAE Standard 90.1, DOE must establish such standard not later than 18 months after publication of the amended industry standard. (42 U.S.C. 6313(a)(6)(A)(ii)(I)) However, if DOE determines that a more-stringent standard is justified under 42 U.S.C. 6313(a)(6)(A)(ii)(II), then it must

[2] To obtain a copy of ASHRAE Standard 90.1–2007, visit *http://www.ashrae.org/technology/page/548* or contact the ASHRAE publications department by e-mail at *orders@ashrae.org* or by telephone at (800) 527–4723.

[3] This part was originally titled Part C; however, it was redesignated Part A–1 after Part C of Title III of EPCA was repealed by Public Law 109–58.

establish such more-stringent standard not later than 30 months after publication of the amended ASHRAE Standard 90.1. (42 U.S.C. 6313(a)(6)(B))

ASHRAE officially released and made public on January 10, 2008, ASHRAE Standard 90.1–2007. This action triggered DOE's obligations under 42 U.S.C. 6313(a)(6), as outlined above.

Pertinent to any rulemaking in response to an ASHRAE revision of Standard 90.1, it is noted that EPCA contains what is commonly known as an ''anti-backsliding'' provision, which mandates that the Secretary shall not prescribe any amended standard that either increases the maximum allowable energy use or decreases the minimum required energy efficiency of covered equipment. (42 U.S.C. 6295(o)(1); 42 U.S.C. 6316(a)) It is a fundamental principle in EPCA's statutory scheme that DOE cannot weaken standards from those that have been published as a final rule. *See Natural Resources Defense Council* v. *Abraham*, 355 F.3d 179 (2d Cir. 2004).

When considering the possibility of a more-stringent standard, DOE's more typical rulemaking requirements under EPCA apply (*i.e.*, a determination of technological feasibility, economic justification, and significant energy savings). For example, EPCA provides that in deciding whether such a standard is economically justified, DOE must determine, after receiving comments on the proposed standard, whether the benefits of the standard exceed its burdens by considering, to the greatest extent practicable, the following seven factors:

1. The economic impact of the standard on manufacturers and consumers of the products subject to the standard;
2. The savings in operating costs throughout the estimated average life of the product in the type (or class) compared to any increase in the price of, or in the initial charges for, or maintenance expenses of the products which are likely to result from the imposition of the standard;
3. The total projected amount of energy savings likely to result directly from the imposition of the standard;
4. Any lessening of the utility or the performance of the products likely to result from the imposition of the standard;
5. The impact of any lessening of competition, as determined in writing by the Attorney General, that is likely to result from the imposition of the standard;
6. The need for national energy conservation; and
7. Other factors the Secretary considers relevant. (42 U.S.C. 6295(o)(2)(B)(i)–(ii); 42 U.S.C. 6316(a))

Additionally, the Secretary may not prescribe an amended standard if interested persons have established by a preponderance of the evidence that the amended standard is ''likely to result in the unavailability in the United States of any product type (or class)'' with performance characteristics, features, sizes, capacities, and volumes that are substantially the same as those generally available in the United States at the time of the Secretary's finding. (42 U.S.C. 6295(o)(4); 42 U.S.C. 6316(a))

Federal energy conservation requirements for commercial equipment generally supersede State laws or regulations concerning energy conservation testing, labeling, and standards. (42 U.S.C. 6316 (a) and (b)) However, DOE can grant waivers of preemption for particular State laws or regulations, in accordance with the procedures and other provisions of section 327(d) of EPCA. (42 U.S.C. 6297(d) and 6316(b)(2)(D))

When considering more stringent standards for the ASHRAE equipment under consideration here, EPCA states that there is a rebuttable presumption that an energy conservation standard is economically justified if the additional cost to the consumer of a product that meets the standard level is less than three times the value of the first-year energy (and as applicable water) savings resulting from the standard, as calculated under the applicable DOE test procedure. (42 U.S.C. 6295(o)(2)(B)(iii) and 42 U.S.C. 6316(a)) Generally, DOE's LCC and PBP analyses generate values that calculate the payback period for consumers of potential energy conservation standards, which includes, but is not limited to, the three-year payback period contemplated under the rebuttable presumption test discussed above. However, DOE routinely conducts a full economic analysis that considers the full range of impacts, including those to the consumer, manufacturer, Nation, and environment, as required under 42 U.S.C. 6295(o)(2)(B)(i) and 42 U.S.C. 6316(a). The results of this analysis serve as the basis for DOE to definitively evaluate the economic justification for a potential standard level (thereby supporting or rebutting the results of any preliminary determination of economic justification).

B. Background

1. ASHRAE Standard 90.1–2007

On January 9, 2008, ASHRAE's Board of Directors gave final approval to ASHRAE Standard 90.1–2007, which ASHRAE released on January 10, 2008. The ASHRAE standard addresses efficiency levels for many types of commercial heating, ventilating, air-conditioning (HVAC), and water-heating equipment covered by EPCA. ASHRAE Standard 90.1–2007 revised the efficiency levels for certain commercial equipment, but for the remaining equipment, ASHRAE left in place the preexisting efficiency levels (*i.e.*, the efficiency levels specified in ASHRAE Standard 90.1–1999 [4]).

Table II.1 below shows the existing Federal energy conservation standards and the efficiency levels specified in ASHRAE Standard 90.1–2007 for equipment where ASHRAE modified its requirements. DOE is addressing this equipment in today's notice. In section IV of today's NOPR, DOE assesses these equipment types to determine whether the amendments in ASHRAE Standard 90.1–2007 constitute increased energy conservation levels, as would necessitate further analysis. This step was necessary because DOE found that while ASHRAE had made changes in ASHRAE Standard 90.1–2007, it was not immediately apparent whether such revisions to the ASHRAE Standard 90.1 level would make the equipment more or less efficient, as compared to the existing Federal energy conservation standards. For example, when setting a standard using a different efficiency metric (as is the case for several types of commercial packaged boiler equipment), ASHRAE Standard 90.1–2007 changes the standard level from that specified in EPCA, but it is not immediately clear whether a standard level will make equipment more or less efficient. Therefore, DOE is undertaking this additional threshold analysis in order to thoroughly evaluate the amendments in ASHRAE Standard 90.1–2007 in a manner consistent with its statutory mandate.

[4] DOE reviewed and adopted some of the efficiency levels in ASHRAE Standard 90.1–1999 in a Final Rule published on January 12, 2001. 66 FR 3336.

TABLE II.1—FEDERAL ENERGY CONSERVATION STANDARDS AND ENERGY EFFICIENCY LEVELS IN ASHRAE STANDARD 90.1–2007 FOR SPECIFIC TYPES OF COMMERCIAL EQUIPMENT*

ASHRAE equipment class	Federal energy conservation standards	ASHRAE standard 90.1–2007	
		Energy efficiency levels	Effective date
Commercial Warm Air Furnaces			
Gas-Fired Commercial Warm Air Furnace	E_t = 80%	E_c = 80% Interrupted or intermittent ignition device, jacket losses not exceeding 0.75% of input rating, power vent, or flue damper**.	1/10/2008‡
Oil-Fired Commercial Warm Air Furnace	E_t =81%	E_t = 81% Interrupted or intermittent ignition device, jacket losses not exceeding 0.75% of input rating, power vent, or flue damper**.	1/10/2008‡
Commercial Package Air-Conditioning and Heating Equipment			
Through-the-Wall Air Conditioners	13.0 SEER*** (Effective as of 06/19/08)	12.0 SEER	1/23/2010
Through-the-Wall Air-Cooled Heat Pumps	13.0 SEER (Effective as of 06/19/08)	12.0 SEER 7.4 HSPF†	1/23/2010
Small Duct, High Velocity, Air-Cooled Air Conditioners.	13.0 SEER (Effective as of 06/19/08)	10.0 SEER	1/10/2008
Small Duct, High-Velocity, Air-Cooled Heat Pumps.	13.0 SEER (Effective as of 06/19/08)	10.0 SEER 6.8 HSPF	1/10/2008
Packaged Air-Cooled Air Conditioners with Cooling Capacity ≥760,000 Btu/h†† and with No Heating or with Electric Resistance Heating.	None	9.7 EER†††	1/1/2010
Packaged Air-Cooled Air Conditioners with Cooling Capacity ≥760,000 Btu/h and with Heating That is Other Than Electric Resistance Heating.	None	9.5 EER	1/1/2010
Water-Cooled and Evaporatively-Cooled Air Conditioner with Cooling Capacity ≥135,000 and <240,000 Btu/h, and with No Heating or with Electric Resistance Heating.	11.0 EER	11.0 EER	1/10/2008‡
Water-Cooled and Evaporatively Cooled Air Conditioner with Cooling Capacity ≥135,000 and <240,000 Btu/h, and with Heating That is Other Than Electric Resistance Heating.	11.0 EER	10.8 EER	1/10/2008‡
Water-Cooled and Evaporatively Cooled Air Conditioner with Cooling Capacity ≥240,000 Btu/h and with No Heating or with Electric Resistance Heating.	None	11.0 EER	1/10/2008‡
Water-Cooled and Evaporatively Cooled Air Conditioner with Cooling Capacity ≥240,000 Btu/h and with Heating That is Other Than Electric Resistance Heating.	None	10.8 EER	1/10/2008‡
Commercial Packaged Boilers			
Small Gas-Fired, Hot Water, Commercial Packaged Boilers.	E_C = 80%	E_T = 80%	3/2/2010
Small Gas-Fired, Steam, All Except Natural Draft Commercial Packaged Boilers.	E_C = 80%	E_T = 79%	3/2/2010
Small Gas-Fired, Steam, Natural Draft, Commercial Packaged Boilers.	E_C = 80%	E_T = 77% E_T = 79%	3/2/2010 3/2/2020
Small Oil-Fired, Hot Water, Commercial Packaged Boilers.	E_C = 83%	E_T = 82%	3/2/2010
Small Oil-Fired, Steam, Commercial Packaged Boilers.	E_C = 83%	E_T = 81%	3/2/2010
Large Gas-Fired, Hot Water, Commercial Packaged Boilers.	E_C = 80%	E_C = 82%	3/2/2010
Large Gas-Fired, Steam, All Except Natural Draft, Boilers.	E_C = 80%	E_T = 79%	3/2/2010
Large Gas-Fired, Steam, Natural Draft, Commercial Packaged Boilers.	E_C = 80%	E_T = 77% E_T = 79%	3/2/2010 3/2/2020
Large Oil-Fired, Hot Water, Commercial Packaged Boilers.	E_C = 83%	E_C = 84%	3/2/2010

TABLE II.1—FEDERAL ENERGY CONSERVATION STANDARDS AND ENERGY EFFICIENCY LEVELS IN ASHRAE STANDARD 90.1–2007 FOR SPECIFIC TYPES OF COMMERCIAL EQUIPMENT*—Continued

ASHRAE equipment class	Federal energy conservation standards	ASHRAE standard 90.1–2007	
		Energy efficiency levels	Effective date
Large Oil-Fired, Steam, Commercial Packaged Boilers.	E_C = 83%	E_T = 81%	3/2/2010

*All equipment classes included in this table are equipment where there is a perceived difference between the current Federal standard levels and the efficiency levels specified by ASHRAE Standard 90.1–2007. Although, in some cases, the efficiency levels in this table may appear to be equal or lower than the Federal energy conservation standards, DOE further reviewed the efficiency levels in ASHRAE Standard 90.1–2007 and presented its findings in section III.

** A vent damper is an acceptable alternative to a flue damper for those furnaces that draw combustion air from conditioned space.

*** Seasonal energy efficiency ratio

† Heating seasonal performance factor

†† British thermal units per hour (Btu/h)

††† Energy efficiency ratio

‡ For the purposes of this NOPR, the date shown in this column is the date of publication of ASHRAE Standard 90.1–2007 (Jan. 10, 2008) for equipment where the ASHRAE Standard 90.1–2007 initially appears to be different from the Federal energy conservation standards and where no effective date was specified by ASHRAE Standard 90.1–2007.

2. Notice of Data Availability and Request for Public Comment

On July 16, 2008, DOE published a notice of data availability (July 2008 NODA) and request for public comment in the **Federal Register** as a preliminary step pursuant to EPCA's requirements for DOE to consider amended energy conservation standards for certain types of commercial equipment covered by ASHRAE Standard 90.1. 73 FR 40770 (July 16, 2008). Specifically, the July 2008 NODA presented for public comment DOE's analysis of the potential energy savings estimates for amended national energy conservation standards for types of commercial equipment based on: (1) The modified efficiency levels contained within ASHRAE Standard 90.1–2007; and (2) more-stringent efficiency levels. *Id.* at 40772. DOE has described these analyses and preliminary conclusions and sought input from interested parties, including the submission of data and other relevant information. *Id.*

In addition, DOE presented a discussion in the July 2008 NODA of the changes found in ASHRAE Standard 90.1–2007. *Id.* at 40776–86. Lastly, the July 2008 NODA includes an initial description of DOE's evaluation of each ASHRAE equipment type to determine which energy conservation standards, if any, have been set pursuant to EPCA, in order for DOE to determine whether the amendments in ASHRAE Standard 90.1–2007 have increased efficiency levels. For those types of equipment in ASHRAE Standard 90.1 for which ASHRAE increased efficiency levels, DOE subjected that equipment to the potential energy savings analysis discussed above and presented the results in the July 2008 NODA for public comment. 73 FR 40770, 40776–86 (July 16, 2008).

As a result of the preliminary determination of scope set forth in the July 2008 NODA, DOE found the only equipment type for which ASHRAE increased the efficiency levels and equipment was available on the market were commercial packaged boilers, generally. 73 FR 40770, 40776–86 (July 16, 2008). DOE presented its methodology, data, and results for the preliminary energy savings analysis developed for most of the commercial packaged boiler equipment classes in the July 2008 NODA for public comment. 73 FR 40770, 40786–91 (July 16, 2008).

III. General Discussion of Comments Regarding the ASHRAE Process and DOE's Interpretation of EPCA's Requirements With Respect to ASHRAE Equipment

In response to its request for comment on the July 2008 NODA, DOE received six comments from manufacturers, trade associations, and energy efficiency advocates. The issues raised in these comments, along with DOE's responses, are set forth below.

A. The ASHRAE Process

In response to the preliminary determination of scope and analyses set forth in the July 2008 NODA, DOE received several comments regarding the ASHRAE process for considering revised efficiency levels for certain commercial heating, ventilating, air-conditioning, and water heater equipment, including commercial packaged boilers.

Edison Electric Institute (EEI) stated its belief that DOE should make proposals for increased efficiency to ASHRAE and not perform a separate rulemaking on commercial packaged boilers. EEI asserted this would streamline DOE's efforts and provide opportunities to increase equipment efficiency through the ASHRAE consensus process. (EEI, No. 2 at p. 2)[5]

The Air-Conditioning, Heating, and Refrigeration Institute (AHRI) asserted that the efficiency levels for commercial packaged boilers in ASHRAE Standard 90.1–2007 are the product of a consensus agreement between AHRI boiler manufacturer members, ACEEE, and several other organizations. AHRI stated its belief these efficiency levels reflect the collective experience of the manufacturers and the knowledge of the relationship between combustion efficiency and thermal efficiency for their models that comes from practical experience of transforming design concepts to models coming off the production line. Further, AHRI asserted DOE should accept the efficiency levels in ASHRAE Standard 90.1–2007 as negotiated standards that can be processed through an expedited rulemaking. (AHRI, No. 3 at p. 4)

The American Council for an Energy-Efficient Economy (ACEEE), the Appliance Standards Awareness Project (ASAP), the Alliance to Save Energy (ASE), the California Energy Commission (CEC), the Natural Resources Defense Council (NRDC), the Northeast Energy Efficiency Partnerships (NEEP), and the Northwest Power and Conservation Council (NPCC) submitted a joint comment in response to the July 2008 NODA

[5] "EEI, No. 2 at p. 2" refers to (1) a statement that was submitted by the Edison Electric Institute and is recorded in the Resource Room of the Building Technologies Program in the docket under "Energy Conservation Program for Certain Industrial Equipment: Energy Conservation Standards for Commercial Heating, Air-Conditioning, and Water-Heating Equipment," Docket Number EERE–2008–BT–STD–0013, as comment number 2; and (2) a passage that appears on page 2 of that statement.

(hereafter referred to as the Advocates Comment). (The Advocates Comment, No. 4 at p. 2) The Advocates Comment stated its support for the adoption of the efficiency levels in ASHRAE Standard 90.1–2007 for commercial boilers, except for any specific equipment class for which further DOE analysis shows that adoption of the ASHRAE efficiency levels would violate the anti-backsliding clause. The Advocates Comment pointed out that the efficiency levels in ASHRAE Standard 90.1–2007 for commercial packaged boilers are the result of a 2006 agreement between several efficiency advocacy groups and the trade association for commercial packaged boilers. (The Advocates Comment, No. 4 at p. 2)

Lastly, AHRI, ACEEE, ASAP, ASE, and NRDC submitted a joint letter to the Assistant Secretary (hereafter referred to as the Joint Letter) urging DOE to adopt as Federal minimum energy conservation standards the efficiency levels contained in ASHRAE Standard 90.1–2007 for commercial packaged boilers. (The Joint Letter, No. 5 at p. 1) The Joint Letter asserted that the commercial boiler efficiency levels are more stringent than the corresponding requirements in the previous version of the ASHRAE Standard.[6] In addition, the Joint Letter pointed out that the efficiency levels in ASHRAE Standard 90.1–2007 for commercial packaged boilers are the result of a consensus recommendation. Finally, the Joint Letter stated its belief that given the origin of these efficiency levels in the consensus process (both with the negotiated agreement and the ASHRAE process) and their significant potential energy savings, DOE should give these recommendations deference and move to adopt them as a final rule as expeditiously as possible. (The Joint Letter, No. 5 at p. 2)

While DOE acknowledges that certain efficiency levels in ASHRAE Standard 90.1–2007 are the result of consensus standards, including those for commercial packaged boilers, EPCA specifies DOE's obligations to review the amendments when ASHRAE issues revised standards. Specifically, EPCA directs that if ASHRAE Standard 90.1 is amended, DOE must adopt amended energy conservation standards at the new efficiency level in ASHRAE Standard 90.1, unless clear and convincing evidence supports a determination that adoption of a more stringent level as a national standard would produce significant additional energy savings and be technologically feasible and economically justified. (42 U.S.C. 6313(a)(6)(A)(ii)) In order to determine if more-stringent efficiency levels would meet EPCA's criteria, DOE must review the efficiency levels in ASHRAE Standard 90.1–2007 and more-stringent efficiency levels for their energy savings and economic potentials irrespective of whether the efficiency levels were once part of a consensus standard. Contrary to what some commenters seem to suggest, DOE may not delegate its standard-setting authority either directly or indirectly to ASHRAE or any other party.

B. The Definition of Amendment With Respect to the Efficiency Levels in an ASHRAE Standard

DOE stated in the July 2008 NODA that EPCA does not explicitly define the term ''amended'' in the context of ASHRAE Standard 90.1, but the July 2008 NODA pointed out that DOE provided its interpretation of what would constitute an ''amended standard'' in a final rule published in the **Federal Register** on March 7, 2007 (72 FR 10038). 73 FR 40770, 40771 (July 16, 2008). In that final rule, DOE stated that the statutory trigger requiring DOE to adopt uniform national standards based on ASHRAE action is for ASHRAE to change a standard for any of the equipment listed in EPCA section 342(a)(6)(A)(i) (42 U.S.C. 6313(a)(6)(A)(i)) by increasing the energy efficiency level for that equipment type. 72 FR 10038, 10042 (March 7, 2007). In other words, if the revised ASHRAE Standard 90.1 leaves the standard level unchanged or lowers the standard, as compared to the level specified by the national standard adopted pursuant to EPCA, DOE does not have the authority to conduct a rulemaking to consider a higher standard for that equipment pursuant to 42 U.S.C. 6313(a)(6)(A). 73 FR 40770, 40771 (July 16, 2008).

In response to DOE's interpretation of the definition of ''amendment,'' the Advocates Comment argued that DOE has applied an unlawfully narrow definition to the word ''amendment.'' (The Advocates Comment, No. 4 at pp. 2–3) Instead, the Advocates Comment asserts that EPCA requires DOE to consider changes to the Federal minimum energy conservation standards for covered products ''[i]f ASHRAE/IES Standard 90.1 is *amended* * * *'' (The Advocates Comment, No. 4 at pp. 2–3 (referring to 42 U.S.C. 6313(a)(6)(A)(i)) (emphasis in original)). In other words, the Advocates Comment suggests that DOE has very broad authority to consider amended standards for any and all ASHRAE equipment, once ASHRAE acts to revise any of the levels in Standard 90.1. The Advocates Comment asserts that Congress's use of the neutral terms ''amended'' and ''amendment'' imposes no threshold requirement that before DOE can analyze the energy saving potential of revised Federal energy conservation standards it must first determine that the amended ASHRAE standard is more stringent than the prior Federal energy conservation standard. The Advocates Comment stated its belief that DOE's very limited definition of ''amendment'' is inconsistent with the plain language of EPCA. (The Advocates Comment, No. 4 at p. 3)

DOE does not agree with the Advocates Comment's assertions. DOE maintains its position that the statutory trigger requiring DOE to adopt uniform national standards based on ASHRAE action is for ASHRAE to change a standard for any of the equipment listed in EPCA section 342(a)(6)(A)(i) (42 U.S.C. 6313(a)(6)(A)(i)) by increasing the energy efficiency level for that equipment type. As described in the March 2007 final rule, the intent of section 342, generally, is for DOE to maintain uniform national standards consistent with those set in ASHRAE Standard 90.1. 72 FR 10038, 10042 (March 7, 2007). Given this intent, if ASHRAE has not amended a standard for a product subject to section 342, there is no change, which would require action by DOE to consider amending the uniform national standard to maintain consistency with ASHRAE Standard 90.1. *Id.* If ASHRAE considered amending the standards for a given equipment type but ultimately chose not to do so, the statutory trigger for DOE to adopt ASHRAE's amended standards did not occur with respect to this equipment. *Id.* The statutory language specifically links ASHRAE's action in amending standards for specific equipment to DOE's action for those same equipment. *Id.*

C. Different Types of Changes in ASHRAE Standard 90.1–2007

The Advocates Comment asserted that ASHRAE Standard 90.1–2007 includes at least three different types of amendments, which must trigger DOE

[6] DOE reviewed the previous efficiency levels for commercial packaged boilers, which were incorporated into ASHRAE Standard 90.1–1999, in a notice of document availability published on March 13, 2006. 71 FR 12634, 12639 (March 13, 2006). At that time, DOE determined it could not adopt the efficiency levels in ASHRAE Standard 90.1–1999 for small commercial packaged boilers due to backsliding concerns. 71 FR 12634, 12639–41 (March 13, 2006). In addition, DOE determined it did not have the authority to consider amended energy conservation standards for large commercial packaged boilers because ASHRAE did not change the existing energy conservation standard levels in ASHRAE Standard 90.1–1999. 71 FR 12634, 12641–42 (March 13, 2006).

review of the existing Federal energy conservation standards, including: (1) A change in the efficiency performance metric; (2) an addition of a new prescriptive or performance requirement; and (3) a possible decrease to the efficiency standard. (The Advocates Comment, No. 4 at p. 4–5) The Advocates Comment further asserted that DOE cannot reject the consideration of amendments which change the performance metric or which add new prescriptive or performance requirements on top of existing Federal requirements. The Advocates Comment further stated that even DOE's definition of ''amendment'' compels consideration of amendments which add energy-saving requirements since these requirements ''increase'' the level of energy efficiency for a given equipment type. If DOE decides it cannot adopt multiple efficiency requirements (an interpretation the Advocates Comment believes is contrary to EPCA), the Advocates Comment argued that these requirements still trigger DOE review. (The Advocates Comment, No. 4 at p. 4–5)

When reviewing the changes in ASHRAE Standard 90.1–2007, DOE stated in the July 2008 NODA that for each class of commercial equipment for which ASHRAE modified the existing standard, DOE would assess whether the change made would increase energy efficiency and, therefore, require further DOE analysis and consideration. 73 FR 40770, 40775 (July 16, 2008). DOE initially completed a comprehensive analysis of the products covered under both EPCA and ASHRAE Standard 90.1–2007 to determine which product types require further analysis. The July 2008 NODA contains a description of DOE's initial evaluation of each ASHRAE equipment type for which energy conservation standards have been set pursuant to EPCA, in order for DOE to determine whether the amendments in ASHRAE Standard 90.1–2007 have resulted in increased efficiency levels. 73 FR 40770, 40773–40786 (July 16, 2008).

DOE does not agree with the Advocates Comment's assertion that DOE is required to review changes in ASHRAE Standard 90.1–2007, which do not increase the efficiency level when compared to the current Federal energy conservation standards for a given piece of equipment. Further as DOE has previously explained, since EPCA does not explicitly define the term ''amended'' in the context of ASHRAE Standard 90.1, DOE provided its interpretation of what would constitute an ''amended standard'' in a final rule published in the **Federal Register** on March 7, 2007. 72 FR 10038. In that rule, DOE stated that the statutory trigger requiring DOE to adopt uniform national standards based on ASHRAE action is for ASHRAE to change a standard for any of the equipment listed in EPCA section 342(a)(6)(A)(i) (42 U.S.C. 6313(a)(6)(A)(i)) by increasing the energy efficiency level for that equipment type. *Id.* at 10042. Even though DOE realizes that these prescriptive requirements could save additional energy in addition to the energy-efficiency level, DOE does not believe adding a prescriptive requirement alone without increasing the efficiency level triggers DOE review. In addition, if ASHRAE adds a prescriptive requirement for equipment where an efficiency level is already specified, DOE does not believe it has the authority to address a dual descriptor for a single equipment type (see section IV.A.1 below for additional explanation). In light of the above, DOE maintains its position set out in the July 2008 NODA. If the revised ASHRAE Standard 90.1 leaves the standard level unchanged (even if ASHRAE adds prescriptive requirements) or lowers the standard, as compared to the level specified by the national standard adopted pursuant to EPCA, DOE does not have the authority to conduct a rulemaking to consider a higher standard for that equipment pursuant to 42 U.S.C. 6313(a)(6)(A). 73 FR 40770, 40771 (July 16, 2008).

D. DOE's Review of ASHRAE Equipment Independent of the ASHRAE Standards Process

The Advocates Comment pointed to language in EPCA (at 42 U.S.C. 6313(a)(6)(C)) that it believes triggers DOE review to determine the need to amend the energy conservation standard for a given piece of equipment, including a six-year timeframe elapsing since the last final rule ''establishing or amending a standard'' for that product. (The Advocates Comment, No. 4 at p. 5) The Advocates Comment also stated that the same provision of EPCA further provides that if DOE determines that the statutory criteria have not been met for amending the energy conservation standard for a product, DOE must conduct the same review process within the next three years. (The Advocates Comment, No. 4 at p. 5) The Advocates Comment stated its belief that the timeline (three or six years) has elapsed for several equipment categories, including: (1) Central water-source and evaporatively-cooled AC products; (2) warm-air furnaces; (3) gas and oil storage water heaters; (4) gas and oil instantaneous water heaters; (4) tankless oil-fired instantaneous water heaters and unfired hot water storage tanks; (5) electric water heaters; (6) tankless gas-fired instantaneous water heaters; and (7) commercial packaged boilers. (The Advocates Comment, No. 4 at p. 5–6)

In response, DOE acknowledges that section 305(b) of the Energy Independence and Security Act of 2007 (EISA 2007), Pub. L. 110–140, amended Section 342(a)(6) of EPCA to create an additional requirement that directs DOE to assess whether there is a need to update the Federal energy conservation standards for certain commercial equipment (*i.e.*, ASHRAE equipment) after a certain amount of time has elapsed. Specifically, EPCA, as amended, states that ''the Secretary must publish either a notice of determination that standards for a product do not need to be amended, or a notice of proposed rulemaking including new proposed standards within 6 years after the issuance of any final rule establishing or amending a standard.'' (42 U.S.C. 6313(a)(6)(C)(i)) In addition, if the Secretary chooses to publish a notice of determination that the standards for a product do not need to be amended, a new determination must be issued within 3 years of the previous determination. (42 U.S.C. 6313(a)(6)(C)(iii)(II)) These requirements are applicable to small commercial package air conditioning and heating equipment, large commercial package air conditioning and heating equipment, very large commercial package air conditioning and heating equipment, packaged terminal air conditioners, packaged terminal 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)(A)(i))

DOE believes that the commenters have misconstrued the amendments in section 305(b) of EISA 2007 by suggesting that the relevant provisions should be applied retroactively, rather than prospectively. DOE does not believe it was Congress's intention to apply these requirements retroactively, so that DOE would immediately be in violation of its legal obligations upon passage of the statute, thereby failing from its inception. DOE does not believe that the interpretation in the Advocates Comment is reasonable, nor does DOE agree with the assertion that DOE is late and should initiate an immediate review of certain commercial equipment cited by the commenters above.

E. Equipment Classes With a Two-Tier Efficiency Level Specified in ASHRAE Standard 90.1–2007

For commercial packaged boilers, ASHRAE Standard 90.1–2007 further divides the existing equipment classes (*i.e.*, gas-fired and oil-fired) into 10 different divisions. For two of the ten equipment classes specified in ASHRAE Standard 90.1–2007, ASHRAE specifies a two-tier efficiency level, with one efficiency level effective in 2010 and another more-stringent efficiency level effective in 2020. The two equipment classes where ASHRAE Standard 90.1–2007 specifies a two-tier efficiency levels are small gas-fired steam natural draft and large gas-fired steam natural draft commercial packaged boilers. In determining whether the efficiency levels in ASHRAE Standard 90.1–2007 violated EPCA's anti-backsliding clause, DOE examined only the efficiency levels with a 2010 effective date. However, DOE considers the two-tier efficiency levels to be a ''package'' set of potential amended energy conservation standards. DOE does not intend to adopt one efficiency level without adopting the latter efficiency level. Accordingly, in its economic and energy savings analysis DOE analyzes these two equipment classes as if both the 2010 and 2020 levels will be adopted on their respective effective dates.

IV. General Discussion of the Changes in ASHRAE Standard 90.1–2007 and Determination of Scope for Further Rulemaking Analyses

As discussed above, before beginning an analysis of economic impacts and energy savings that would result from adopting the efficiency levels specified by ASHRAE Standard 90.1–2007 or more-stringent efficiency levels, DOE first sought to determine whether or not the ASHRAE Standard 90.1–2007 efficiency levels actually represented an increase in efficiency above the current Federal standard levels. This section discusses each equipment class where the ASHRAE Standard 90.1–2007 efficiency level differs from the current Federal standard level, along with DOE's preliminary conclusion as to the action DOE would take with respect to that equipment.

A. Commercial Warm Air Furnaces

Under EPCA, a ''warm air furnace'' is defined as ''a self-contained oil-or gas-fired furnace designed to supply heated air through ducts to spaces that require it and includes combination warm-air furnace/electric air-conditioning units but does not include unit heaters and duct furnaces.'' (42 U.S.C. 6311(11)(A)) In its regulations, DOE defines a ''commercial warm air furnace'' as a ''warm-air furnace that is industrial equipment, and that has a capacity (rated maximum input) of 225,000 Btu [British thermal units] per hour or more.'' 10 CFR 431.72. The amendments in ASHRAE Standard 90.1–2007 changed the efficiency metric for gas-fired commercial warm air furnaces and added design requirements for both gas-fired and oil-fired commercial warm air furnaces, thereby triggering DOE to further review ASHRAE's changes as presented below.

1. Gas-Fired Commercial Warm Air Furnaces

Gas-fired commercial warm air furnaces are fueled by either natural gas or propane. The Federal energy conservation standard for commercial gas-fired warm air furnaces corresponds to the efficiency level in ASHRAE Standard 90.1–1999, which specifies that for equipment with a capacity of 225,000 Btu per hour (h) or more, the thermal efficiency at the maximum rated capacity (rated maximum input) must be no less than 80 percent. 10 CFR 431.77(a). The Federal energy conservation standard for gas-fired commercial warm air furnaces applies to equipment manufactured on or after January 1, 1994. 10 CFR 431.77.

ASHRAE changed the efficiency levels for gas-fired commercial warm air furnaces by changing the metric from a thermal efficiency descriptor to a combustion efficiency descriptor and adding three design requirements. Specifically, the efficiency levels in ASHRAE Standard 90.1–2007 specify a minimum combustion efficiency of 80 percent. ASHRAE Standard 90.1–2007 also specifies the following design requirements for commercial gas-fired warm air furnaces: The gas-fired commercial warm air furnace must use an interrupted or intermittent ignition device, have jacket losses no greater than 0.75 percent of the input rating, and use a power vent or flue damper.

To evaluate the change in efficiency level (if any) specified by the amended ASHRAE standard, DOE reviewed the change of metric for gas-fired commercial warm air furnaces. In general, the energy efficiency of a product is a function of the relationship between the product's output of services and its energy input. A furnace's output is largely the energy content of its output (*i.e.*, warm air delivered to the building). A furnace's energy losses consist of energy that escapes through its flue (commonly referred to as ''flue losses''), and of energy that escapes into the area surrounding the furnace (commonly referred to as ''jacket losses'').

In a final rule published in the **Federal Register** on October 21, 2004 (the October 2004 final rule), DOE incorporated definitions for commercial warm air furnaces and its efficiency descriptor, energy efficiency test procedures, and energy conservation standards. 69 FR 61916 (Oct. 21, 2004). In the October 2004 final rule, DOE pointed out that EPCA specifies the energy conservation standard levels for commercial warm air furnaces in terms of thermal efficiency (42 U.S.C. 6313(a)(4)(A)–(B); 10 CFR 431.77), but provides no definition for this term. *Id.* DOE proposed to interpret this term in the context of commercial warm air furnaces to mean combustion efficiency (*i.e.*, 100 percent minus percent flue loss). *Id.* Given the use of the thermal efficiency term in EPCA and its continued use as the efficiency descriptor for furnaces in ANSI Standard Z21.47, ''Gas-Fired Central Furnaces'' (DOE's test procedure for this equipment), DOE stated that it would be confusing to use the term ''combustion efficiency'' in the final rule. Accordingly, DOE defined the term ''thermal efficiency'' to mean 100 percent minus the percent flue loss in the October 2004 final rule for gas-fired commercial warm air furnaces. *Id.*

DOE presented an initial review of the ASHRAE efficiency levels for warm-air furnaces in the July 2008 NODA. DOE stated that upon reviewing the efficiency levels and methodology specified in ASHRAE Standard 90.1–2007, DOE believed that despite changing the name of the energy efficiency descriptor from ''thermal efficiency'' to ''combustion efficiency,'' ASHRAE did not intend to change the efficiency metric for gas-fired commercial warm air furnaces. 73 FR 40770, 40776 (July 16, 2008). When ASHRAE specified a newer version of the test procedure for manufacturers' use with gas-fired commercial air furnaces (*i.e.*, ANSI Standard Z21.47–2001), the calculation of thermal efficiency did not change from the previous version. Therefore, despite that change in the name of the energy efficiency descriptor, the terms are synonymous in the present context because the calculation of that value has not changed (*i.e.*, 100 percent minus the percent flue loss). DOE sees no plausible reason why ASHRAE would have chosen to incorporate a different metric than that used in the ANSI Standard Z21.47–2001 test procedure. Consequently, because the amendments for this type of equipment set out in ASHRAE Standard 90.1–2007 do not appear to have substantively changed the efficiency level, DOE tentatively decided to leave the existing Federal energy conservation standards in place for gas-fired commercial warm air furnaces; these standards specify a thermal efficiency of 80 percent using the definition of ''thermal efficiency'' established by DOE in the October 2004 final rule and presented in subpart D to 10 CFR part 431. 73 FR 40770, 40776 (July 16, 2008).

In response to the preliminary review set forth in the July 2008 NODA, the Advocates Comment noted that ASHRAE added additional energy saving requirements, including a standard limiting jacket losses, a prescriptive requirement for intermittent or interrupted ignition devices, and a requirement for power venting or flue dampers in ASHRAE Standard 90.1–2007 for commercial gas-fired warm air furnaces. (The Advocates Comment, No. 4 at p. 6) The Advocates Comment further stated that the addition of these requirements triggers DOE review, which must lead to either adoption of the new ASHRAE standards or more-stringent standards. (The Advocates Comment, No. 4 at p. 6) The Advocates Comment also asserted that ASHRAE recognized that combustion efficiency is an inadequate efficiency descriptor and added these additional efficiency requirements to capture off cycle losses, which can waste significant amounts of energy. (The Advocates Comment, No. 4 at p. 6) Even though the comments concluded DOE has asserted in other rulemakings that it lacks the authority to apply more than one efficiency metric to a given product, the commenters believe DOE's viewpoint is contrary to the language and purposes of EPCA. (The Advocates Comment, No. 4 at p. 7) Further, the Advocates Comment stated that because ASHRAE has adopted a performance standard and multiple design requirements, DOE must read the statute as permitting DOE sufficient authority to harmonize Federal and ASHRAE requirements. Lastly, the comments point out that some of the multi-part standards (*e.g.*, those for commercial storage instantaneous water heaters and commercial heat pumps) are based on equivalent multi-part requirements in ASHRAE 90.1. (The Advocates Comment, No. 4 at p. 6–7)

DOE has determined that the design requirements in ASHRAE Standard 90.1–2007 for gas-fired commercial warm air furnaces are beyond the scope of its legal authority. EPCA authorizes the Secretary to amend the energy conservation standards for specified equipment. (42 U.S.C. 6313(a)(6)) Section 340(18) of EPCA defines the term ''energy conservation standard'' as:

''(A) a performance standard that prescribes a minimum level of energy efficiency or a maximum quantity of energy use for a product; or

(B) a design requirement for a product.''

(42 U.S.C. 6311(18))

The language of EPCA authorizes DOE to establish a performance standard or a single design standard. As such, a standard that establishes both a performance standard and a design requirement is beyond the scope of DOE's legal authority, as would be a standard that included more than one design requirement. In this case, ASHRAE Standard 90.1–2007 recommends three design requirements, which goes beyond EPCA's limit of one design requirement for the specified covered equipment.

Therefore, DOE has not changed its preliminary review set forth in the July 2008 NODA. Because the amendments for this type of equipment set out in ASHRAE Standard 90.1–2007 do not appear to have changed the efficiency level, DOE is leaving the existing Federal energy conservation standards in place for gas-fired commercial warm air furnaces; these standards specify a thermal efficiency of 80 percent using the definition of ''thermal efficiency'' established by DOE in the October 2004 final rule and presented in subpart D to 10 CFR part 431. 73 FR 40770, 40776 (July 16, 2008). DOE is not conducting any further analysis on gas-fired commercial warm air furnaces.

2. Oil-Fired Commercial Warm Air Furnaces

The Federal energy conservation standard for commercial oil-fired warm air furnaces corresponds to the efficiency level in ASHRAE Standard 90.1–1999, which specifies that for equipment with a capacity of 225,000 [British thermal units per hour] (Btu/h) or more, the thermal efficiency at the maximum rated capacity (rated maximum input) must be no less than 81 percent. 10 CFR 431.77(b). The Federal energy conservation standard for oil-fired commercial warm air furnaces applies to equipment manufactured on or after January 1, 1994. 10 CFR 431.77.

The efficiency level in ASHRAE Standard 90.1–2007 specifies a minimum thermal efficiency of 81 percent. ASHRAE did not change the efficiency levels for oil-fired commercial warm air furnaces, but ASHRAE added three design requirements. ASHRAE Standard 90.1–2007 now specifies that commercial, oil-fired, warm air furnaces must use an interrupted or intermittent ignition device, have jacket losses no greater than 0.75 percent of the input rating, and use a power vent or flue damper.

DOE published a final rule in the **Federal Register** on March 7, 2007, which states that the statutory trigger that requires DOE to adopt uniform national standards based on ASHRAE action is for ASHRAE to change a standard by increasing the energy efficiency of the equipment listed in EPCA section 342(a)(6)(A)(i) (42 U.S.C. 6313(a)(6)(A)(i)). 72 FR 10038, 10042.

In practice, 42 U.S.C. 6313 generally allows ASHRAE Standard 90.1 to set energy efficiency levels for equipment as a model building code and directs DOE to use these efficiency levels as the basis for maintaining consistent, uniform national energy conservation standards for the same equipment, provided all other applicable statutory requirements are met. DOE stated in the July 2008 NODA that if ASHRAE has not changed an efficiency level for a class of equipment subject to 42 U.S.C. 6313, DOE does not have authority to consider amending the uniform national standard at the time of publication of the amended ASHRAE Standard 90.1. 73 FR 40770, 40777 (July 16, 2008). DOE also pointed out that although ASHRAE added design requirements in ASHRAE Standard 90.1–2007, it did not change the efficiency levels for oil-fired commercial warm air furnaces. *Id.* Therefore, DOE tentatively concluded that it does not have authority to amend the uniform national standard for this equipment. *Id.*

In response to the preliminary review of oil-fired commercial warm air furnaces set forth in the July 2008 NODA, the Advocates Comment made the same assertion regarding the three design requirements added by ASHRAE as it did for gas-fired commercial warm air furnaces above. (The Advocates Comment, No. 4 at p. 7)

DOE does not have any reason to treat oil-fired commercial warm air furnaces any differently than gas-fired commercial warm air furnaces. The language of EPCA authorizes DOE to establish a performance standard or a single design standard. As such, DOE is concluding a standard for oil-fired commercial warm air furnaces that establishes both a performance standard and a design requirement is beyond the scope of DOE's legal authority, as it did with gas-fired commercial warm air furnaces.

Therefore, DOE has not changed its preliminary review set forth in the July 2008 NODA. Because the amendments for this equipment type set out in

ASHRAE Standard 90.1–2007 did not change the efficiency level for oil-fired commercial warm air furnaces, DOE is leaving the existing Federal energy conservation standards in place for this equipment; these standards specify a thermal efficiency of 81 percent. Accordingly, DOE is not conducting any further analysis on oil-fired commercial warm air furnaces.

B. Commercial Package Air-Conditioning and Heating Equipment

EPCA, as amended, defines ''commercial package air-conditioning and heating equipment'' as ''air-cooled, water-cooled, evaporatively cooled, or water source (not including ground water source) electrically operated, unitary central air conditioners and central air-conditioning heat pumps for commercial application.'' (42 U.S.C. 6311(8)(A); 10 CFR 431.92) EPCA also defines ''small,'' ''large,'' and ''very large commercial package air-conditioning and heating equipment'' based on the equipment's rated cooling capacity. (42 U.S.C. 6311(8)(B)–(D); 10 CFR 431.92) Specifically, the term ''small commercial package air-conditioning and heating equipment'' means ''commercial package air-conditioning and heating equipment that is rated below 135,000 Btu per hour (cooling capacity).'' (42 U.S.C. 6311(8)(B); 10 CFR 431.92) The term ''large commercial package air-conditioning and heating equipment'' means ''commercial package air-conditioning and heating equipment that is rated: (i) At or above 135,000 Btu per hour and (ii) below 240,000 Btu per hour (cooling capacity).'' (42 U.S.C. 6311(8)(C); 10 CFR 431.92) The term ''very large commercial package air-conditioning and heating equipment'' means ''commercial package air-conditioning and heating equipment that is rated: (i) at or above 240,000 Btu per hour; and (ii) below 760,000 Btu per hour (cooling capacity).'' (42 U.S.C. 6311(8)(D); 10 CFR 431.92)

The amendments in ASHRAE Standard 90.1–2007 include: (1) Identifying separate efficiency levels for three-phase through-the-wall air-cooled air conditioners and heat pumps and three-phase, small-duct, high-velocity air-cooled air conditioners and heat pumps; (2) adding equipment classes corresponding efficiency levels for commercial package air-cooled air conditioners with a cooling capacity at or above 760,000 Btu/h and water-cooled and evaporatively-cooled commercial package air conditioners and heat pumps with a cooling capacity at or above 240,000 Btu/h; and (3) changing the efficiency levels for water-cooled and evaporatively-cooled commercial package air conditioners and heat pumps with a cooling capacity at or above 135,000 Btu/h and less than 240,000 Btu/h, thereby triggering DOE to further review ASHRAE's changes as presented below.

1. Three-Phase Through-the-Wall Air-Cooled Air Conditioners and Heat Pumps

ASHRAE Standard 90.1–2007 identifies efficiency levels for three-phase through-the-wall air-cooled air conditioners and heat pumps, single-package and split systems, with a cooling capacity of no greater than 30,000 Btu/h. The efficiency levels specified by ASHRAE Standard 90.1–2007 include a seasonal energy efficiency ratio of 12.0 for cooling mode and a heating seasonal performance factor of 7.4 for equipment manufactured on or after January 23, 2010.[7] ASHRAE aligned these efficiency levels and its corresponding effective dates with the efficiency levels established in EPCA for single-phase residential versions of the same products.

Neither EPCA nor DOE has established a specific definition for commercial ''through-the-wall air-cooled air conditioners and heat pumps.'' Residential through-the-wall air-cooled air conditioners and heat pumps are consumer products covered as ''central air conditioners'' under EPCA, as amended, which are defined at 42 U.S.C. 6291(21) and 10 CFR 430.2. Residential through-the-wall air-cooled air conditioners and heat pumps are by definition single-phase products (*Id.*), whereas the commercial through-the-wall air-cooled air conditioners and heat pumps mentioned in ASHRAE Standard 90.1–2007 are three-phase products. In DOE's regulations, a residential ''[t]hrough-the-wall air conditioner and heat pump'' means ''a central air conditioner or heat pump that is designed to be installed totally or partially within a fixed-size opening in an exterior wall * * *'' 10 CFR 430.2. Furthermore to be covered, this equipment (1) must be manufactured before January 23, 2010; (2) must not be weatherized; (3) must be clearly and permanently marked for installation only through an exterior wall; (4) have a rated cooling capacity no greater than 30,000 Btu/h; (5) exchange all of its outdoor air across a single surface of the equipment cabinet; and (6) have a combined outdoor air exchange area of less than 800 square inches (split systems) or less than 1,210 square inches (single packaged systems) as measured on the surface described in paragraph (5) of this definition. *Id.*

In terms of equipment construction, commercial and residential through-the-wall air-cooled air conditioners and heat pumps use the same components in the same configurations to provide space cooling and heating. Commercial versions of through-the-wall air-cooled air conditioners and heat pumps are essentially the same as residential versions, except that they are powered using three-phase electric power.

EPCA does not separate three-phase through-the-wall air-cooled air conditioners and heat pumps from other types of small commercial package air-conditioning and heating equipment in its definitions. Therefore, EPCA's definition of ''small commercial package air-conditioning and heating equipment'' would include three-phase through-the-wall air-cooled air conditioners and heat pumps. Although EPCA does not use the term ''three-phase through-the-wall air-cooled air conditioners and heat pumps,'' the three-phase versions of this equipment, regardless of cooling capacity, fall within the definition of ''small commercial package air-conditioning and heating equipment.'' (42 U.S.C. 6311(8)(A)–(B)) There is no language in EPCA to indicate that three-phase through-the-wall air-cooled air conditioners and heat pumps are a separate class of covered equipment.

The Federal energy conservation standards for three-phase commercial package air conditioners and heat pumps less than 65,000 Btu/h were established by EISA 2007 for such products manufactured on or after June 19, 2008. Specifically, section 314(b)(4)(C) of EISA 2007 amended section 342(a)(7) of EPCA (42 U.S.C. 6313(a)(7)) by adding new provisions for three-phase commercial package air conditioners with a cooling capacity of less than 65,000 Btu/h. (42 U.S.C. 6313(a)(7)(D)) These provisions in EISA 2007 mandate SEERs for cooling mode and HSPFs for heating mode of air-cooled three-phase electric central air conditioners and central air-conditioning heat pumps with a cooling capacity of less than 65,000 Btu/h.[8]

[7] ASHRAE provides the same requirement for single-phase and three-phase through-the-wall air-cooled air conditioners and heat pumps used in covered commercial buildings, but points out that single-phase products are regulated as residential products under 10 CFR 430.32(c)(2).

[8] Section 314(b)(4)(C) of EISA 2007 specifies for ''equipment manufactured on or after the later of January 1, 2008, or the date that is 180 days after the date of enactment of the Energy Independence and Security Act of 2007—

(i) the minimum seasonal energy efficiency ratio of air-cooled 3-phase electric central air

Three-phase through-the-wall air-cooled air conditioners and heat pumps are a smaller subset of three-phase commercial package air conditioners with a cooling capacity of less than 65,000 Btu/h, and were not explicitly excluded from the standards in section 314(b)(4)(C) of EISA 2007. DOE noted in the July 2008 NODA that since EISA 2007 set these standards, DOE must follow them, and they are more stringent than the levels contained in ASHRAE Standard 90.1–2007 for three-phase through-the-wall air-cooled air conditioners and heat pumps. 73 FR 40770, 40778 (July 16, 2008). Accordingly, DOE affirmed that the EISA 2007 efficiency levels for small commercial package air-conditioning and heating equipment less than 65,000 Btu/h, as set forth at 42 U.S.C. 6313(a)(7)(D), apply to three-phase through-the-wall air-cooled air conditioners and heat pumps with a cooling capacity no greater than 30,000 Btu/h. *Id.*

In response to the preliminary conclusions set forth in the July 2008 NODA, AHRI stated that the minimum energy efficiency standards for small commercial package air conditioning and heating equipment less than 65,000 Btu/h specified in ASHRAE Standard 90.1–2007 were initially amended by addendum f to ASHRAE/IES 90.1–2004 in 2005, well before Congress enacted EISA 2007. (AHRI, No. 3 at pp. 1–2) AHRI further commented ''[t]he intent behind addendum f was to harmonize the minimum energy efficiency standards, product classes and effective dates for the three-phase products covered by ASHRAE Standard 90.1 with the respective efficiency standards, product classes and effective dates established under EPCA for single-phase residential products.'' *Id.* AHRI further noted that it believes the intent of Congress was very clear in EISA 2007 (*i.e.*, to harmonize the standard for three-phase commercial products with cooling capacities less than 65,000 Btu/h with that of the single-phase residential products of the same capacity). Further, AHRI commented that Congress never intended to require a minimum 13 SEER/7.7 HSPF standards for three-phase, through-the-wall, air-cooled air conditioners and heat pumps; DOE itself found it impossible to meet that efficiency level during the last rulemaking on central air conditioners and heat pumps. (AHRI, No. 3 at pp. 1–2)

AHRI also stated its belief that DOE has the authority to establish a separate product class for three-phase, through-the-wall, air-cooled air conditioners and heat pumps. (AHRI, No. 2 at p. 2) AHRI pointed out that prior to the last rulemaking on residential central air conditioners (*i.e.*, single-phase, air-cooled air conditioners and heat pumps), EPCA did not specifically address through-the-wall products. AHRI asserted it was DOE that established the product class when it determined that through-the-wall products had unique space-constraint challenges that warranted a lower minimum efficiency standard than conventional systems. (AHRI, No. 3 at p. 2) AHRI commented that DOE can and should do the same for commercial three-phase versions of these products. AHRI also stated that DOE can adopt the proposed ASHRAE 90.1–2007 efficiency levels for three-phase through-the-wall air-cooled air conditioners and heat pumps because the efficiency levels were developed and justified by DOE through a lengthy rulemaking process (*i.e.*, the 2001 rulemaking on central air conditioners and heat pumps [9]). Lastly, AHRI pointed out that due to space-constraint issues, three-phase through-the-wall air-cooled air conditioners and heat pumps cannot meet the 13 SEER/7.7 standard established by EISA 2007. AHRI stated that manufacturers of three-phase commercial through-the-wall products would have no choice but to file for a waiver if the ASHRAE Standard 90.1–2007 efficiency levels were not adopted by DOE for this equipment class. (AHRI, No. 3 at p. 2)

DOE does not agree with AHRI's assertions regarding three-phase through-the-wall air-cooled air conditioners and heat pumps. Specifically, while ASHRAE may have been trying to harmonize the definitions, equipment classes, and energy conservation standards for equipment classes of similar types with their residential counterparts, the energy conservation standards specified by EISA 2007 supersede the efficiency levels in ASHRAE Standard 90.1–2007. EISA 2007 did not explicitly exclude three-phase through-the-wall air-cooled air conditioners and heat pumps from its regulations for the larger class of small commercial package air conditioning and heating equipment.

As to AHRI's assertion regarding establishing a separate equipment class for these subsets of equipment, DOE agrees with AHRI that DOE has the authority to adopt a separate equipment class for this equipment when initially established by ASHRAE Standard 90.1–2007. However, DOE does not have the authority to adopt a less stringent efficiency level for a separate equipment class, including three-phase through-the-wall air-cooled air conditioners and heat pumps in contravention of the prescriptive standard levels set by EISA 2007. Effectively, the efficiency levels in ASHRAE Standard 90.1–2007 are less stringent than the energy conservation standards specified by EISA 2007 for three-phase, through-the-wall, air-cooled air conditioners and heat pumps. As DOE stated in the July 2008 NODA, DOE is affirming in today's notice that the EISA 2007 efficiency levels set forth in 42 U.S.C. 6313(a)(7)(D) for small commercial package air-conditioning and heating equipment less than 65,000 Btu/h apply to three-phase through-the-wall air-cooled air conditioners and heat pumps with a cooling capacity no greater than 30,000 Btu/h. 73 FR 40770, 40778 (July 16, 2008). DOE does not have authority to grant exception relief from the prescriptive standard levels set by EISA 2007 for three-phase commercial through-the-wall air conditioners and heat pumps, nor can it provide a waiver from the test procedure as a means of avoiding this statutory requirement.

2. Three-Phase, Small-Duct, High-Velocity Air-Cooled Air Conditioners and Heat Pumps

ASHRAE Standard 90.1–2007 identifies efficiency levels for three-phase small-duct, high-velocity (SDHV) air-cooled air conditioners and heat pumps, both single-package and split systems, with a cooling capacity less than 65,000 Btu/h.[10] The efficiency levels specified by ASHRAE Standard 90.1–2007 include a SEER of 10.0 for cooling mode and a HSPF of 6.8 for

conditioners and central air-conditioning heat pumps less than 65,000 Btu per hour (cooling capacity), split systems, shall be 13.0;

(ii) the minimum seasonal energy efficiency ratio of air-cooled 3-phase electric central air conditioners and central air-conditioning heat pumps less than 65,000 Btu per hour (cooling capacity), single package, shall be 13.0;

(iii) the minimum heating seasonal performance factor of air-cooled 3-phase electric central air-conditioning heat pumps less than 65,000 Btu per hour (cooling capacity), split systems, shall be 7.7; and

(iv) the minimum heating seasonal performance factor of air-cooled 3-phase electric central air-conditioning heat pumps less than 65,000 Btu per hour (cooling capacity), single package, shall be 7.7.'' (42 U.S.C. 6313(a)(7)(D)).

[9] DOE published a final rule amending the energy conservation standards for residential central air conditioners and heat pumps on January 22, 2001. 66 FR 7170 (Jan. 22, 2001).

[10] ASHRAE Standard 90.1–2007 includes efficiency levels for three-phase and single-phase SDHV air-cooled air conditioners and heat pumps used in commercial buildings. ASHRAE Standard 90.1–2007 also includes a footnote to these provisions, which indicates that the single-phase versions of this equipment are regulated as residential products under 10 CFR 430.32(c)(2).

equipment. ASHRAE aligned these efficiency levels and the corresponding effective dates with the efficiency levels established in EPCA for single-phase residential versions of the same products.[11]

Just as with three-phase through-the-wall air-cooled air conditioners and heat pumps, neither EPCA nor DOE has established a specific definition for commercial ''three-phase SDHV air conditioners and heat pumps.'' In its regulations, DOE defines a residential ''SDHV air-cooled air conditioner or heat pump'' as ''a heating and cooling product that contains a blower and indoor coil combination that: (1) Is designed for and produces at least 1.2 inches of external static pressure when operated at the certified air volume rate of 220–350 CFM [cubic feet per minute] per rated ton of cooling; and (2) When applied in the field, uses high-velocity room outlets generally greater than 1,000 fpm [feet per minute] which have less than 6.0 square inches of free area.'' 10 CFR 430.2.

In terms of equipment construction, commercial and residential SDHV air conditioners and heat pumps utilize the same components in the same configurations to provide space cooling and heating. Commercial versions of SDHV systems are essentially the same as residential versions powered with single-phase electric power, except that they are powered using three-phase electric power.

EPCA does not separate three-phase SDHV air conditioners and heat pumps from other types of small commercial package air-conditioning and heating equipment in its definitions. Therefore, EPCA's definition of ''small commercial package air-conditioning and heating equipment'' would include three-phase SDHV air conditioners and heat pumps. Although EPCA does not use the term ''three-phase SDHV air conditioners and heat pumps,'' the three-phase versions of this equipment, regardless of cooling capacity, fall within the definition of ''small commercial package air-conditioning and heating equipment.'' (42 U.S.C. 6311(8)(A)–(B)) There is no language in EPCA to indicate that three-phase SDHV air conditioners and heat pumps are a separate type of covered equipment.

The Federal energy conservation standards for three-phase, commercial package air conditioners and heat pumps less than 65,000 Btu/h were established by EISA 2007 for products manufactured on or after June 19, 2008. Specifically, section 314(b)(4)(C) of EISA 2007 amended section 342(a) of EPCA (42 U.S.C. 6313(a)) by adding new provisions for three-phase commercial package air conditioners with a cooling capacity of less than 65,000 Btu/h. (42 U.S.C. 6313(a)(7)(D)) As mentioned previously, this provision in EISA 2007 mandates seasonal energy efficiency ratios for cooling mode and heating seasonal performance factors for heating mode of air-cooled three-phase electric central air conditioners and central air-conditioning heat pumps with a cooling capacity of less than 65,000 Btu/h. (42 U.S.C. 6313(a)(7)(D)) Three-phase SDHV air conditioners and heat pumps are a smaller subset of three-phase commercial package air conditioners with a cooling capacity of less than 65,000 Btu/h and were not explicitly excluded from the standards in section 314(b)(4)(C) of EISA 2007. Because EISA 2007 set such standards, and because they are more stringent than the levels contained in ASHRAE Standard 90.1–2007 for those products, DOE must continue to implement the EISA 2007 standards and will not consider amended standard levels based on ASHRAE's action.

Thus, manufacturers of three-phase SDHV equipment must follow the energy conservation standards in EISA 2007. DOE affirms that the EISA 2007 efficiency levels for three-phase small commercial package air-conditioning and heating equipment less than 65,000 Btu/h apply to three-phase SDHV air-cooled air conditioners and heat pumps with a cooling capacity less than 65,000 Btu/h. Accordingly, DOE is not conducting any further analysis on three-phase SDHV equipment. DOE notes that it does not have authority to grant exception relief from the prescriptive standard levels set by EISA 2007 for three-phase SDHV air-cooled air conditioners and heat pumps, nor can it provide a waiver from the test procedure as a means of avoiding this statutory requirement.

3. Commercial Package Air-Cooled Air Conditioners With a Cooling Capacity at or Above 760,000 Btu per Hour

EPCA specifies energy conservation standards for small (cooling capacities at or above 65,000 and less than 135,000 Btu/h), large (cooling capacities at or above 135,000 and less than 240,000 Btu/h), and very large (cooling capacities at or above 240,000 and less than 760,000 Btu/h) commercial package air-cooled air conditioners. (42 U.S.C. 6313(a)(1)–(2), (7)–(9); 10 CFR 431.97) However, there are no Federal energy conservation standards for commercial package air-cooled air conditioners with a cooling capacity at or above 760,000 Btu/h. In contrast, ASHRAE Standard 90.1–2007 sets the energy efficiency levels for commercial package air-cooled air conditioners with a cooling capacity at or above 760,000 Btu/h at 9.7 EER for equipment with electric resistance heating, and 9.5 EER for equipment with any other type of heating or without heating. The efficiency level in ASHRAE Standard 90.1–2007 applies to equipment manufactured on or after January 1, 2010.

Units with capacities at or above 760,000 Btu/h fall outside the definitions of the small, large, and very large commercial package air-cooled air conditioner equipment classes established in EPCA. (42 U.S.C. 6311(8)(A)–(D); 10 CFR 431.92) Therefore, DOE has concluded that it does not have the authority to review the efficiency level for that equipment. Accordingly, DOE is not conducting any further analysis on commercial package air-cooled air conditioners with a cooling capacity at or above 760,000 Btu/h.

4. Water-Cooled and Evaporatively-Cooled Commercial Package Air Conditioners and Heat Pumps With a Cooling Capacity at or Above 135,000 Btu/h and Less Than 240,000 Btu/h

The Federal energy conservation standard for water-cooled and evaporatively-cooled commercial package air conditioners and heat pumps with a cooling capacity at or above 135,000 Btu/h and less than 240,000 Btu/h requires an EER no less than 11.0 for equipment manufactured on or after October 29, 2004. 10 CFR 431.97, Table 1.

ASHRAE Standard 90.1–2007 includes the same efficiency level for water-cooled and evaporatively-cooled commercial package air conditioners and heat pumps with a cooling capacity at or above 135,000 Btu/h and less than 240,000 Btu/h that use electric

[11] DOE notes that the residential versions of SDHV are subject to an exception issued by DOE's Office of Hearing and Appeals (OHA). On October 14, 2004, OHA granted an exception to SpacePak and Unico, Inc., authorizing them to manufacture SDHV systems (as defined in 10 CFR 430.2) with a SEER of no less than 11.0 and a heating seasonal performance factor (HSPF) of 6.8. The exception relief will remain in effect until DOE modifies the general energy efficiency standard for central air conditioners and establishes a different standard for SDHV systems that complies with EPCA. However, this exception only applies to the residential single-phase SDHV systems and would, therefore, exclude three-phase SDHV equipment. (DOE's Office of Hearing and Appeals, Decision and Order: Applications for Exception (Oct. 14, 2004) (Available at: *http://www.oha.doe.gov/cases/ee/tee0010.pdf.*))

resistance heating (*i.e.*, an EER no less than 11.0). However, ASHRAE Standard 90.1–2007 specifies a different efficiency level for water-cooled and evaporatively-cooled commercial package air conditioners and heat pumps with a cooling capacity at or above 135,000 Btu/h and less than 240,000 Btu/h that use any type of heating other than electric resistance (*i.e.*, an EER no less than 10.8).

DOE reviewed a final rule published on January 12, 2001 (hereafter referred to as the January 2001 final rule) which considered ASHRAE Standard 90.1–1999 to determine the efficiency levels applicable to water-cooled and evaporatively-cooled commercial package air conditioners and heat pumps with a cooling capacity at or above 135,000 Btu/h and less than 240,000 Btu/h. 66 FR 3336, 3340 (Jan. 12, 2001). DOE adopted the efficiency levels specified by ASHRAE Standard 90.1–1999 for water-cooled and evaporatively-cooled commercial package air conditioners and heat pumps with a cooling capacity at or above 135,000 Btu/h and less than 240,000 Btu/h in the January 2001 final rule. *Id.* at 33340. The January 2001 final rule did not establish different efficiency levels for different types of supplemental heating systems associated with this equipment. *Id.* All large water-cooled and evaporatively-cooled commercial package air conditioners and heat pumps were subject to the same efficiency level of 11.0 EER regardless of heating type. ASHRAE Standard 90.1–1999 did establish different efficiency levels applicable to water-cooled and evaporatively-cooled commercial package air conditioners and heat pumps with a cooling capacity at or above 135,000 Btu/h and less than 240,000 Btu/h for different types of supplemental heating systems.

DOE has concluded that the ASHRAE Standard 90.1–2007 efficiency levels for water-cooled and evaporatively-cooled commercial package air conditioners and heat pumps with a cooling capacity at or above 135,000 Btu/h and less than 240,000 Btu/h that utilize electric resistance heating or no heating would maintain the efficiency level in the current Federal energy conservation standard. ASHRAE Standard 90.1–2007 would effectively lower the efficiency levels (*i.e.*, EER) required by EPCA and allow increased energy consumption for equipment that utilize any type of heating other than electric resistance. Not only has ASHRAE Standard 90.1–2007 not increased the efficiency levels for water-cooled and evaporatively-cooled commercial package air conditioners and heat pumps with a cooling capacity at or above 135,000 Btu/h and less than 240,000 Btu/h, but it could result in backsliding for those products that utilize any type of heating other than electric resistance. Accordingly, DOE is not conducting any further analysis on water-cooled and evaporatively-cooled commercial package air conditioners and heat pumps with a capacity at or above 135,000 Btu/h and less than 240,000 Btu/h.

5. Water-Cooled and Evaporatively-Cooled Commercial Package Air Conditioners and Heat Pumps With a Cooling Capacity at or Above 240,000 Btu/h and Below 760,000 Btu/h

Under EPCA, ''commercial package air-conditioning and heating equipment'' means ''air-cooled, water-cooled, evaporatively cooled, or water source (not including ground water source) electrically operated, unitary central air conditioners and central air-conditioning heat pumps for commercial application.'' (42 U.S.C. 6311(8)(A); 10 CFR 431.92) EPCA goes on to define ''very large commercial package air-conditioning and heating equipment'' as commercial package air-conditioning and heating equipment that is rated at or above 240,000 Btu per hour and below 760,000 Btu per hour (cooling capacity). (42 U.S.C. 6311(8)(D); 10 CFR 431.92) Although water-cooled and evaporatively-cooled commercial package air conditioners and heat pumps with a cooling capacity at or above 240,000 Btu/h and less than 760,000 Btu/h fall within the definition of very large commercial package air-conditioning and heating equipment, EPCA does not specify Federal energy conservation standards for this equipment class. (EPCA set standards for air-cooled systems only, under 42 U.S.C. 6313(a)(7)–(9).) ASHRAE added this new equipment class to ASHRAE Standard 90.1–2007, setting efficiency levels at 11.0 EER for equipment with electric resistance heating or without heating, and at 10.8 EER for equipment with all other types of heating. Under EPCA, DOE must either adopt the efficiency level specified in ASHRAE Standard 90.1–2007 for this new class of equipment, or consider a more stringent level that would result in significant additional energy savings and is technologically feasible and economically justified. (42 U.S.C. 6313(a)(6))

For the July 2008 NODA, DOE reviewed the market for water-cooled and evaporatively-cooled commercial package air conditioners and heat pumps and found that manufacturers offer few models. 73 FR 40770, 40779–80 (July 16, 2008). For this study, DOE surveyed the AHRI Directory of Certified Product Performance, but did not identify any equipment on the market with a cooling capacity at or above 240,000 Btu/h. *Id.* DOE stated in the July 2008 NODA that there are no energy savings associated with this class because there is no equipment being manufactured in this class, and therefore, it is not possible to assess the potential for additional energy savings beyond the levels anticipated in ASHRAE Standard 90.1–2007. *Id.* Thus, DOE did not perform a potential energy-savings analysis on this equipment type. DOE specifically sought comment from interested parties on the market and energy savings potential for this equipment type in the July 2008 NODA. 73 FR 40770, 40780 and 40791 (July 16, 2008).

In response to the March 2008 NODA, DOE did not receive any comments on the market for water-cooled and evaporatively-cooled commercial package air conditioners and heat pumps with a cooling capacity at or above 240,000 Btu/h. In absence of a market for water-cooled and evaporatively-cooled equipment in the given capacity range, DOE cannot perform an economic and energy savings analysis.

However, DOE is proposing to adopt the ASHRAE Standard 90.1–2007 efficiency levels for water-cooled and evaporatively-cooled commercial package air conditioners and heat pumps with a cooling capacity at or above 240,000 Btu/h and less than 760,000 Btu/h as required by EPCA. (42 U.S.C. 6313(a)(6)(A)(ii)) Even though ASHRAE specified efficiency levels for water-cooled and evaporatively-cooled commercial package air conditioners and heat pumps with a cooling capacity at or above 240,000 Btu/h, DOE is specifying an upper bound to the cooling capacity since DOE's authority under the very large commercial package air-conditioning and heating equipment definition only covers equipment with cooling capacities less than 760,000 Btu/h. (42 U.S.C. 6311(8)(D)(ii)) DOE is proposing to add subsection (d) to 10 CFR Part 431.97, which will specify the proposed standards and effective dates for this equipment. These standards would be applicable to any water-cooled and evaporatively-cooled commercial package air conditioner or heat pump with a cooling capacity at or above 240,000 Btu/h and less than 760,000 Btu/h manufactured on or after the effective date, which is three years after the effective date specified in ASHRAE

Standard 90.1–2007. (42 U.S.C. 6313(a)(6)(D)(ii)) Since ASHRAE Standard 90.1–2007 does not explicitly set an effective date for this equipment, DOE is interpreting the effective date of amended standards to be three years from the publication of ASHRAE Standard 90.1–2007 (*i.e.*, January 10, 2011).

C. Commercial Packaged Boilers

EPCA defines a ''packaged boiler'' as ''a boiler that is shipped complete with heating equipment, mechanical draft equipment, and automatic controls; usually shipped in one or more sections.'' (42 U.S.C. 6311(11)(B)) In its regulations, DOE further refined the ''packaged boiler'' definition to exclude a boiler that is custom designed and field constructed. 10 CFR 431.102. Additionally, if the boiler is shipped in more than one section, the sections may be produced by more than one manufacturer, and may be originated or shipped at different times and from more than one location. *Id.* In the marketplace, there are various different types of commercial packaged boilers, which can be distinguished based on the input capacity size (*i.e.*, small or large), fuel type (*i.e.*, oil or gas), output (*i.e.*, hot water or steam), and draft type (*i.e.*, natural draft or other).

However, the current Federal energy conservation standards separate commercial packaged boilers only by the type of fuel used by the boiler, creating two equipment classes: (1) Gas-fired, and (2) oil-fired. (42 U.S.C. 6313(a)(4)(C)–(D); 10 CFR 431.87) As set forth below, EPCA specified minimum Federal standards for commercial packaged boilers manufactured on or after January 1, 1994. *Id.* The minimum combustion efficiency at the maximum rated capacity of a gas-fired packaged boiler with capacity of 300,000 Btu/h (300 kBtu/h) or more must be 80 percent. (42 U.S.C. 6313(a)(4)(C); 10 CFR 431.87(a)) The minimum combustion efficiency at the maximum rated capacity of an oil-fired packaged boiler with capacity of 300,000 Btu/h or more must be 83 percent. (42 U.S.C. 6313 (a)(4)(D); 10 CFR 431.87(b))

In contrast, ASHRAE has adopted a different approach when considering commercial packaged boilers, as described below. ASHRAE Standard 90.1–2007 further divided these two equipment classes into the following ten classes:

- Small gas-fired hot water boilers;
- Small gas-fired steam, all except natural draft boilers;
- Small gas-fired steam, natural draft boilers;
- Small oil-fired hot water boilers;
- Small oil-fired steam boilers;
- Large gas-fired hot water boilers;
- Large gas-fired steam, all except natural draft boilers;
- Large gas-fired steam, natural draft boilers;
- Large oil-fired hot water boilers; and
- Large oil-fired steam boilers.

Table IV.1 shows the ten equipment classes and efficiency levels established by ASHRAE.

TABLE IV.1—ASHRAE STANDARD 90.1–2007 ENERGY EFFICIENCY LEVELS FOR COMMERCIAL PACKAGED BOILERS

Equipment type	Size category (Input kBtu/h)	ASHRAE standard 90.1–2007 (effective 3/2/2010)*	ASHRAE standard 90.1–2007 (effective 3/2/2020)*
Small Gas-fired Hot Water	300–2,500	E_T = 80%	E_T = 80%
Small Gas-fired Steam All Except Natural Draft	300–2,500	E_T = 79%	E_T = 79%
Small Gas-fired Steam Natural Draft	300–2,500	E_T = 77%	E_T = 79%
Small Oil-fired Hot Water	300–2,500	E_T = 82%	E_T = 82%
Small Oil-fired Steam	300–2,500	E_T = 81%	E_T = 81%
Large Gas-fired Hot Water	>2,500	E_C = 82%	E_C = 82%
Large Gas-fired Steam All Except Natural Draft	>2,500	E_T = 79%	E_T = 79%
Large Gas-fired Steam Natural Draft	>2,500	E_T = 77%	E_T = 79%
Large Oil-fired Hot Water	>2,500	E_C = 84%	E_C = 84%
Large Oil-fired Steam	>2,500	E_T = 81%	E_T = 81%

*E_C = combustion efficiency; E_T = thermal efficiency.

Of particular relevance here, ASHRAE changed the metric for determining energy efficiency for five equipment classes of small commercial packaged boilers and three equipment classes of large commercial packaged boilers in ASHRAE Standard 90.1–2007. Whereas the Federal energy conservation standards for these eight equipment classes are expressed in terms of combustion efficiency (42 U.S.C. 6313(a)(4)), the efficiency levels in ASHRAE Standard 90.1–2007 are expressed in terms of thermal efficiency. ASHRAE initially attempted to transition small commercial boilers from an energy conservation standard using the combustion efficiency metric to a standard using the thermal efficiency metric the last time the efficiency levels for commercial packaged boilers in ASHRAE Standard 90.1 were revised, in 1999 (*i.e.*, ASHRAE Standard 90.1–1999). However, DOE was unable to accept those efficiency levels due to EPCA's anti-backsliding clause, which resulted in DOE leaving the existing standard levels in place in terms of combustion efficiency, as explained below. 72 FR 10038, 10043 (March 7, 2007). The sections below detail the following: (1) The differences between the thermal and combustion efficiency metrics; (2) the analysis done for DOE's review of small commercial packaged boiler efficiency levels in ASHRAE Standard 90.1–1999; (3) the market analysis developed for DOE's current review of the efficiency levels in ASHRAE Standard 90.1–2007; (4) the preliminary conclusions regarding the market analysis; and (5) DOE's conclusions regarding the efficiency levels contained in ASHRAE Standard 90.1–2007 for commercial packaged boilers.

1. Efficiency Metric Description (Combustion Efficiency and Thermal Efficiency)

In general, the energy efficiency of a product is a function of the relationship between the product's output of services and its energy input. A boiler's output of services is measured largely by the energy content of its output (steam or hot water). Consequently, its efficiency is understood to be the ratio between its energy output and its energy input, with the energy output being calculated as the energy input minus the energy lost in producing the output. A boiler's energy losses consist of energy that escapes through its flue (commonly referred to as ''flue losses''), and of energy that escapes into the area surrounding the boiler (commonly referred to as jacket losses). However, the combustion efficiency descriptor used for commercial packaged boilers in EPCA only accounts for flue losses, and is defined as ''100 percent minus percent flue loss.'' (42 U.S.C. 6313(a)(4)(C)–(D); 10 CFR 431.82) The thermal efficiency descriptor used in ASHRAE Standard 90.1–2007 accounts for jacket losses as well as flue losses, and can be considered combustion efficiency minus jacket loss. Because all boilers will have at least some jacket losses (even if small) and because thermal efficiency takes these losses into account, the thermal efficiency for a particular boiler, as measured under the same set of conditions, must necessarily be lower than its combustion efficiency.

While the above-described relationship exists between combustion and thermal efficiencies, there is no direct mathematical correlation between these two measures of efficiency. The factors that contribute to jacket loss (*e.g.*, the boiler's design and materials) have little or no direct bearing on combustion efficiency. The lack of correlation between combustion efficiency and thermal efficiency causes difficulties in comparing an energy conservation standard that is based on thermal efficiency to an energy conservation standard based on combustion efficiency. However, when DOE last evaluated the change in efficiency metric for commercial packaged boilers in response to ASHRAE Standard 90.1–1999, it developed a methodology to determine quantitatively whether backsliding could occur, as explained in section IV.C.2 below. DOE uses the methodology developed for determining backsliding in DOE's review of ASHRAE Standard 90.1–1999, along with the consideration of several other factors (described in detail in the sections below) to evaluate the appropriateness of the efficiency levels for commercial packaged boilers specified by ASHRAE Standard 90.1–2007.

2. Analysis of Energy Efficiency Levels in ASHRAE Standard 90.1–1999

Prior to publishing ASHRAE Standard 90.1–2007, the last time ASHRAE revised the efficiency levels for commercial packaged boilers in ASHRAE Standard 90.1 occurred in 1999 (ASHRAE Standard 90.1–1999). DOE reviewed the efficiency levels in ASHRAE Standard 90.1–1999 for small commercial packaged boilers and issued a Notice of Data Availability (NODA) in March 2006 (here after referred to the March 2006 NODA) to present its findings. 71 FR 12634 (March 13, 2006). In the March 2006 NODA, DOE examined whether the thermal efficiencies for small gas-fired and small oil-fired commercial packaged boilers specified in ASHRAE Standard 90.1–1999 would result in a decrease in the required efficiency for particular piece of equipment compared to the Federal energy conservation standard established by EPCA. *Id.*

For the 2006 analysis, DOE examined the average thermal efficiency of small commercial packaged boiler models that were minimally compliant with the Federal standard. Id. DOE defined ''minimally compliant'' as being within one percent of the minimum combustion efficiency set by EPCA. 71 FR 12634, 12684 (March 13, 2006). DOE specifically examined the minimally complying boilers because the anti-backsliding clause in EPCA mandates that DOE not prescribe a standard that ''decreases the minimum required energy efficiency.'' (42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(1)) [12] DOE determined that it would be appropriate to examine the boilers currently at the minimum required combustion efficiency established in EPCA to determine whether the potential adoption of the thermal efficiency levels in ASHRAE Standard 90.1, as Federal minimums, would allow for a decrease in the efficiency of those models.

DOE calculated the average thermal efficiency of the boilers classified as minimally compliant and compared it to the thermal efficiency specified in ASHRAE Standard 90.1–1999. DOE found that the thermal efficiency levels for small commercial packaged boilers specified in ASHRAE Standard 90.1–1999 were significantly lower (*i.e.*, 1.8 percent lower for small gas-fired boilers and 3.1 percent lower for small oil-fired boilers) than the average thermal efficiency of the minimally complying models on the market. 71 FR 12634, 12640 (March 13, 2006). DOE stated in the March 2006 NODA that this analysis did not establish directly that the small boiler efficiency levels in Standard 90.1–1999 were lower than those in EPCA because EPCA's combustion efficiency standards for this equipment set maximum amounts of flue losses, but do not regulate jacket losses. *Id.* Thermal efficiency is a function of both flue losses (*i.e.*, combustion efficiency) and jacket losses. 71 FR 12634, 12640 (March 13, 2006). Since these two losses can be independent of one another, in theory, a small boiler could meet or exceed EPCA's applicable combustion efficiency standard, but have sufficiently large jacket losses that cause it to have a thermal efficiency lower than the efficiency levels specified in ASHRAE Standard 90.1–1999. *Id.* Thus, DOE stated that adoption of ASHRAE Standard 90.1–1999 thermal efficiency levels would not have directly decreased the minimum combustion efficiencies required in EPCA for small boilers. *Id.* However, the adoption of the ASHRAE Standard 90.1–1999 thermal efficiency levels for small boilers would have had the effect of lowering minimum combustion efficiency levels required by EPCA. *Id.*

DOE outlined its basis for rejecting the efficiency levels for small commercial boilers specified by ASHRAE Standard 90.1–1999 in the March 2006 NODA. The basis for DOE's decision was as follows:

> The thermal efficiency of a small commercial boiler is a function of (1) the manufacturer's compliance with the applicable EPCA combustion efficiency standard and (2) decisions it makes independent of EPCA concerning the boiler's design, materials, and other features that affect jacket losses. Although EPCA does not regulate jacket losses, for both small gas-fired and oil-fired commercial packaged boilers with relatively low combustion efficiencies, manufacturers restricted jacket losses to levels that kept thermal efficiencies, within an average of 2.6 percentage points below their combustion efficiencies. [DOE] does not believe its adoption of Standard 90.1–1999's thermal efficiency levels for small commercial boilers would result in manufacturers' increasing the amount of jacket losses for this equipment. No reason is readily apparent as to why manufacturers would alter their current practices to make equipment that has greater jacket losses, even if mandatory thermal efficiency levels were set below the levels that equipment was currently achieving. However, setting thermal efficiency standards at levels lower than the thermal efficiencies of existing equipment could potentially result in equipment with lower combustion efficiencies. This allows for the possibility of equipment having lower efficiencies than permitted by EPCA, meaning that the current Federal minimum (required) efficiency would be decreased.
>
> For these reasons, it appears to [DOE] that EPCA precludes it from prescribing as amended Federal energy conservation standards the ASHRAE Standard 90.1–1999 thermal efficiency levels (one for gas-fired and the other for oil-fired equipment) for small commercial packaged boilers because each would decrease the minimum required efficiency of the equipment. (42 U.S.C. 6313(a)(6)(B)(ii))

71 FR 12634; 12641 (March 13, 2006).

[12] At the time, a different anti-backsliding clause was in effect for commercial boilers, although it contained language identical to that quoted here in the text (previously, 42 U.S.C. 6313(a)(6)(B)(ii) prior to the enactment of EISA 2007).

3. Analysis of Energy Efficiency Levels in ASHRAE Standard 90.1–2007

For its current analysis of the efficiency levels for commercial packaged boilers in ASHRAE Standard 90.1–2007, DOE based the preliminary market assessment and potential energy savings analysis performed for the July 2008 NODA solely on the information provided by the January 2008 edition of the I=B=R Ratings for Boilers, Baseboard Radiation, Finned Tube (Commercial) Radiation and Indirect-Fired Water Heaters[13] (referred to hereafter as the January 2008 I=B=R Directory).

Regarding the preliminary analysis performed in the July 2008 NODA, AHRI stated its belief that the January 2008 I=B=R Directory is incomplete because participation in the certification program and listing in the directory is voluntary and some manufacturers do not participate. (AHRI, No. 3 at p.3) Burnham Hydronics made a similar assertion, pointing out that Bryan Steam's (another Burnham Holdings subsidiary) boilers are not listed in the January 2008 I=B=R Directory (Burnham Hydronics, No. FDMS DRAFT 0003 at pp. 1–2).

In response to these comments and in an effort to enhance its analysis, DOE made further efforts to identify commercial boiler manufacturers along with commercial boiler equipment produced by these manufacturers that are not included in the January 2008 I=B=R Directory. DOE examined the Canadian Standards Association-International (CSA-International) certified product listings and the South Coast Air Quality Management District (SCAQMD) list of certified boiler equipment. For the CSA-International product listings, DOE only identified those manufacturers that certified their equipment to U.S. standards. From these two product listings, DOE went to each manufacturer's Web site and verified that they produced equipment that meets the definition of commercial packaged boilers. From this review, DOE identified 16 additional commercial boiler manufacturers, as listed in section V.B.3.b. DOE also identified manufacturers with other model offerings not included in the January 2008 I=B=R Directory. When DOE found equipment that fit the definition of ''commercial packaged boiler'' and found efficiency ratings reported for that equipment in manufacturer literature, DOE included the equipment in its database of commercial boiler equipment used for this analysis (hereafter referred to as DOE's commercial boiler database).

However, for today's analysis of commercial packaged boilers, DOE did not use all of the models in the January 2008 I=B=R Directory or in its own database. DOE filtered out any boiler models that did not contain all of the information needed for DOE's analysis or that appeared to have erroneous efficiency ratings before analyzing commercial packaged boiler data for its market analysis. DOE divided the boilers into the equipment classes in which they would be classified to apply ASHRAE Standard 90.1–2007. Then, for the eight equipment classes where ASHRAE Standard 90.1–2007 specifies an efficiency level in thermal efficiency, DOE filtered out boilers that did not contain a thermal efficiency rating. DOE did not filter out models without a thermal efficiency rating for the two equipment classes where ASHRAE Standard 90.1–2007 specifies an efficiency level in combustion efficiency. Next, for all equipment classes, DOE eliminated any boilers where both thermal and combustion efficiency were provided, but the thermal efficiency was higher than the combustion efficiency. DOE eliminated those boilers because it is physically impossible for a boiler to have a thermal efficiency that is higher than its combustion efficiency, which led DOE to conclude that the efficiency ratings for those boilers may be inaccurate.[14] See chapter 2 of the NOPR Technical Support Document (TSD)[15] for other market data regarding DOE's commercial packaged boiler database of equipment.

To review the commercial packaged boiler efficiency levels specified in ASHRAE Standard 90.1–2007, DOE first developed a quantitative analysis similar to that conducted for the March 2006 NODA for the commercial boiler equipment classes specified in ASHRAE Standard 90.1–2007. DOE analyzed the available market data to estimate the percentage of the market held by each equipment class. DOE also examined the percentage of models available on the market below the efficiency levels in ASHRAE Standard 90.1–2007, the average efficiency of models currently available on the market, and the range of efficiencies currently on the market for each equipment class. In addition, for each equipment class with an efficiency metric change, DOE separated out the models that minimally comply with the existing EPCA standard levels (*i.e.*, models with $80 \leq E_C < 81$ for gas-fired boilers and $83 \leq E_C < 84$ for oil-fired boilers), and then calculated the average thermal efficiency of those models for each equipment class based on the thermal efficiencies in DOE's database of market data. Table IV.2 shows the results of DOE's quantitative market analysis for the eight equipment classes where ASHRAE Standard 90.1–2007 specifies a thermal efficiency level, as well as for the two equipment classes where ASHRAE Standard 90.1–2007 specifies a combustion efficiency level.

TABLE IV.2—RESULTS OF DOE'S COMMERCIAL PACKAGED BOILER QUANTITATIVE MARKET ANALYSIS *

Equipment class	Market share**	Current federal energy conservation standard	ASHRAE standard 90.1–2007 efficiency level	Average thermal efficiency of minimally complying boilers	Range of thermal efficiencies of minimally complying boilers	Percentage of market below ASHRAE standard 90.1–2007 efficiency level	Average efficiency of equipment class
Small Gas-fired Hot Water	24.2%	80% E_C	80% E_T	78.3% E_T	77.0%–80.0%	8.9%	84.9% E_T
Small Gas-fired Steam All Except Natural Draft	8.2%	80% E_C	79% E_T	79.6% E_T	79.3%–79.9%	9.0%	80.5% E_T

[13] The Hydronics Institute division of the Air Conditioning, Heating, and Refrigerating Institute, I=B=R Ratings for Boilers, Baseboard Radiation, Finned Tube (Commercial) Radiation, and Indirect-Fired Water Heaters (Jan. 2008). Available at: *http://www.gamanet.org/gama/inforesources.nsf/vAttachmentLaunch/E9E5FC7199EBB1BE85256FA100838435/$FILE/01-08_CBR.pdf.*

[14] These anomalous ratings are likely due to Hydronics Institute's (HI) de-rating procedures, manufacturers' interpolation of results, varying test chambers and instrument calibration among manufacturers, or submittal of erroneous ratings.

[15] Available at: *http://www1.eere.energy.gov/buildings/appliance_standards/commercial/ashrae_products_docs_meeting.html.*

TABLE IV.2—RESULTS OF DOE'S COMMERCIAL PACKAGED BOILER QUANTITATIVE MARKET ANALYSIS *—Continued

Equipment class	Market share**	Current federal energy conservation standard	ASHRAE standard 90.1–2007 efficiency level	Average thermal efficiency of minimally complying boilers	Range of thermal efficiencies of minimally complying boilers	Percentage of market below ASHRAE standard 90.1–2007 efficiency level	Average efficiency of equipment class
Small Gas-fired Steam Natural Draft	12.6%	80% E_C	77% E_T (2010) 79% E_T (2020)	76.7% E_T	75.4%–78.6%	26.5% (2010) 77.6% (2020)	77.4% E_T
Small Oil-fired Hot Water	6.8%	83% E_C	82% E_T	80.7% E_T	79.2%–81.8%	29.3%	83.8% E_T
Small Oil-fired Steam	11.4%	83% E_C	81% E_T	81.6% E_T	79.7%–83.6%	17.5%	82.2% E_T
Large Gas-fired Hot Water	3.9%	80% E_C	82% E_C			17.0%	83.6% E_C
Large Gas-fired Steam All Except Natural Draft	7.1%	80% E_C	79% E_T	79.4% E_T	78.8%–79.9%	17.7%	80.6% E_T
Large Gas-fired Steam Natural Draft	9.1%	80% E_C	77% E_T (2010) 79% E_T (2020)	78.1% E_T	75.4%–79.4%	3.3% (2010) 57.7% (2020)	78.9% E_T
Large Oil-fired Hot Water	1.9%	83% E_C	84% E_C			0%	86.5% E_C
Large Oil-fired Steam	15.0%	83% E_C	81% E_T	81.9% E_T	81.1%–83.5%	0%	82.8% E_T

* E_C is combustion efficiency and E_T is thermal efficiency.
** DOE calculated the percentage of boilers in each equipment class based on the number of models it analyzed for that equipment class divided by the total number of models it analyzed in all equipment classes. These totals were taken after all filters and modifications to DOE's commercial packaged boiler database, described in section 3, were applied.

4. Preliminary Conclusions From Market Analysis for Commercial Packaged Boilers

Based solely on the quantitative analysis, DOE found that the average thermal efficiency of the minimally compliant equipment was higher than the efficiency level specified by ASHRAE Standard 90.1–2007 for five of the commercial packaged boiler equipment classes, as shown in Table IV.2. This indicates that it would be theoretically possible for backsliding to occur for those equipment classes. As explained below, several interested parties commented on DOE's method for determining backsliding in response to the preliminary analysis presented in the July 2008 NODA. However, when DOE also evaluated a number of other considerations (including accuracy of the thermal efficiency ratings), it tentatively concluded that backsliding is unlikely to occur for any of the classes in question. This topic is discussed in further detail below.

Burnham Hydronics stated that DOE could not use the least efficient boiler on the market as the *de facto* standard for determining whether a standard is backsliding. (Burnham Hydronics, No. FDMS DRAFT 0003 at p. 2) Burnham Hydronics asserted that ''DOE's legal framework defines backsliding in terms of 'maximum *allowable* energy use,' not 'maximum energy actually used by an individual product on the market at a particular moment in time.' '' (Burnham Hydronics, No. FDMS DRAFT 0003 at p. 2) To determine that an efficiency level is backsliding, Burnham Hydronics stated that DOE must ''prove that a less efficient boiler could not be built under the current [F]ederal standards [than could be built if the efficiency levels in ASHRAE Standard 90.1–2007 were adopted as Federal energy conservation standards].'' (Burnham Hydronics, No. FDMS DRAFT 0003 at pp. 2)

In response, DOE does not agree with Burnham's assertion that to determine backsliding DOE must prove that a less efficient boiler could not be built under the Federal standards than could be built if the efficiency levels in ASHRAE Standard 90.1–2007 were adopted as Federal energy conservation standards. EPCA's anti-backsliding clause states, ''[t]he Secretary may not prescribe any amended standard which increases the maximum allowable energy use * * * or decreases the minimum required energy efficiency of a covered product.'' (42 U.S.C. 6295(o)(1); 42 U.S.C. 6316(a)) Because the Federal standard levels for commercial packaged boilers are specified in terms of an energy efficiency requirement rather than an allowable energy use requirement, DOE believes that the applicable part of EPCA's anti-backsliding clause here is the requirement that the Secretary may not prescribe any amended standard that ''decreases the minimum required efficiency'' of this equipment. DOE believes that to determine backsliding it must prove that the efficiency levels in ASHRAE Standard 90.1–2007 would allow for the construction of equipment with lower combustion efficiencies than the current Federal standards require, thereby decreasing the minimum required energy efficiency. Therefore, to determine backsliding, DOE examined whether the thermal efficiency levels in ASHRAE Standard 90.1–2007 would effectively result in a decrease in the required combustion efficiencies currently specified in EPCA (*i.e.*, 80 percent combustion efficiency for gas-fired equipment and 83 percent combustion efficiency for oil-fired equipment).

Further, Federal standards currently do not regulate the thermal efficiency or the jacket losses of commercial packaged boilers. Consequently, although it is not practical, a boiler could theoretically be constructed with 100 percent jacket losses under the Federal standards, resulting in an infinite amount of energy use. If DOE were to examine ''the maximum allowable energy use,'' as Burnham suggests, then any thermal efficiency level would not constitute backsliding because there are no existing Federal energy conservation standards regulating the jacket losses. Therefore, DOE has investigated the potential for backsliding with respect to the energy efficiency of the equipment rather than the allowable energy use (as noted above).

DOE does note, however, that models currently being manufactured with the highest jacket losses (*i.e.*, the models with the lowest thermal efficiencies) represent the practical limit to the amount of jacket losses that occur in commercial boilers. DOE also notes that there is equipment manufactured with thermal efficiencies lower than the thermal efficiency levels specified by ASHRAE Standard 90.1–2007, which would create the need for manufacturers to discontinue or redesign certain models to meet the efficiency levels in ASHRAE Standard 90.1–2007 if those levels are adopted as Federal minimums. Because certain models manufactured under the current Federal standards would be discontinued or replaced with higher-efficiency models if the ASHRAE Standard 90.1–2007 levels were adopted as Federal minimums, DOE recognizes that the ASHRAE Standard 90.1–2007 efficiency levels represent an increase in efficiency and a decrease in energy use when compared to the EPCA levels.

AHRI stated that the criterion to determine backsliding (where a specific minimum thermal efficiency requirement is considered less stringent if it might theoretically allow a model to have a combustion efficiency lower than the current minimum combustion efficiency requirement) is overly stringent because there is no direct mathematical correlation between combustion and thermal efficiency. (AHRI, No. 3 at p. 2)

DOE considered both Burnham Hydronics' and AHRI's comments when determining whether the efficiency levels for commercial packaged boilers are in violation of EPCA's anti-backsliding clause. DOE considered the difference between the average thermal efficiency of minimally-complying models and the efficiency levels specified in ASHRAE Standard 90.1–2007. DOE used the average thermal efficiency because DOE found there was a range of thermal efficiencies that correspond to the minimally-complying models. DOE found that the difference is very small (between 0.4 and 0.9 percent) for those equipment classes where it is believed that backsliding could potentially occur. Therefore, there are several other important issues to consider in determining whether the efficiency levels specified in ASHRAE Standard 90.1–2007 are, in fact, backsliding. DOE also considered the uncertainty of the reported thermal efficiency ratings, the benefit of switching to an energy conservation standard using a thermal efficiency metric, and the overall energy savings that could result from adopting the ASHRAE Standard 90.1–2007 efficiency levels for commercial packaged boilers. Each of these considerations is discussed below.

a. Accuracy of Thermal Efficiency Ratings

The Federal energy conservation standards for commercial packaged boilers are expressed only using the combustion efficiency metric. 10 CFR 431.86. Although the industry standard incorporated by reference in the applicable DOE test procedure also contains a test for thermal efficiency, DOE's test procedures only specify that manufacturers need to conduct the combustion efficiency test for determining the energy efficiency of commercial packaged boilers. *Id.* Consequently, all manufacturers test for combustion efficiency, but only some of the manufacturers test for thermal efficiency. Of the manufacturers that report results for thermal efficiency, only some actually test for thermal efficiency, while the others estimate it. The method of estimation can vary from one manufacturer to another and is not described in manufacturer literature. The fact that a requirement to test and rate the thermal efficiency of commercial packaged boilers in accordance with an approved DOE test procedure does not exist brings into question the validity of the reported values for thermal efficiency. The reported thermal efficiency ratings are the basis for the vast majority of DOE's quantitative analysis for this equipment. Since DOE has no way of determining which thermal efficiency ratings are the result of actual testing and which are simply manufacturer estimates, DOE cannot be absolutely certain of the accuracy and validity of the thermal efficiency ratings used in its analyses. In fact, when performing an analysis of its data, DOE had to exclude nearly one-fifth of the ratings because they appeared to be erroneous.[16] However, with the exclusion of the models with erroneous ratings and the uncertainties in accuracy of the considered ratings, DOE believes that it has adequately controlled for the potential sources of error and that the 2008 I=B=R Directory and manufacturer catalogs represent the best available sources of information that could be used for the analyses that DOE must conduct in this rulemaking.

As mentioned previously, AHRI stated that DOE's analysis relied too heavily on the information presented in the 2008 I=B=R Directory. AHRI stated that the directory is incomplete because participation in the certification program and listing in the directory is voluntary and some manufacturers do not participate. Because the program does not require a manufacturer to list all the models that come within the scope of the program, AHRI asserted that the commercial boiler listings are incomplete, and stated that it can be assumed manufacturers do not list their least-efficient offerings. Further, AHRI stated that due to anomalous combustion and thermal listings caused by a variety of testing issues, the values from the tests cannot be used definitively to evaluate the true relationship between combustion and thermal efficiency for a specific listing. (AHRI, No. 3 at pp. 3–4)

Burnham Hydronics also stated that the I=B=R Directory is unsuitable for use as the basis for DOE's analysis. Burnham Hydronics stated that the I=B=R Directory does not consistently represent the relationship between thermal and combustion efficiency. (Burnham Hydronics, No. FDMS DRAFT 0003 at pp. 1–2)

DOE agrees with the comments made by AHRI and Burnham Hydronics, and recognizes the inconsistent relationship between combustion and thermal efficiencies listed in the January 2008 I=B=R Directory. However, because no other widely-recognized source for commercial packaged boiler ratings exists, DOE relied on the January 2008 I=B=R Directory and manufacturers' catalogs as its primary sources for its analysis. Whenever possible, DOE checked the efficiency ratings in the January 2008 I=B=R Directory against manufacturers' literature for consistency. Also, although manufacturers are not required to test for thermal efficiency and report it to the I=B=R Directory, DOE believes the majority of the ratings in the I=B=R Directory are valid. DOE believes the I=B=R Directory, with the addition of boiler models from manufacturers that are not included from the directory, provides a good proxy of what the thermal efficiency ratings would be if all commercial boiler models were tested and rated according to the Hydronics Institute (HI) BTS–2000 test procedure for thermal efficiency (*i.e.*, the industry standard incorporated by reference in the DOE test procedure for these products).

Once DOE has determined the efficiency levels in ASHRAE Standard 90.1–2007 for commercial packaged boilers represent, on average, an increase in energy efficiency when

[16] These boiler models list a thermal efficiency rating greater than its combustion efficiency rating, which is physically impossible. These anomalous ratings are likely due to Hydronics Institute's (HI's) de-rating procedures, manufacturers' interpolation of results, variances in test chambers and instrument calibration among manufacturers, or submittal of erroneous ratings.

compared to the Federal energy conservation standards for this equipment, DOE will further consider amended energy conservation standards at the ASHRAE Standard 90.1–2007 efficiency levels as presented in section V. The limited confidence in the thermal efficiency data being reported for commercial packaged boilers and the lack of a mathematical conversion between thermal and combustion efficiency (explained in section IV.A.1) become an issue when deciding whether efficiency levels in ASHRAE Standard 90.1–2007 are comparable to Federal energy conservation standards, which would be based solely on the average thermal efficiency of minimally-complying equipment. In addition, even if all commercial packaged boilers were tested for thermal efficiency, there would be some margin of error inherent to the testing and measurement of thermal efficiency. For these reasons, DOE believes the difference between the listed thermal efficiencies of the minimally-complying models and the efficiency levels in ASHRAE Standard 90.1–2007 is within the margin of error of this analysis. (See chapter 2 of the NOPR TSD for more details about thermal efficiency of minimally-complying models.)

This identified problem would be mitigated if DOE migrates to a thermal efficiency metric, because DOE would amend its test procedure to require manufacturers to verify their equipment's thermal efficiency ratings through testing in accordance with a DOE-mandated test procedure. A Federal energy conservation standard based on thermal efficiency, rather than combustion efficiency, would also require manufacturers to rate the thermal efficiency of their equipment, thereby resolving the issue of uncertainty in the reporting of the thermal efficiency metric.

b. Benefits of the Thermal Efficiency Metric

In the March 2006 NODA, DOE stated that the thermal efficiency metric provides a preferred method for measuring the efficiency of commercial boilers because it is more inclusive and better reflects the total energy losses of the equipment, as compared to the combustion efficiency metric prescribed by EPCA. 71 FR 12634, 12641 (March 13, 2006). In addition, the thermal efficiency metric is more consistent with EPCA's definition of ''energy efficiency'' [17] for commercial equipment. *Id.* Interested parties agree that thermal efficiency is superior to combustion efficiency as a metric for rating boilers because it is a more complete measure of efficiency. (AHRI, No. 3 at p. 3) Although DOE preferred the thermal efficiency approach expressed in ASHRAE Standard 90.1–1999, DOE was prevented from adopting those standard levels due to the backsliding concerns discussed above. ASHRAE Standard 90.1–2007, for the reasons discussed below, has largely resolved such concerns. Not adopting the efficiency levels in ASHRAE Standard 90.1–2007 for several of the equipment classes would prevent the efficiency metric change (from combustion efficiency to thermal efficiency) that DOE has recognized in the past and continues to recognize as beneficial in the regulation of commercial packaged boilers.

In a written comment to DOE, AHRI stated that there are several key aspects that support rating commercial boilers using the thermal efficiency metric. These key factors include: (1) Thermal efficiency provides more useful information since it indicates the energy being put into the water; (2) in many cases the specified minimum thermal efficiency will require models to have a combustion efficiency higher than the current minimum combustion efficiency, and the current combustion efficiency requirements allow models to have significantly lower thermal efficiency values; and (3) even if the thermal efficiency is two or three points less than the corresponding combustion efficiency, it is still more stringent than a combustion efficiency standard because it focuses on energy transferred rather than energy not lost through the flue. (AHRI, No. 3 at p. 2)

DOE agrees with AHRI that the thermal efficiency metric does provide key benefits over the current combustion efficiency metric for commercial packaged boilers used in EPCA. As stated in the March 2006 NODA, the thermal efficiency metric provides a preferred method for measuring the efficiency of commercial boilers because it is more inclusive and better reflects the total energy losses in the equipment than the combustion efficiency metric prescribed by EPCA. 71 FR 12634, 12641 (March 13, 2006). In addition, because ASHRAE Standard 90.1 has switched to a thermal efficiency metric for certain commercial packaged boiler equipment classes, a one-time conversion in the DOE efficiency metric will be required at some point. Once the issue of differing efficiency metrics is resolved, DOE will again be able to make direct comparisons with future versions of ASHRAE Standard 90.1.

c. Overall Energy Savings

As a further consideration, the efficiency levels specified in ASHRAE Standard 90.1–2007, taken together, when compared to the Federal energy conservation standards, would result in increased energy savings to the Nation. Conversely, a decision by DOE not to adopt the efficiency levels in ASHRAE Standard 90.1–2007 for the equipment classes where it believes backsliding could possibly occur would result in a loss of potential energy savings by not adopting the thermal efficiency levels provided in ASHRAE Standard 90.1–2007 for those five equipment classes (See chapter 7 of the NOPR TSD for details on the potential energy savings). Although not controlling on the issue of determining backsliding, it does carry some weight in terms of how DOE acts in resolving the uncertainties associated with conversions and calculations between the two different metrics.

5. Conclusions Regarding the Efficiency Levels in ASHRAE Standard 90.1–2007 for Commercial Packaged Boilers

When considering if adopting ASHRAE Standard 90.1–2007's efficiency levels would violate EPCA's anti-backsliding provision, DOE considered the uncertainty in the reporting of the thermal efficiency metric, the benefits of rating the efficiency of commercial packaged boilers with a thermal efficiency metric, and the overall energy savings that would result from the adoption of ASHRAE Standard 90.1–2007. When viewed comprehensively, DOE has tentatively concluded that these considerations justify analyzing and proposing adoption of the efficiency levels in ASHRAE Standard 90.1–2007 as Federal energy conservation standards (see section V for a discussion of the commercial packaged boiler analysis methodology and section VI for the analytical results of the commercial packaged boiler analysis). Although the average thermal efficiency of minimally-compliant [18] models on the market is slightly higher than the levels specified in ASHRAE Standard 90.1–2007 for 5 of the 10 equipment classes, the difference

[17] For commercial equipment, ''[t]he term 'energy efficiency' means the ratio of the useful output of services from an article of industrial equipment to the energy use by such article, determined in accordance with test procedures under section 6314 of [title 42 of the United States Code].'' (42 U.S.C. 6311(3))

[18] It is noted here that in the selection of ''minimally compliant'' boilers, DOE included boilers whose combustion efficiency was up to 0.9 percentage point above the EPCA minimum level.

between the two values are small, which is within the margin of error of the analysis.[19] The current situation is unlike the boiler analysis conducted for the March 2006 NODA, which reviewed the commercial packaged boiler efficiency levels in ASHRAE Standard 90.1–1999 and found the differences between the ASHRAE Standard 90.1–1999 efficiency levels and the average thermal efficiency of minimally-compliant models to be relatively large (*i.e.,* significantly greater than a percentage point).

Therefore, based upon this analysis of the efficiency levels in ASHRAE Standard 90.1–2007, DOE has tentatively concluded that the qualitative considerations outweigh the slight differences revealed by the quantitative analysis of the ASHRAE Standard 90.1–2007 efficiency levels for the five equipment classes at issue. In light of the foregoing, DOE has determined that the efficiency levels for all ten equipment classes identified in ASHRAE Standard 90.1–2007 represent an increase in efficiency for commercial packaged boilers as compared to the current Federal energy conservation standards. Consequently, DOE performed a market analysis, economic analysis, and energy savings analysis for all of the identified commercial packaged boiler equipment classes to consider energy conservation standards at the ASHRAE Standard 90.1–2007 efficiency levels, as well as levels more stringent than those found in ASHRAE Standard 90.1–2007, in accordance with EPCA. (42 U.S.C. 6313 (a)(6)(A)(ii)(II))

V. Methodology and Discussion of Comments for Commercial Packaged Boilers

This section addresses the analyses DOE has performed for this rulemaking with respect to commercial packaged boilers. A separate subsection addresses each analysis. DOE used a spreadsheet to calculate the life-cycle cost (LCC) and payback periods (PBPs) of potential amended energy conservation standards. DOE used another spreadsheet to provide shipments forecasts and then calculate national energy savings and net present value impacts of potential amended energy conservation standards.

This section also proposes amendments to the DOE test procedure for commercial packaged boilers to require testing in terms of thermal efficiency, consistent with the amended efficiency levels in ASHRAE Standard 90.1–2007. In addition, DOE is proposing to remove certain outdated provisions from the test procedure (*e.g.,* references to an alternate test procedure that has been phased out).

A. Test Procedures

Section 343(a) of EPCA requires the Secretary to amend the test procedures for packaged boilers to the latest version generally accepted by industry or the rating procedures developed or recognized by the Air-Conditioning and Refrigeration Institute (ARI)[20] or by ASHRAE, as referenced by ASHRAE/IES Standard 90.1, unless the Secretary determines by clear and convincing evidence that the latest version of the industry test procedure does not meet the requirements for test procedures described in paragraphs (2) and (3) of section 343(a). (42 U.S.C. 6314(a)(4)(B)) DOE published a final rule on October 21, 2004 that amended its test procedure for commercial packaged boilers to incorporate by reference the industry test procedure for commercial packaged boilers, the Hydronics Institute (HI) division of the Gas Appliance Manufacturer's Association (GAMA) Boiler Testing Standard BTS–2000, ''Method to Determine the Efficiency of Commercial Space Heating Boilers'' (HI BTS–2000). 69 FR 61949. This rulemaking responded to ASHRAE's action in ASHRAE Standard 90.1–1999 to revise the test procedures for certain commercial equipment, including commercial packaged boilers.

In 2007, AHRI made several changes to BTS–2000 and reaffirmed BTS–2000 (Rev06.07) as the testing standard for commercial boilers. The changes include updating the numbering of the subsections and a change to the tolerance of the inlet temperature for condensing boilers (from ±5 °F to ±10 °F). DOE compared the two versions and found that the only changes were to the inlet temperature tolerances and there were no other changes to the testing method. Furthermore, DOE believes the changes to the test tolerances do not significantly affect the measure of energy efficiency. Therefore, DOE is proposing to update the uniform test procedure for commercial packaged boilers to incorporate by reference the version of HI BTS–2000 (Rev06.07) that AHRI reaffirmed in 2007.

In the October 2004 test procedure final rule for commercial packaged boilers, DOE also incorporated by reference the American Society of Mechanical Engineers (ASME) Power Test Codes for Steam Generating Units, ASME PTC 4.1–1964, reaffirmed 1991 (including 1968 and 1969 addenda) (ASME PTC 4.1) as an alternate test method for rating the efficiency of steel commercial packaged boilers only. 69 FR 61956 (Oct. 21, 2004). DOE provided ASME PTC 4.1, with modifications, as an alternate test procedure for steel commercial packaged boilers because many manufacturers of steel boilers were unfamiliar with HI BTS–2000 and its predecessor, HI–1989, and typically tested their boilers using the ASME PTC 4.1 test procedure. *Id* at 61951. DOE designated a transition period for manufacturers to convert from using the ASME PTC 4.1 test procedure to the HI BTS–2000 test procedure. *Id*. This would allow manufacturers of steel boilers an opportunity to become familiar with HI BTS–2000 and ensure that their equipment would be able to comply with EPCA standards using that procedure. *Id*. at 61956. DOE stated that it would allow the use of ASME PTC 4.1 as an alternate test procedure for two years after the publication of the October 2004 final rule. *Id*. The transition period ended on October 23, 2006, and now all commercial boilers are required to be tested using the HI BTS–2000 test procedure. 10 CFR 431.86

Because DOE no longer accepts the ASME PTC 4.1 as a method for testing steel commercial packaged boilers, DOE is proposing to remove item (b)(2) of 10 CFR 431.85, which listed ASME PTC 4.1 as a material incorporated by reference. Further, DOE proposes to delete item (d) of 10 CFR 431.86, which describes use of ASME PTC 4.1 as an alternative test method for commercial packaged boilers. Finally, in item (c) of 10 CFR 431.86, DOE proposes to remove the sentence instructing manufacturers to follow either the provisions in (c) or (d) of that part for steel commercial packaged boilers because part (d) will be removed. Manufacturers are required to use the provisions in part (c) for all commercial packaged boilers. Eliminating the references to ASME PTC 4.1 in the CFR does not introduce any changes to the test procedure for this equipment; it simply removes obsolete references. Manufacturers are still required to test all steel boilers using the method that references the HI BTS–2000 test procedure, as they have been since October 23, 2006.

[19] DOE believes the small differences between the two efficiency metrics attributing to the margin of error could arise from a number of factors including manufacturing tolerances, testing tolerances, and equipment design differences.

[20] The Air-Conditioning and Refrigeration Institute (ARI) and the Gas Appliance Manufacturers Association (GAMA) announced on December 17, 2007, that their members voted to approve the merger of the two trade associations to represent the interests of cooling, heating, and commercial refrigeration equipment manufacturers. The merged association became AHRI on January 1, 2008.

Currently, the uniform test method for the measurement of energy efficiency of commercial packaged boilers requires that only the combustion efficiency be tested and calculated in accordance with the HI BTS–2000. 10 CFR 431.86(c)(1)(ii). In this notice, DOE is proposing to adopt as Federal energy conservation standards several thermal efficiency levels described in ASHRAE Standard 90.1–2007. For this reason, DOE intends to amend the definitions in 10 CFR 431.82 to incorporate the definition of ''thermal efficiency'' as written in section 3.0 of the HI BTS–2000 (Rev06.07) test procedure. Thus, DOE is proposing to add the definition of ''thermal efficiency'' to 10 CFR 431.82 as follows: ''Thermal efficiency for a commercial packaged boiler is determined using test procedures prescribed under § 431.86 and is the ratio of the heat absorbed by the water or the water and steam to the higher heating value in the fuel burned.''

In addition to adding the definition of ''thermal efficiency'' to its regulations, DOE is proposing to amend the definition of ''combustion efficiency'' to remove the statement describing it as ''the efficiency descriptor for packaged boilers.'' DOE is proposing this change because after the effective date of the final rule amending the energy conservation standards for commercial packaged boilers to include efficiency levels based on those specified in ASHRAE Standard 90.1–2007 (*i.e.,* March 2, 2012), combustion efficiency would no longer be the efficiency descriptor for all commercial packaged boiler equipment classes. Thus, DOE proposes to amend the definition of ''combustion efficiency'' in 10 CFR 431.82 to read: ''Combustion efficiency for a commercial packaged boiler is determined using the test procedures prescribed under § 431.86 and equals to 100 percent minus percent flue loss (percent flue loss is based on input fuel energy).'' DOE is seeking input from interested parties about its proposed definitions for ''thermal efficiency'' and ''combustion efficiency.'' This is identified as Issue 1 under ''Issues on Which DOE Seeks Comment'' in section VIII.E of today's NOPR.

In addition, DOE is proposing to modify 10 CFR 431.86 (Uniform test method for measurement of energy efficiency of commercial packaged boilers) to include requirements for the measurement of thermal efficiency for those commercial packaged boiler classes where the thermal efficiency metric is being proposed in today's notice. In 10 CFR 431.86(a), *Scope,* DOE is proposing to modify the scope to state that in addition to procedures for measuring combustion efficiency of commercial packaged boilers, that section also contains procedures for measuring the thermal efficiency of commercial packaged boilers. Under 10 CFR 431.86(c), ''Test Method for Commercial Packaged Boilers—General,'' DOE is proposing to update several items. DOE proposes to amend subparagraph (c)(1)(ii), the test setup requirements, to require manufacturers to perform the thermal efficiency test in section 5.1 (thermal efficiency test) of the HI BTS–2000 (Rev06.07) for the following eight commercial packaged boiler equipment classes, if the ASHRAE Standard 90.1–2007 efficiency levels go into effect as Federal energy conservation standards, as proposed:

- Small gas-fired hot water;
- Small gas-fired steam all except natural draft;
- Small gas-fired steam natural draft;
- Small oil-fired hot water;
- Small oil-fired steam;
- Large gas-fired steam all except natural draft;
- Large gas-fired steam, natural draft;
- Large oil-fired steam.

DOE proposes to direct manufacturers rating their commercial packaged boilers before March 2, 2012 (the effective date of a final rule for amended energy conservation standards) to use the test setup requirements in section 5.2 (Combustion Efficiency Test) of the HI BTS–2000 (Rev06.07) for all commercial packaged boiler equipment classes in accordance with the Federal energy conservation standards in 10 CFR 431.86. 69 FR 61961 (Oct. 21, 2004). DOE is proposing that manufacturers use the revised version of the test procedure (*i.e.,* HI BTS–2000 (Rev06.07) effective thirty days from the publication of the final rule in the **Federal Register** to represent their model's energy efficiency and compliance with the current Federal energy conservation standards. DOE is also proposing to revise the requirement to conduct the combustion efficiency test to specify that beginning on March 2, 2012 (the effective date if DOE were to adopt the ASHRAE Standard 90.1–2007 efficiency levels as Federal energy conservation standards) the combustion efficiency test will only be required for large gas-fired hot water and large oil-fired hot water boilers.

In 10 CFR 431.86(c)(1)(iv), ''Test Conditions,'' DOE proposes to add a requirement to use the test conditions from section 8.0 of HI BTS–2000 (Rev06.07) for testing the thermal efficiency, in addition to the combustion efficiency (which is already provided, along with certain exclusions). DOE proposes to update the exclusions for the combustion efficiency test conditions to exclude only section 8.6.2 to reflect the changes made to HI BTS–2000 (Rev06.07) when it was reaffirmed in 2007. In addition, DOE proposes to delete 10 CFR 431.86(c)(1)(iv)(A). DOE is proposing to eliminate 10 CFR 431.86(c)(1)(iv)(A) from the test procedure, because in the HI BTS–2000 (Rev06.07) (reaffirmed 2007), the test procedures for condensing boilers were amended to be identical to those listed in 10 CFR 431.86(c)(1)(iv)(A). Therefore, paragraph (c)(1)(iv)(A) and any provisions referring to it are no longer necessary. Eliminating this paragraph and replacing it with a reference to the applicable HI BTS–2000 (Rev06.07) section (section 8.5.2 for test conditions and section 9.1.2.1.4 for test procedures) would not introduce any changes to the test procedure because the requirements in HI BTS–2000 (Rev06.07) are now the same as the requirements that had been set forth in 10 CFR 431.86(c)(1)(iv)(A).

In 10 CFR 431.86(c)(2), ''Test Measurements,'' DOE is proposing to include an additional provision to measure thermal efficiency according to sections 9.1 and 10.1 of the HI BTS–2000 (Rev06.07) for the commercial packaged boiler equipment classes in cases where the Federal standard would be specified in thermal efficiency. DOE is proposing that manufacturers should continue to measure the combustion efficiency of equipment in those eight equipment classes until proposed amended energy conservation standards based on the ASHRAE Standard 90.1–2007 efficiency levels would become effective on March 2, 2012. At such time, manufacturers would be expected to begin measuring the thermal efficiency for the applicable equipment classes. Also, DOE proposes to update the instructions for measuring combustion efficiency in the Test Measurements section to specify that combustion efficiency only needs to be measured for the two equipment classes where the Federal standard will be specified in combustion efficiency (*i.e.,* large gas-fired hot water and large oil-fired hot water commercial packaged boilers) after the effective date of a final rule for amended national standards.

DOE also proposes to update the instructions for measuring combustion efficiency in 10 CFR 431.86(c)(2). DOE proposes to remove the provision in 10 CFR 431.86(c)(2) that excludes section 9.1.2.1.4 of HI–BTS 2000 and replaces it with the requirements in 10 CFR 431.86(c)(1)(iv)(A) for condensing boiler tests. DOE is proposing to allow for the use of section 9.1.2.1.4 because in HI BTS–2000 (Rev06.07), the requirements in that section were modified to be the same as those in 10 CFR 431.86(c)(1)(iv)(A). Such modification would not introduce any substantive changes to the test procedure because the requirements in HI BTS–2000 are now the same as the requirements in 10 CFR 431.86(c)(1)(iv)(A).

Under 10 CFR 431.86(c)(2)(iii), ''Test Measurements for a Boiler Capable of Supplying Either Steam or Water,'' DOE is proposing to update the provision that allows manufacturers to measure and rate the combustion efficiency of these boilers only as steam boilers. DOE proposes to change that provision to require the testing and measurement of thermal efficiency in addition to combustion efficiency for any boiler capable of producing steam and hot water that is being tested only as a steam boiler for equipment manufactured on and after March 2, 2012. Prior to that date, DOE proposes to instruct manufacturers to continue testing only for combustion efficiency of those boilers being tested in steam mode only. DOE must require manufacturers to test for both the combustion and thermal efficiencies in steam mode for units capable of producing both steam and hot water because, due to the new efficiency levels specified in ASHRAE Standard 90.1–2007, the boilers would be required to meet an efficiency level using both metrics under any amended energy conservation standard based upon ASHRAE Standard 90.1–2007. In other words, DOE is proposing to allow manufacturers to test dual output boilers (*i.e.*, those capable of producing both steam and hot water) in only steam mode. However, DOE is modifying its existing provisions to require manufacturers to conduct both the combustion efficiency and the thermal efficiency test for these dual output boilers. This will ensure that a dual output boiler is meeting the thermal efficiency requirement when operated in steam mode and the combustion efficiency requirement when operated in hot water mode, because achieving compliance in steam mode is generally more challenging. Thus, a boiler that complies with the standard in steam mode would be presumed to meet the standard in hot water mode. In essence, manufacturers will be required to rate dual output boilers using both the thermal and combustion efficiency metrics. DOE points out that the only other alternative for testing dual output boilers would be for manufacturers to separately run the combustion efficiency test in hot water mode and the thermal efficiency test in steam mode on or after March 2, 2012. Because DOE believes running two independent tests on the same boiler could be burdensome and that testing only in steam mode would suffice for compliance purposes, DOE is proposing to allow manufacturers to only test in steam mode for both metrics to mitigate this additional testing burden to manufacturers.

In addition to allowing boilers capable of producing both steam and hot water to be tested only in steam mode, the test procedure at 10 CFR 431.86(c)(2)(iii) also allows boilers capable of producing steam and hot water to be tested and rated in both steam mode and hot water mode separately. DOE proposes to amend 10 CFR 431.86(c)(2)(iii) of the test procedure to specify that when testing a large gas-fired or oil-fired boiler in hot water mode on or after March 2, 2012, combustion efficiency must be tested for and rated; however, for large gas- or oil-fired boilers in steam mode or for any other boiler equipment class, the thermal efficiency must be tested and rated.

Finally, DOE proposes to amend 10 CFR 431.86(c), ''Test Method for Commercial Packaged Boilers—General,'' by adding a provision to calculate the thermal efficiency using the calculation procedure described in section 11.1 of HI BTS–2000. DOE proposes to note in this provision that thermal efficiency should be calculated only for the eight equipment classes of commercial packaged boilers for which DOE is proposing to adopt a Federal energy conservation standard using a thermal efficiency metric. In addition, DOE proposes to specify this should only be done on or after March 2, 2012, the anticipated effective date of the corresponding amended energy conservation standards for this equipment.

In addition, DOE proposes to modify the ''Calculation of Combustion Efficiency'' under 10 CFR 431.86(c)(3) to specify that on or after March 2, 2012, combustion efficiency only needs to be calculated when rating commercial packaged boiler equipment classes with a Federal energy conservation standard specified in combustion efficiency (*i.e.*, large gas-fired hot water and large oil-fired hot water commercial packaged boilers).

See the regulatory text at the end of today's notice for all the changes made to the definitions, reference materials, effective dates, and the uniform test procedure for commercial packaged boilers in 10 CFR 431.86.

B. Market Assessment

When beginning a review of the ASHRAE Standard 90.1–2007 efficiency levels, DOE developed information that provides an overall picture of the market for the equipment concerned, including the purpose of the equipment, the industry structure, and market characteristics. This activity includes both quantitative and qualitative assessments based primarily on publicly-available information. The subjects addressed in the market assessment for this rulemaking include equipment classes, manufacturers, quantities, and types of equipment sold and offered for sale. The key findings of DOE's market assessment are summarized below. For additional detail, see chapter 2 of the NOPR TSD.

1. Definitions of Commercial Packaged Boilers

EPCA defines a ''packaged boiler'' as ''a boiler that is shipped complete with heating equipment, mechanical draft equipment, and automatic controls; usually shipped in one or more sections.'' (42 U.S.C. 6311(11)(B)) In its regulations at 10 CFR 431.102, DOE further refined the ''packaged boiler'' definition to exclude a boiler that is custom designed and field constructed. Additionally, 10 CFR 431.102 provides that if the boiler is shipped in more than one section, the sections may be produced by more than one manufacturer, and may be originated or shipped at different times and from more than one location. In its regulations in 10 CFR 431.82, DOE also defines a ''commercial packaged boiler'' as a type of packaged low pressure boiler that is industrial equipment with a capacity, (rated maximum input) of 300,000 BTU per hour (Btu/h) or more which, to any significant extent, is distributed in commerce: (1) For heating or space conditioning applications in buildings; or (2) For service water heating in buildings but does not meet the definition of 'hot water supply boiler' in [part 431]. 10 CFR 431.82.

2. Equipment Classes

Federal energy conservation standards currently separate commercial packaged boilers only by the type of fuel used by the boiler, creating two equipment classes: (1) Gas-fired, and (2) oil-fired. (42 U.S.C. 6313(a)(4)(C)–(D); 10 CFR 431.87) However, commercial packaged boilers can be distinguished by several factors, which include the input capacity size (*i.e.*, small or large), fuel type (*i.e.*, oil or gas), output (*i.e.*, hot water or steam), and draft type (*i.e.*, natural draft or other). ASHRAE

Standard 90.1–2007 further divided the two equipment classes designated in EPCA into the following ten classes:

- Small gas-fired hot water boilers;
- Small gas-fired steam, all except natural draft;
- Small gas-fired steam, natural draft boilers;
- Small oil-fired hot water boilers;
- Small oil-fired steam boilers;
- Large gas-fired hot water boilers;
- Large gas-fired steam all except natural draft boilers;
- Large gas-fired steam natural draft boilers;
- Large oil-fired hot water boilers; and
- Large oil-fired steam boilers.

In general, DOE divides equipment classes by the type of energy used or by capacity or other performance-related features that affect efficiency. Different energy conservation standards may apply to different equipment classes. (42 U.S.C. 6295(q)) In the context of the present rulemaking, DOE believes input capacity size (*i.e.*, small or large), fuel type (*i.e.*, oil or gas), output (*i.e.*, hot water or steam), and draft type (*i.e.*, natural draft or other) are all performance-related features that affect commercial packaged boiler efficiency. By examining the market data, DOE found commercial packaged boilers in a wide range of efficiencies depending on their design and features. Consequently, DOE is proposing the ten equipment classes in ASHRAE Standard 90.1–2007 to differentiate between types of commercial packaged boilers.

3. Review of Current Market for Commercial Packaged Boilers

In order to obtain the information needed for the market assessment for this rulemaking, DOE consulted a variety of sources, including trade associations, manufacturers, and shipments data (*i.e.*, the quantities and types of equipment sold and offered for sale). The information DOE gathered serves as resource material throughout the rulemaking. Chapter 2 of the NOPR TSD provides additional detail on the market assessment.

a. Trade Association Information

AHRI, formerly GAMA (and sometimes referred to as such in this notice), is the trade association representing commercial packaged boiler manufacturers. AHRI develops and publishes technical standards for residential and commercial equipment using rating criteria and procedures for measuring and certifying equipment performance. The DOE test procedure is an AHRI standard. The HI division of AHRI has developed the Boiler Testing Standard (BTS) 2000 ''Method to Determine the Efficiency of Commercial Space Heating Boilers,'' as discussed in section IV.A above. The DOE test procedure incorporates by reference this AHRI standard.[21]

The Institute of Boiler and Radiator Manufacturers (I=B=R), a division of the HI, developed a certification program that the majority of the manufacturers in the commercial packaged boiler industry use to certify their equipment. Through the certification program, AHRI determines if the equipment conforms to HI BTS–2000. Once AHRI has determined that the equipment has met all the requirements under the HI BTS–2000 standards and certification program, it is added to the I=B=R Directory. DOE used I=B=R's certification data, as summarized by the January 2008 I=B=R Directory, in the engineering analysis.

Another trade association representing the interests of commercial boiler manufacturers is the American Boiler Manufacturers Association (ABMA). ABMA represents manufacturers serving a number of markets. One of these markets is boilers intended for use in commercial systems. ABMA's Web site[22] describes ''light commercial'' systems as having Btu input capacities of 400,000 to 12.5 MMBH and applications that include ''hydronic hot water heating boilers, low-pressure steam boilers * * * for heating * * * applications.'' Because such boilers meet the definition of commercial packaged boilers covered by this rulemaking, ABMA is a trade association that could represent commercial packaged boiler manufacturers covered by this rulemaking.

b. Manufacturer Information

DOE initially identified manufacturers of commercial packaged boilers by reviewing AHRI's January 2008 I=B=R Directory of commercial packaged boilers and equipment literature. Table V.1 shows the 26 separate commercial packaged boiler manufacturers identified in the January 2008 I=B=R Directory. Several of these manufacturers share the same parent company, which is shown in parentheses next to the individual brand name.

TABLE V.1—COMMERCIAL PACKAGED BOILER MANUFACTURERS REPRESENTED IN AHRI'S JANUARY 2008 I=B=R RATINGS DIRECTORY

A.O. Smith Water Products Co.	New Yorker Boiler Co., Inc. (Burnham Holdings, Inc.)
AERCO International, Inc	P B Heat, LLC.
BIASI, S.p.A. c/o QHT, Inc	Pennco (ECR International, Inc.).
Bosch Thermotechnology Corp	Raypak, Inc.
Burnham Commercial (Burnham Holdings, Inc.)	RBI Water Heaters (Mestek, Inc.).
Burnham Hydronics (Burnham Holdings, Inc.)	Slant/Fin Corporation.
Columbia Boiler Company of Pottstown	Smith Cast Iron Boilers.
Crown Boiler Co. (Burnham Holdings, Inc.)	Thermal Solutions Products, LLC (Burnham Holdings, Inc.).
De Dietrich	Thermo-Dynamics Boiler Co.
Dunkirk Boilers (ECR International, Inc.)	Triangle Tube.
Heat Transfer Products Inc	Utica Boilers (ECR International, Inc.).
LAARS Heating Systems Company	Viessmann Manufacturing Company, Inc.
Lochinvar Corporation	Weil-McLain.

While several of the manufacturers listed in Table V.1 specialize in residential boiler equipment, all offer at least some equipment with capacities that classify them as commercial boilers. DOE also identified 20 additional manufacturers of commercial packaged boiler equipment from ABMA's member listings, and from searching the

[21] DOE has incorporated by reference HI BTS–2000 as the DOE test procedure at 10 CFR 431.85.

[22] For more information on ABMA's commercial systems group, visit *http://www.abma.com/commercialSystems.html.*

SCAQMD certification directory and the CSA-International product listings. The additional manufacturers DOE identified through these methods were: AESYS Technologies, Inc.; Ajax Boiler, Inc.; Bryan Steam, LLC; Cleaver-Brooks, Inc.; Easco Boiler Corporation; Johnston Boiler Company; Miura; Sellers Engineering; Superior Boiler Works, Inc.; Vapor Power International; Fulton Boiler; Parker Boiler; Patterson-Kelley Company (division of Harsco); Triad Boiler Systems; CAMUS Hydronics, Ltd.; Gasmaster Industries; General Boiler Co., Inc.; Hurst Boiler and Welding Co., Inc.; Lattner Boiler Company; and Unilux Advanced Manufacturing, LLC. Each commercial boiler manufacturer generally specializes in a specific type of commercial boiler construction. For example, manufacturers such as Weil-McLain, Smith Cast Iron, and Burnham Commercial specialize in cast iron boilers; manufacturers such as Raypak and Lochinvar tend to manufacture a higher number of copper-tube boilers.

c. Shipments Information

DOE obtained data on estimated annual shipments for commercial packaged boilers from AHRI, which totaled approximately 36,000 units in 2007. DOE notes that these estimated total shipments likely underestimates the actual total shipments of the commercial packaged boiler market because the data only include information provided through AHRI. Some manufacturers have not have provided information to AHRI regarding their shipments. However, DOE believes the fraction of shipments not included in this total would be small. Further details regarding the shipments estimates and forecasts can be found in section V.G., National Impact Analysis, below.

C. Engineering Analysis

The engineering analysis establishes the relationship between the cost and efficiency of a piece of equipment DOE is evaluating for potential amended energy conservation standards. This relationship serves as the basis for cost-benefit calculations for individual consumers and the Nation. The engineering analysis identifies representative baseline equipment, which is the starting point for analyzing the possibility for energy efficiency improvements. A baseline piece of equipment here refers to a model having features and technologies typically found in equipment currently offered for sale. The baseline model in each equipment class represents the typical characteristics of equipment in that class and, for equipment already subject to energy conservation standards, usually is a model that just meets the current Federal standard. After identifying the baseline models, DOE estimates the costs to the customer through an analysis of contractor costs and markups. ''Markups'' are the multipliers DOE uses to determine the costs to the customer based on contractor cost.

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 product being analyzed.

1. Approach

For this analysis, DOE used an efficiency-level approach to evaluate the cost of commercial packaged boilers at the baseline efficiency level, as well as efficiency levels above the baseline. DOE used the efficiency level approach because of the wide variety of designs available of the market and because the efficiency level approach does not examine a specific design in order to reach each of the efficiency levels. The efficiency levels that DOE considered in the engineering analysis were representative of commercial packaged boilers currently being produced by manufacturers at the time the engineering analysis was developed. DOE relied primarily on data collected through discussions with mechanical contractors or equipment distributors of commercial boiler equipment to develop its cost-efficiency relationship for commercial packaged boilers. (See chapter 3 of the NOPR TSD for further detail.)

2. Representative Input Capacities

For commercial packaged boilers, each energy efficiency level is expressed as either a thermal efficiency or combustion efficiency, which covers the full output capacity range. For each ''small'' equipment class analyzed, DOE collected contractor cost data for three representative rated output capacities of small commercial packaged boilers: 400, 800, and 1,500 kBtu/h. DOE then normalized the contractor costs by capacity for each small commercial packaged boiler equipment class. DOE used all the normalized contractor costs on a per kBtu/h basis to create a single cost-efficiency curve with 800 kBtu/h as the representative capacity. DOE chose 800 kBtu/h because it is the median of the three representative capacities and because a large number of shipments correspond to this capacity.

For each ''large'' equipment class analyzed, DOE used a similar approach, in which it collected cost data and created a cost-efficiency curve for one representative output capacity, 3,000 kBtu/h. (See chapter 3 of the NOPR TSD for additional details.)

3. Baseline Equipment

DOE selected baseline efficiency levels as reference points for each equipment class, against which it measured changes resulting from potential amended energy conservation standards. DOE defined the baseline efficiency levels in the engineering analysis and the LCC and PBP analyses as reference points to compare the technology, energy savings, and cost of equipment with higher energy efficiency levels. Typically, units at the baseline efficiency level just meet Federal energy conservation standards and provide basic consumer utility. However, DOE is not able to consider efficiency levels lower than those specified in ASHRAE Standard 90.1–2007 for commercial packaged boilers. Therefore, the baseline efficiency levels DOE identified for this analysis were the efficiency levels specified for each commercial packaged boiler equipment class in ASHRAE Standard 90.1–2007. Table V.2 lists the ASHRAE Standard 90.1–2007 efficiency levels for each commercial packaged boiler equipment class.

TABLE V.2—BASELINE EFFICIENCY LEVELS FOR COMMERCIAL PACKAGED BOILERS

Equipment class	ASHRAE standard 90.1–2007 efficiency level (percent)
Small Gas-Fired Hot Water	80 E_T
Small Gas-Fired Steam All Except Natural Draft	79 E_T
Small Gas-Fired Steam Natural Draft	77 E_T
Small Oil-Fired Hot Water	82 E_T
Small Oil-Fired Steam	81 E_T
Large Gas-Fired Hot Water	82 E_C
Large Gas-Fired Steam, All Except Natural Draft	79 E_T
Large Gas-Fired Steam Natural Draft	77 E_T
Large Oil-Fired Hot Water	84 E_C
Large Oil-Fired Steam	81 E_T

4. Identification of Efficiency Levels for Analysis

In the engineering analysis, DOE established energy efficiency levels for each equipment class that reflect the current commercial packaged boiler market. DOE reviewed the commercial packaged boiler market to determine what types of equipment are available to consumers. DOE examined all of the manufacturers' product offerings to identify the energy efficiencies that correspond to efficiency levels with models already widely available on the market. DOE used these energy efficiencies to develop the efficiency levels of the engineering analysis. For this NOPR, DOE used an efficiency level approach, which allows DOE to estimate the costs and benefits associated with a particular efficiency level rather than a particular design. Table V.3 through Table V.12 show the efficiency levels analyzed for each equipment class.

a. Small Gas-Fired Hot Water Commercial Packaged Boiler Efficiency Levels

For small gas-fired hot water commercial packaged boilers, DOE selected four efficiency levels to analyze above the baseline efficiency level. Table V.3 shows the efficiency levels DOE selected. DOE examined these efficiency levels for the representative output capacity (*i.e.*, 800 kBtu/h) for analysis purposes. However, DOE notes these efficiency levels can be found at numerous other capacities within the range of covered capacities.

TABLE V.3—SMALL GAS-FIRED HOT WATER COMMERCIAL PACKAGED BOILER EFFICIENCY LEVELS

Efficiency level	Thermal efficiency (E_T) levels for analysis (percent)
Baseline Efficiency	80
Efficiency Level 1	82
Efficiency Level 2	84
Efficiency Level 3	86
Efficiency Level 4 (Condensing)	92

b. Small Gas-Fired Steam All Except Natural Draft Commercial Packaged Boiler Efficiency Levels

For small gas-fired steam all except natural draft commercial packaged boilers, DOE selected four efficiency levels to analyze above the baseline efficiency level. Table V.4 shows the efficiency levels DOE selected. DOE examined these efficiency levels for the 800 kBtu/h representative output capacity for analysis purposes. However, DOE notes these efficiency levels can be found at numerous other capacities within the range of covered capacities.

TABLE V.4—SMALL GAS-FIRED STEAM, ALL EXCEPT NATURAL DRAFT COMMERCIAL PACKAGED BOILER EFFICIENCY LEVELS

Efficiency level	Thermal efficiency (E_T) levels for analysis (percent)
Baseline Efficiency	79
Efficiency Level 1	80
Efficiency Level 2	81
Efficiency Level 3	82
Efficiency Level 4	83

c. Small Gas-Fired Steam Natural Draft Water Commercial Packaged Boiler Efficiency Levels

For small gas-fired steam natural draft commercial packaged boilers, DOE selected three efficiency levels to analyze above the baseline efficiency level. Table V.5 shows the efficiency levels DOE selected. DOE examined these efficiency levels for the 800 kBtu/h representative output capacity for analysis purposes. However, DOE notes these efficiency levels can be found at numerous other capacities within the range of covered capacities.

TABLE V.5—SMALL GAS-FIRED STEAM NATURAL DRAFT COMMERCIAL PACKAGED BOILER EFFICIENCY LEVELS

Efficiency level	Thermal efficiency (E_T) levels for analysis (percent)
Baseline Efficiency	77
Efficiency Level 1	78
Efficiency Level 2	79
Efficiency Level 3	80

d. Small Oil-Fired Hot Water Commercial Packaged Boiler Efficiency Levels

For small oil-fired hot water commercial packaged boilers, DOE selected three efficiency levels to analyze above the baseline efficiency level. Table V.6 shows the efficiency levels DOE selected. DOE examined these efficiency levels for the 800 kBtu/h representative output capacity for analysis purposes. However, DOE notes these efficiency levels can be found at numerous other capacities within the range of covered capacities.

TABLE V.6—SMALL OIL-FIRED HOT WATER COMMERCIAL PACKAGED BOILER EFFICIENCY LEVELS

Efficiency level	Thermal efficiency (E_T) levels for analysis (percent)
Baseline Efficiency	82
Efficiency Level 1	84
Efficiency Level 2	86
Efficiency Level 3	88

e. Small Oil-Fired Steam Commercial Packaged Boiler Efficiency Levels

For small oil-fired steam commercial packaged boilers DOE selected three efficiency levels to analyze above the baseline efficiency level. Table V.7 shows the efficiency levels DOE selected. DOE examined these efficiency levels for the 800 kBtu/h representative output capacity for analysis purposes. However, DOE notes these efficiency levels can be found at numerous other capacities within the range of covered capacities.

TABLE V.7—SMALL OIL-FIRED STEAM COMMERCIAL PACKAGED BOILER EFFICIENCY LEVELS

Efficiency level	Thermal efficiency (E_T) levels for analysis (percent)
Baseline Efficiency	81
Efficiency Level 1	82
Efficiency Level 2	83
Efficiency Level 3	85

f. Large Gas-Fired Hot Water Commercial Packaged Boiler Efficiency Levels

For large gas-fired hot water commercial packaged boilers, DOE selected four efficiency levels to analyze above the baseline efficiency level. Table V.8 shows the efficiency levels DOE selected. DOE examined these efficiency levels for the 3,000 kBtu/h representative output capacity for analysis purposes. However, DOE notes these efficiency levels can be found at numerous other capacities within the range of covered capacities.

TABLE V.8—LARGE GAS-FIRED HOT WATER COMMERCIAL PACKAGED BOILER EFFICIENCY LEVELS

Efficiency level	Combustion efficiency (E_C) levels for analysis (percent)
Baseline Efficiency	82
Efficiency Level 1	83
Efficiency Level 2	84
Efficiency Level 3	85
Efficiency Level 4 (Condensing)	95

g. Large Gas-Fired Steam, All Except Natural Draft Commercial Packaged Boiler Efficiency Levels

For large gas-fired steam, all except natural draft commercial packaged boilers, DOE selected four efficiency levels to analyze above the baseline efficiency level. Table V.9 shows the efficiency levels selected by DOE. DOE examined these efficiency levels for the 3,000 kBtu/h representative output capacity for analysis purposes. However, DOE notes these efficiency levels can be found at numerous other capacities within the range of covered capacities.

TABLE V.9—LARGE GAS-FIRED STEAM, ALL EXCEPT NATURAL DRAFT COMMERCIAL PACKAGED BOILER EFFICIENCY LEVELS

Efficiency level	Thermal efficiency (E_T) levels for analysis (percent)
Baseline Efficiency	79
Efficiency Level 1	80
Efficiency Level 2	81
Efficiency Level 3	82
Efficiency Level 4	83

h. Large Gas-Fired Steam Natural Draft Commercial Packaged Boiler Efficiency Levels

For large gas-fired steam natural draft commercial packaged boilers, DOE selected four efficiency levels to analyze above the baseline efficiency level. Table V.10 shows the efficiency levels DOE selected. DOE examined these efficiency levels for the 3,000 kBtu/h representative output capacity for analysis purposes. However, DOE notes these efficiency levels can be found at numerous other capacities within the range of covered capacities.

TABLE V.10—LARGE GAS-FIRED STEAM NATURAL DRAFT COMMERCIAL PACKAGED BOILER EFFICIENCY LEVELS

Efficiency level	Thermal efficiency (E_T) levels for analysis (percent)
Baseline Efficiency	77
Efficiency Level 1	78
Efficiency Level 2	79
Efficiency Level 3	80
Efficiency Level 4	81

i. Large Oil-Fired Hot Water Commercial Packaged Boiler Efficiency Levels

For large oil-fired hot water commercial packaged boilers, DOE selected three efficiency levels to analyze above the baseline efficiency level. Table V.11 shows the efficiency levels DOE selected. DOE examined these efficiency levels for the 3,000 kBtu/h representative output capacity for analysis purposes. However, DOE notes these efficiency levels can be found at numerous other capacities within the range of covered capacities.

TABLE V.11—LARGE OIL-FIRED HOT WATER COMMERCIAL PACKAGED BOILER EFFICIENCY LEVELS

Efficiency level	Combustion efficiency (E_C) levels for analysis (percent)
Baseline Efficiency	84
Efficiency Level 1	86
Efficiency Level 2	87
Efficiency Level 3	88

j. Large Oil-Fired Steam Commercial Packaged Boiler Efficiency Levels

For large oil-fired steam commercial packaged boilers, DOE selected four efficiency levels to analyze above the baseline efficiency level. Table V.12 shows the efficiency levels DOE selected. DOE examined these efficiency levels for the 3,000 kBtu/h representative output capacity for analysis purposes. However, DOE notes these efficiency levels can be found at numerous other capacities within the range of covered capacities.

TABLE V.12—LARGE OIL-FIRED STEAM COMMERCIAL PACKAGED BOILER EFFICIENCY LEVELS

Efficiency level	Thermal efficiency (E_T) levels for analysis (percent)
Baseline Efficiency	81
Efficiency Level 1	82
Efficiency Level 2	83
Efficiency Level 3	84
Efficiency Level 4	86

5. Oil-Fired Commercial Packaged Boilers

DOE estimated that oil-fired commercial packaged boilers are, on average, 3 percent more efficient than gas-fired boilers of identical construction. Because the construction of oil-fired and gas-fired boilers is basically the same, with the exception of some differences in controls, DOE assumed the incremental cost for increasing the efficiency of both types of boilers would be the same. The difference in the cost of controls would make no difference in the incremental cost of equipment because the same additional cost for controls would be applied across the range of oil-fired commercial boiler efficiencies. Once the cost-efficiency curves were normalized, the cost of the controls was subtracted. For these reasons, DOE estimated the incremental cost-efficiency curves for oil-fired equipment by shifting the cost-efficiency curves for each gas-fired equipment class by 3 percent (*e.g.*, DOE shifted the small gas-fired hot water curve 3 percent higher in efficiency to obtain the small oil-fired hot water curve).

For the steam curves, where gas-fired equipment is divided into natural draft and all except natural draft curves, DOE used the all except natural draft curves to develop the cost-efficiency curves for oil-fired steam boilers. This is because the majority of oil-fired steam boilers in DOE's database are categorized as all except natural draft.

6. Dual Output Boilers

Dual output boilers are boilers capable of producing either hot water or steam as the boiler's output of services. DOE analyzed dual output boilers by classifying them as steam only boilers. DOE did this because the current test procedure for commercial packaged boilers instructs manufacturers to test boilers capable of producing both steam and hot water either only in steam mode or in both steam mode and hot water mode. 10 CFR 431.86(c)(2)(iii)(A).

Further, the test procedure states that if a manufacturer chooses to test a boiler in both steam mode and hot water mode, the boiler must be rated for efficiency in each mode as two separate listings in the I=B=R Directory. 10 CFR 431.86(c)(2)(iii)(B). Therefore, DOE assumed the efficiency ratings for dual output boilers were representative of the efficiency of the boiler tested in steam mode only. DOE seeks comment from interested parties regarding the efficiency of dual output boilers in both steam mode and hot water mode. Specifically, DOE is interested in receiving data or comments, which would allow DOE to convert the steam ratings in the I=B=R Directory and manufacturers' catalogs to hot water ratings. This is identified as Issue 2 under ''Issues on Which DOE Seeks Comment'' in section VIII.E of today's NOPR.

7. Engineering Analysis Results

The result of the engineering analysis is a set of cost-efficiency curves. Creating the cost-efficiency curves involved three steps: (1) Plotting the contractor cost versus efficiency; (2) aggregating the cost data by manufacturer; and (3) using an exponential regression analysis to fit a curve that best defines the aggregated data. DOE refers to the contractor cost—provided directly from mechanical contractors or equipment distributors—as the ''absolute cost.'' DOE correlated the absolute cost as a function of each commercial packaged boiler's rated efficiency. Most manufacturers publish the rated thermal and/or combustion efficiencies of their commercial packaged boilers according to AHRI specifications. DOE only presents the incremental costs of increasing the efficiency of a commercial packaged boiler in the NOPR TSD to avoid the possibility of revealing sensitive information about individual manufacturers' equipment. Different manufacturers might have substantially different absolute costs for their equipment at the same efficiency level due to design modifications and manufacturing practices.

To determine the relationship of incremental cost versus efficiency for each of the representative capacities in each equipment class, DOE aggregated the absolute cost data. After aggregating the data, DOE fit an exponential curve to the data at each representative capacity for each equipment class and normalized the data. That is, DOE adjusted the costs of every manufacturer's equipment so that the cost of its equipment was zero at the baseline ASHRAE Standard 90.1–2007 efficiency levels (Table V.2). The normalized exponential cost curves from the aggregated data establish cost-efficiency curves for each equipment class that represent the average incremental cost of increasing efficiency above the ASHRAE Standard 90.1–2007 levels.

The curves do not represent any single manufacturer, and they do not describe any variance among manufacturers. The curves simply represent, on average, the industry's cost to increase equipment efficiency. It should be noted that in this analysis, several types of boiler construction are aggregated into single equipment classes, and the cost-efficiency curves represent only an average boiler and not any individual boiler with any specific design characteristics. For example, small gas hot water boilers are commonly manufactured as copper tube boilers or as cast iron sectional boilers. The difference in the two materials and the construction of these boilers results in a wide range of prices and efficiencies for this boiler equipment class. DOE attempted in its analysis to determine what the average cost-efficiency relationship would look like across the range of boiler types included in each equipment class. The results show that the cost-efficiency relationships for each of the ten equipment classes are nonlinear. As efficiency increases, manufacturing becomes more difficult and more costly for manufacturers. Chapter 3 of the NOPR TSD provides additional information about the engineering analysis, as well as the complete set of cost-efficiency results.

D. Markups To Determine Equipment Price

DOE understands that the price of commercial boilers depends on the distribution channel the customer uses to purchase the equipment. Typical distribution channels for commercial HVAC equipment include manufacturers' national accounts, wholesalers, mechanical contractors, and/or general contractors. DOE developed costs for mechanical contractors directly in the engineering analysis and estimated cost to customers using a markup chain beginning with the mechanical contractor cost. DOE did not develop an estimate for manufacturer selling prices in the engineering analysis and consequently, did not develop an estimate of markups for national account distribution channels with sales directly from manufacturers to customers. Because of the complexity of installation and based on few shipments to mercantile/retail building types, DOE estimated most sales of commercial packaged boilers involved mechanical contractors. Consequently, DOE did not develop separate markups for costs through a national account distribution chain or directly from wholesalers.

DOE developed supply chain markups in the form of multipliers that represent increases above the mechanical contractor cost. DOE applied these markups (or multipliers) to the mechanical contractor costs it developed from the engineering analysis. DOE then added sales taxes and installation costs to arrive at the final installed equipment prices for baseline and higher-efficiency equipment. See chapter 5 of the NOPR TSD for additional details on markups. DOE identified two separate distribution channels for commercial boilers to describe how the equipment passes from the mechanical contractor to the customer (Table V.13).

*COM022*TABLE V.13—DISTRIBUTION CHANNELS FOR COMMERCIAL PACKAGED BOILER EQUIPMENT

Channel 1 (replacements)	Channel 2 (new construction)
Mechanical Contractor.	Mechanical Contractor.
	General Contractor.
Customer	Customer.

DOE assumed that general contractors would be involved in new construction involving installation of commercial boilers. DOE assumed that replacement of existing boilers would not involve general contractors.

DOE estimated percentages for both the new construction and replacement markets based on data developed for the shipment's model and based on growth in new construction and replacement of existing stock as shown in Table V.14. Based on these results, DOE assumes that approximately 33 percent of commercial boilers purchased will be installed in new construction, and the remaining 67 percent will replace existing commercial boilers.

TABLE V.14—PERCENTAGE OF COMMERCIAL PACKAGED BOILER MARKET SHARES PASSING THROUGH EACH DISTRIBUTION CHANNEL

	Channel 1 (%)	Channel 2 (%)
Replacement Market	100	0
New Construction Market	0	100

For each step in the distribution channels presented above, DOE estimated a baseline markup and an incremental markup. DOE defined a baseline markup as a multiplier that converts the mechanical contractor cost of equipment with baseline efficiency to the customer purchase price for the equipment at the same baseline efficiency level. An incremental markup is defined as the multiplier to convert the incremental increase in mechanical contractor cost of higher-efficiency equipment to the customer purchase price for the same equipment. Both baseline and incremental markups only depend on the particular distribution channel and are independent of the boiler efficiency levels.

DOE developed the markups for each distribution channel based on available financial data. DOE based the mechanical contractor markups on data from the Air Conditioning Contractors of America (ACCA)[23] and on the 2002 U.S. Census Bureau financial data[24] for the plumbing, heating, and air conditioning industry. DOE derived the general contractor markups from U.S. Census Bureau financial data for the commercial and institutional building construction sector.

The overall markup is the product of all the markups (baseline or incremental) for the different steps within a distribution channel plus sales tax. DOE calculated sales taxes based on 2008 State-by-State sales tax data reported by the Sales Tax Clearinghouse. Because both contractor costs and sales tax vary by State, DOE developed distributions of markups within each distribution channel by State. Because the State-by-State distribution of boiler unit sales varies by building type, the National distribution of the markups varies among business types. Chapter 5 of the NOPR TSD provides additional detail on markups.

[23] Air Conditioning Contractors of America. Financial Analysis for the HVACR Contracting Industry, 2005. Available at: *http://www.acca.org.*

[24] The 2002 U.S. Census Bureau financial data for the plumbing, heating, and air conditioning industry is the latest version data set and was issued in December 2004. Available at: *http://www.census.gov/prod/ec02/ec0223i236220.pdf.*

E. Energy Use Characterization

DOE used the building energy use characterization analysis to assess the energy savings potential of commercial boilers at different efficiency levels. This analysis estimates the energy use of commercial boilers at specified efficiency levels by using previously calculated Full Load Equivalent Operating Hour (FLEOH) metrics by building type and by climate across the United States. FLEOHs are effectively the number of hours that a system would have to run at full capacity to serve a total load equal to the annual load on the equipment. Boiler FLEOHs are calculated as the annual heating load divided by the equipment capacity. The FLEOH values used for the boiler analysis were based on simulations documented for the ''Screening Analysis for EPACT-Covered Commercial [Heating, Ventilating and Air-Conditioning] HVAC and Water-Heating Equipment''[25] (hereafter, 2000 Screening Analysis) (66 FR 3336 (Jan. 12, 2001)) and used 7 different building types and 11 different U.S. climates.

For each equipment class, DOE estimated the energy use of a given piece of equipment by multiplying the characteristic equipment output capacity by the FLEOH appropriate to each combination of representative building type and climate location. The product is effectively the total annual heat output from the boiler. The input energy is then determined by dividing the annual heat output by the thermal efficiency of the equipment at each efficiency level. The thermal efficiency is used here for all equipment classes since it defines the relationship between energy input and useful output of a commercial packaged boiler. For the two classes where a thermal efficiency metric was not specified by ASHRAE Standard 90.1–2007, an estimate of the thermal efficiency of equipment just meeting the combustion efficiency requirements specified by ASHRAE Standard 90.1–2007 was developed based on DOE's market analysis. DOE adjusted the unit energy use for each nominal equipment efficiency level DOE considered.

[25] U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, ''Energy Conservation Program for Consumer Products: Screening Analysis for EPACT-Covered Commercial HVAC and Water-Heating Equipment Screening Analysis'' (April 2000).

In addition for condensing hot water boilers, it is recognized that the thermal efficiency of a commercial packaged boiler in actual use depends on the return water conditions. In turn, the return water conditions are dependent upon the hydronic system design and control. For DOE's analysis, the rated thermal efficiencies for fully condensing equipment were further adjusted to reflect return water conditioners based on installation in existing buildings with conventional hydronic heating coils. DOE's estimates allow for the supply water temperature to reset sufficiently to meet the estimated heating coil loads during the year. See chapter 4 of the TSD for further details.

DOE estimated the national energy impacts of higher efficiency equipment by: (1) Mapping climate locations onto regions; and (2) estimating the fraction of each year's national equipment shipments (by product category) within market segments, as defined by a representative building type within a particular region of the United States. Seven representative building types were used, including: Assembly, Education, Food Service, Lodging, Office, Retail, and Warehouse buildings, as were used in the 2000 Screening Analysis. Because detailed statistical information related to where and in what types of buildings the equipment is currently being installed is generally unavailable, DOE developed an allocation process. The estimated allocation of national shipments to market segments was based on information from the 2003 Commercial Buildings Energy Consumption Survey (CBECS)[26] related to floor space and relative fraction of floor space reporting use of boilers for each market segment.

DOE developed the energy use estimates for the seven key commercial building types in 11 geographic regions. Seven of these regions correspond directly to U.S. Census divisions. The Pacific and Mountain Census divisions were subdivided individually into northern and southern regions to

[26] Energy Information Administration (2003). Available at: *http://www.eia.doe.gov/emeu/cbecs/contents/html* (2003).

account for north-south climate variation within those Census divisions, as discussed in the 2000 Screening Analysis. The LCC and national energy savings (NES) analyses use the annual energy consumption of commercial boilers in each equipment class analyzed. As expected, annual energy use of commercial boilers decreased as the efficiency level increased from the baseline efficiency level to the highest efficiency level analyzed. Chapter 4 of the NOPR TSD provides additional details on the energy use characterization analysis.

F. Life-Cycle Cost and Payback Period Analyses

DOE conducted the LCC and PBP analyses to estimate the economic impacts of potential standards on individual customers of commercial packaged boilers. DOE first analyzed these impacts for commercial packaged boilers by calculating the change in customers' LCCs likely to result from higher efficiency levels compared with the baseline efficiency levels. The LCC calculation considers total installed cost (contractor cost, sales taxes, distribution chain markups, and installation cost), operating expenses (energy, repair, and maintenance costs), equipment lifetime, and discount rate. DOE calculated the LCC for all customers as if each would purchase a new commercial boiler unit in the year the standard takes effect. Since DOE is considering both the efficiency levels in ASHRAE Standard 90.1–2007 and more-stringent efficiency levels, an amended energy conservation standard becomes effective on different dates depending upon the efficiency level and equipment class. The statutory lead times for DOE adopting of the ASHRAE Standard 90.1–2007 efficiency levels and more-stringent efficiency levels are different. (See section V.H.1 below for additional explanation of the effective dates.) However, from the customer's viewpoint, there is only a single boiler purchase date in determining the LCC benefits to the customer from purchase of a boiler at more-stringent efficiency levels. To account for this, DOE presumes that the purchase year for the LCC calculation is 2014, the earliest year in which DOE can establish an amended energy conservation level at an efficiency level more stringent than the ASHRAE efficiency level. To compute LCCs, DOE discounted future operating costs to the time of purchase and summed them over the lifetime of the equipment.

Second, DOE analyzed the effect of changes in installed costs and operating expenses by calculating the PBP of potential standards relative to baseline efficiency levels. The PBP estimates the amount of time it would take the customer to recover the incremental increase in the purchase price of more-efficient equipment through lower operating costs. The PBP is the change in purchase price divided by the change in annual operating cost that results from the standard. DOE expresses this period in years. Similar to the LCC, the PBP is based on the total installed cost and the operating expenses. However, unlike the LCC, DOE only considers the first year's operating expenses in the PBP calculation. Because the PBP does not account for changes in operating expense over time or the time value of money, it is also referred to as a simple PBP.

DOE conducted the LCC and PBP analyses using a commercially-available spreadsheet model. This spreadsheet accounts for variability in energy use, installation costs and maintenance costs, and energy costs, and uses weighting factors to account for distributions of shipments to different building types and States to generate national LCC savings by efficiency level. The results of DOE's LCC and PBP analyses are summarized in section VI below and described in detail in chapter 5 of the NOPR TSD.

1. Approach

Recognizing that each business that uses commercial packaged boiler equipment is unique, DOE analyzed variability and uncertainty by performing the LCC and PBP calculations assuming a one-to-one correspondence between business types and market segments (characterized as building types) for customers located in seven types of commercial buildings. DOE developed financial data appropriate for the customers in each building type. Each type of building has typical customers who have different costs of financing because of the nature of the business. DOE derived the financing costs based on data from the Damodaran Online site.[27]

The LCC analysis used the estimated annual energy use for each commercial packaged boiler unit described in section V.E. Because energy use of commercial packaged boilers is sensitive to climate, it varies by State. Aside from energy use, other important factors influencing the LCC and PBP analyses are energy prices, installation costs, equipment distribution markups, and sales tax. At the national level, the LCC spreadsheets explicitly modeled both the uncertainty and the variability in the model's inputs, using probability distributions based on the shipment of commercial packaged boiler equipment to different States.

As mentioned above, DOE generated LCC and PBP results by building type and State and used developed weighting factors to generate national average LCC savings and PBP for each efficiency level. As there is a unique LCC and PBP for each calculated value at the building type and State level, the outcomes of the analysis can also be expressed as probability distributions with a range of LCC and PBP results. A distinct advantage of this type of approach is that DOE can identify the percentage of customers achieving LCC savings or attaining certain PBP values due to an increased efficiency level, in addition to the average LCC savings or average PBP for that efficiency level.

2. Life-Cycle Cost Inputs

For each efficiency level DOE analyzed, the LCC analysis required input data for the total installed cost of the equipment, its operating cost, and the discount rate. Table V.15 summarizes the inputs and key assumptions DOE used to calculate the customer economic impacts of all energy efficiency levels analyzed in this rulemaking. A more detailed discussion of the inputs follows.

TABLE V.15—SUMMARY OF INPUTS AND KEY ASSUMPTIONS USED IN THE LCC AND PBP ANALYSES

Inputs	Description
Affecting Installed Costs	
Equipment Price	Equipment price was derived by multiplying contractor cost (from the engineering analysis) by mechanical and general contractor markups as needed plus sales tax from the markups analysis.

[27] Damodaran Online. Leonard N. Stern School of Business, New York University (Jan. 2006). Available at: *http://www.stern.nyu.edu/adamodar/New_Home_Page/data.html*.

TABLE V.15—SUMMARY OF INPUTS AND KEY ASSUMPTIONS USED IN THE LCC AND PBP ANALYSES—Continued

Inputs	Description
Installation Cost	Installation cost includes installation labor, installer overhead, and any miscellaneous materials and parts, derived from *RS Means CostWorks 2007*.[28] DOE added additional costs to reflect the installation of near condensing and condensing boilers at efficiency levels more stringent than ASHRAE Standard 90.1–2007 efficiency levels. These costs include control modifications, stainless steel flues, and condensate pumps and piping to remove condensate.
Affecting Operating Costs	
Annual Energy Use	DOE derived annual energy use using FLEOH data for commercial boilers combined with thermal efficiency estimates for each boiler efficiency level analyzed. DOE did not incorporate differences in annual electricity use by efficiency level. DOE used State-by-State weighting factors to estimate the national energy consumption by efficiency level.
Fuel Prices	DOE developed average commercial natural gas and fuel oil prices for each State using EIA's State Energy Database Data for 2006 for natural gas and oil price data.[29] DOE used AEO2008 energy price forecasts to project oil and natural gas prices into the future.
Maintenance Cost	DOE estimated annual maintenance costs for commercial boilers based on MARS 8 Facility Cost Forecast System Database [30] for commercial boilers. Annual maintenance cost did not vary as a function of efficiency.
Repair Cost	DOE estimated the annualized repair cost for baseline efficiency commercial boilers based on cost data from MARS 8 Facility Cost Forecast System Database for commercial boilers. DOE assumed that repair costs would vary in direct proportion with the MSP at higher efficiency levels because it generally costs more to replace components that are more efficient.
Affecting Present Value of Annual Operating Cost Savings	
Equipment Lifetime	DOE estimated equipment lifetime assuming a 30-year lifespan for all commercial boilers based on data published by ASHRAE.
Discount Rate	Mean real discount rates for all buildings range from 2.3 percent for education buildings to 5.9 percent for retail building owners.
Analysis Start Year	Start year for LCC is 2014, which is four years after the publication of the final rule for amended energy conservation standards higher than ASHRAE.
Analyzed Efficiency Levels	
Analyzed Efficiency Levels	DOE analyzed the baseline efficiency levels (ASHRAE Standard 90.1–2007) and up to four higher efficiency levels for all ten equipment classes. See the engineering analysis for additional details.

a. Equipment Prices

The price of a commercial boiler reflects the application of distribution channel markups (mechanical and general contractor markups) and sales tax to the mechanical contractor cost established in the engineering analysis. As described in section V.C, DOE determined mechanical contractor costs for ten commercial boilers defined by a single representative equipment capacity (output capacity) for each of ten equipment classes. For each equipment class, the engineering analysis provided contractor costs for the baseline equipment and up to four higher equipment efficiencies.

The markup is the percentage increase in price as the commercial packaged boiler equipment passes through the distribution channel. As explained in section V.D, distribution chain markups are based on two truncated distribution channels, starting with a mechanical contractor cost for each efficiency level, based on whether the equipment is being purchased for the new construction market or to replace existing equipment.

b. Installation Costs

DOE derived national average installation costs for commercial boilers from data provided in *RS Means CostWorks 2007* (RS Means) for commercial boiler equipment with efficiencies at or below the ASHRAE Standard 90.1–2007 efficiency levels.[31] RS Means provides estimates for installation costs for hot water and steam boilers by equipment capacity and fuel type, as well as cost indices that reflect the variation in installation costs for 295 cities in the United States. The RS Means data identifies several cities in all 50 States and the District of Columbia. DOE incorporated location-based cost indices into the analysis to capture variation in installation cost, depending on the location of the customer.

For more-stringent efficiency levels, DOE estimated the cost for stainless steel venting at more-stringent efficiency levels based on an assumed 35-foot flue length and applied the entire materials cost to commercial packaged boilers going into the replacement market. In addition, DOE assumed additional costs for control modifications for higher-efficiency boilers and for condensate removal for near condensing and condensing boilers. DOE recognized, however, that installation costs could potentially be higher with higher efficiency commercial packaged boilers due primarily to venting concerns with existing flues and chimney cases in the replacement market. DOE did not have data to calibrate the extent to which additional cost should apply. This is identified as Issue 3 under ''Issues on Which DOE Seeks Comment'' in section VIII.E of today's NOPR.

[28] RS Means CostWorks 2007, R.S. Means Company, Inc. 2007. Kingston, Massachusetts (2007). Available at: *http://www.meanscostworks.com/*.

[29] Natural Gas Price and Expenditure Estimates by Sector, EIA, 2006. Available at: *http://www.eia.doe.gov/emeu/states/sep_fuel/html/fuel_pr_ng.html*. 2006 Distillate Fuel Price and Expenditure Estimates by Sector, EIA, 2006. Available at: *http://www.eia.doe.gov/emeu/states/hf.jsp?incfile=sep_fuel/html/fuel_pr_df.html*

[30] MARS 8 Facility Cost Forecast System Database, Whitestone Research, 2008. Washington, DC. Available at: *http://www.whitestoneresearch.com/mars/index.htm*.

[31] RS Means CostWorks 2007, R.S. Means Company, Inc. 2007. Kingston, Massachusetts (2007). Available at: *http://www.meanscostworks.com/*.

c. Annual Energy Use

DOE estimated the annual natural gas or fuel oil energy consumed by each class of commercial boiler, by efficiency level, based on the energy use characterization described in section V.E. DOE aggregated the average annual energy use per unit at the State level by applying a regional building-type weighting factor to establish the relative building type shipments for each of 11 geographic regions composed of select States, and then a population-weighting factor for each State within the geographic regions.

DOE adjusted the condensing efficiency levels identified in the engineering analysis for small and large gas-fired hot water commercial packaged boilers to more accurately reflect actual field efficiencies. In both cases, DOE degraded the thermal efficiencies to 88 percent. DOE assumed that commercial packaged boilers serve a standard fan coil or air handler delivery system and that the load of the system varies linearly with the outdoor temperature from a balance point of 50 degrees Fahrenheit. Chapter 4 of the NOPR TSD describes the annual energy use calculations.

In determining the reduction in energy consumption of commercial packaged boiler equipment due to increased efficiency, DOE did not take into account a rebound effect. The rebound effect occurs when a piece of equipment, after it is made more efficient, is used more intensively, and therefore the expected energy savings from the efficiency improvement do not fully materialize. For the commercial boilers that are the subject of this rulemaking, DOE has no basis for concluding that a rebound effect would occur and has not taken the rebound effect into account in the energy use characterization.

d. Fuel Prices

Fuel prices are needed to convert the gas or oil energy savings from higher-efficiency equipment into energy cost savings. Because of the variation in annual fuel consumption savings and equipment costs across the country, it is important to consider regional differences in electricity prices. DOE used average effective commercial natural gas and commercial fuel oil prices at the State level from Energy Information Administration (EIA) data for 2006 and 2007. Where 2006 data were used, EIA fuel escalation factors from the 2008 Annual Energy Outlook (*AEO2008*) were used to escalate prices to 2007 average fuel price estimates. This approach captured a wide range of commercial fuel prices across the United States. Furthermore, different kinds of businesses typically use electricity in different amounts at different times of the day, week, and year, and therefore face different effective prices. To make this adjustment, DOE used EIA's 2003 CBECS [32] data set to identify the average prices the seven building types paid and compared them with the average prices all commercial customers paid.[33] DOE used the ratios of prices paid by the seven types of businesses to the national average commercial prices seen in the 2003 CBECS as multipliers to adjust the average commercial 2007 State price data.

DOE weighted the prices each building type paid in each State by the estimated sales of commercial boilers to each building type to obtain a weighted-average national electricity and national average fuel oil price for 2007. The State/building type weights reflect the probabilities that a given boiler unit shipped will operate with a given fuel price. The effective prices (2007$) range from approximately $4.75 per million Btu to approximately $27.98 per million Btu for natural gas, and from approximately $14.83 per million Btu to approximately $17.56 cents per million Btu for commercial fuel oil. (See chapter 5 of the NOPR TSD.)

The natural gas and fuel price trends provide the relative change in fuel costs for future years to 2042. DOE applied the *AEO2008* reference case as the default scenario and extrapolated the trend in values from 2020 to 2030 of the forecast to establish prices in 2030 to 2042. This method of extrapolation is in line with methods the EIA uses to forecast fuel prices for the Federal Energy Management Program. DOE provides a sensitivity analysis of the LCC savings and PBP results to different fuel price scenarios using both the *AEO2008* high-price and low-price forecasts in chapter 5 of the NOPR TSD.

e. Maintenance Costs

Maintenance costs are the costs to the customer of maintaining equipment operation. Maintenance costs include services such as cleaning heat-exchanger coils and changing air filters. DOE estimated annual routine maintenance costs for commercial boiler equipment as $1.445/kbtu-hr output capacity per year for boilers with output capacities of nominally 800 kBtu/h, and as $0.945/kbtu-hr output capacity per year for boilers with output capacities of 3000 kBtu/h, reported in the MARS 8 Facility Cost Forecast System database. Because data were not available to indicate how maintenance costs vary with equipment efficiency, DOE decided to use preventive maintenance costs that remain constant as equipment efficiency increases.

f. Repair Costs

The repair cost is the cost to the customer of replacing or repairing components that have failed in the commercial boiler. DOE estimated the annualized repair cost for baseline efficiency commercial boilers as $443/yr for boilers with output capacities of nominally 800 kBtu/h, and as $820/yr for boilers with output capacities of 3000 kBtu/h, based on costs for component repair documented in MARS 8 Facility Cost Forecast System database. DOE determined that repair costs would increase in direct proportion with increases in equipment prices. Because the price of boilers increases with efficiency, the cost for component repair will also increase as the efficiency of equipment increases.

g. Equipment Lifetime

DOE defines equipment lifetime as the age when a commercial boiler is retired from service. DOE reviewed available literature and consulted with manufacturers to establish typical equipment lifetimes. The literature and experts consulted offered a wide range of typical equipment lifetimes. DOE used a 30-year lifetime for commercial boilers in the 2000 Screening Analysis based on data from ASHRAE's 1995 Handbook of HVAC Applications.[34] DOE continued to use this estimate for the LCC analysis. Chapter 5 of the NOPR TSD contains a discussion of equipment lifetime.

h. Discount Rate

The discount rate is the rate at which future expenditures are discounted to establish their present value. DOE estimated the discount rate by estimating the cost of capital for purchasers of commercial boilers. Most purchasers use both debt and equity capital to fund investments. Therefore, for most purchasers, the discount rate is the weighted-average cost of debt and equity financing, or the weighted-average cost of capital (WACC), less the expected inflation.

[32] EIA's Commercial Buildings Energy Consumption Survey, Energy Information Agency. Public use microdata available at: *http://www.eia.doe.gov/emeu/cbecs/cbecs2003/public_use_2003/cbecs_pudata2003.html.*

[33] EIA's 2003 CBECS is the most recent version of the data set.

[34] ASHRAE Handbook: 1995 Heating, Ventilating, and Air-Conditioning Applications, ASHRAE, 1995. Available for purchase at: *http://www.ashrae.org/publications/page/1287.*

To estimate the WACC of commercial boiler purchasers, DOE used a sample of over 2000 companies grouped to be representative of operators of each of five of seven commercial building types (food service, lodging, office, retail, and warehouse) and drawn from a database of 7,369 U.S. companies presented on the Damodaran Online website.[35] This database includes most of the publicly-traded companies in the United States. For public assembly and education buildings, DOE estimated the cost of capital based on composite tax exempt bond rates. When one or more of the variables needed to estimate the discount rate was missing or could not be obtained, DOE discarded the firm from the analysis. The WACC approach for determining discount rates accounts for the current tax status of individual firms on an overall corporate basis. DOE did not evaluate the marginal effects of increased costs, and thus depreciation due to more expensive equipment, on the overall tax status.

DOE used the final sample of companies to represent purchasers of commercial boilers. For each company in the sample, DOE derived the cost of debt, percent debt financing, and systematic company risk from information on the Damodaran Online Web site. Damodaran estimated the cost of debt financing from the long-term government bond rate (4.39 percent) and the standard deviation of the stock price. DOE then determined the weighted average values for the cost of debt, range of values, and standard deviation of WACC for each category of the sample companies. Deducting expected inflation from the cost of capital provided estimates of real discount rate by ownership category. Based on this database, DOE calculated the weighted average after-tax discount rate for commercial boiler purchases, adjusted for inflation, in each of the seven building types used in the analysis. Chapter 5 of the NOPR TSD contains the detailed calculations on the discount rate.

3. Payback Period

DOE also determined the economic impact of potential amended energy conservation standards on customers by calculating the PBP of more-stringent efficiency levels relative to a baseline efficiency level. The PBP measures the amount of time it takes the commercial customer to recover the assumed higher purchase expense of more-efficient equipment through lower operating costs. Similar to the LCC, the PBP is based on the total installed cost and the operating expenses for each building type and State, weighted on the probability of shipment to each market. Because the PBP does not take into account changes in operating expense over time or the time value of money, DOE considered only the first year's operating expenses to calculate the PBP, unlike the LCC. Chapter 5 of the NOPR TSD provides additional details about the PBP.

G. National Impact Analysis—National Energy Savings and Net Present Value Analysis

The national impacts analysis evaluates the impact of a proposed energy conservation standard from a national perspective rather than from the customer perspective represented by the LCC. This analysis assesses the net present value (NPV) (future amounts discounted to the present) and the NES of total commercial customer costs and savings, which are expected to result from amended standards at specific efficiency levels. For each efficiency level analyzed, DOE calculated the NPV and NES for adopting more-stringent standards than the efficiency levels specified in ASHRAE Standard 90.1–2007. The NES refers to cumulative energy savings from 2012 through 2042. DOE calculated new energy savings in each year relative to a base case, defined as DOE adoption of the efficiency levels specified by ASHRAE Standard 90.1–2007. The NPV refers to cumulative monetary savings. DOE calculated net monetary savings in each year relative to the base case as the difference between total operating cost savings and increases in total installed cost. Cumulative savings are the sum of the annual NPV over the specified period. DOE accounted for operating cost savings until 2085, when 95 percent of all the equipment installed in 2042 should be retired.

1. Approach

Over time, equipment that is more efficient in the standards case gradually replaces less-efficient equipment. This affects the calculation of both the NES and NPV, which are a function of the total number of units in use and their efficiencies. Both the NES and NPV depend on annual shipments and equipment lifetime, including changes in shipments and retirement rates in response to changes in equipment costs due to amended energy conservation standards. Both calculations start by using the shipments estimate and the quantity of units in service derived from the shipments model.

With regard to estimating the NES, because more-efficient boilers gradually replace less-efficient ones, the energy per unit of capacity used by the boilers in service gradually decreases in the standards case relative to the base case. DOE calculated the NES by subtracting energy use under a standards-case scenario from energy use in a base case scenario.

Unit energy savings for each equipment class are the weighted-average values calculated in the LCC spreadsheet. To estimate the total energy savings for each efficiency level, DOE first calculated the national site energy consumption (*i.e.,* the energy directly consumed by the units of equipment in operation) for each class of commercial packaged boilers for each year of the analysis period. The NES and NPV analysis periods began with the earliest expected effective date of amended Federal energy conservation standards (*i.e.,* 2012) based on DOE adoption of the baseline ASHRAE 90.1–2007 efficiency levels. For the analysis of DOE adoption of more-stringent efficiency levels, the earliest effective date is 2014, four years after DOE would likely issue a final rule requiring such standards. Second, DOE determined the annual site energy savings, consisting of the difference in site energy consumption between the base case and the standards case for each class of boiler. Third, DOE converted the annual site energy savings into the annual amount of energy saved at the source of gas generation (the source energy), using a site-to-source conversion factor. Finally, DOE summed the annual source energy savings from 2012 to 2042 to calculate the total NES for that period. DOE performed these calculations for each efficiency level considered for commercial packaged boilers in this rulemaking.

DOE considered whether a rebound effect is applicable in its NES analysis. A rebound effect occurs when an increase in equipment efficiency leads to an increased demand for its service. EIA in its national energy modeling system (NEMS) model assumes a certain elasticity factor to account for an increased demand for service due to the increase in cooling (or heating) efficiency.[36] EIA refers to this as an efficiency rebound.[37] For the

[35] Damodaran financial data used for determining cost of capital available at: *http://pages.stern.nyu.edu/~adamodar/ for commercial businesses.* Data for determining financing for public buildings available at: *http://finance.yahoo.com/bonds/composite_bond_rates.*

[36] DOE used the NEMS version consistent with *AEO2008.* An overview of the NEMS model and documentation is found at *http://www.eia.doe.gov/oiaf/aeo/overview/index.html.*

[37] EIA, Assumptions to the *Annual Energy Outlook 2007* (2007). Available at: *http://www.eia.doe.gov/oiaf/aeo/assumption/index.html.*

commercial heating equipment market, there are two ways that a rebound effect could occur: (1) Increased use of the heating equipment within the commercial buildings they are installed in; and (2) additional instances of heating a commercial building where it was not being heated before.

The first instance does not occur often because commercial buildings are generally heated to the thermal comfort temperatures desired in these buildings during the occupied periods. DOE also does not believe that increases in the efficiency of commercial boilers would result in significant increases in operating hours during which heating might be utilized in buildings.

With regard to the second instance, commercial boilers are unlikely to be installed in previously unheated building spaces, because commercial packaged boilers are not primarily found in warehouse buildings. Furthermore, relatively little unheated commercial building space exists outside of warehouse buildings. For warehouse buildings generally, other heating equipment types tend to be utilized today and will likely continued to be used in the future, because of lower first costs with direct heating equipment such as furnaces and unit heaters as well as the use of high temperature radiant heaters for human comfort in some warehouses. Therefore, DOE did not assume a rebound effect in the present NOPR analysis. DOE seeks input from interested parties on whether there will be a rebound effect for improvements in the efficiency of commercial packaged boilers. If interested parties believe a rebound effect will occur, DOE is interested in receiving data quantifying the effects as well as input regarding how should DOE quantify this in its analysis. This is identified as Issue 4 under ''Issues on Which DOE Seeks Comment'' in section VIII.E of today's NOPR.

To estimate NPV, DOE calculated the net impact as the difference between total operating cost savings (including electricity, repair, and maintenance cost savings) and increases in total installed costs (including customer prices and installation cost). DOE calculated the NPV of each standard level over the life of the equipment using the following three steps. First, DOE determined the difference between the equipment costs under the standard-level case and the base case in order to obtain the net equipment cost increase resulting from the higher standard level. Second, DOE determined the difference between the base-case operating costs and the standard-level operating costs in order to obtain the net operating cost savings from each higher efficiency level. Third, DOE determined the difference between the net operating cost savings and the net equipment cost increase in order to obtain the net savings (or expense) for each year. DOE then discounted the annual net savings (or expenses) to 2008 for boilers bought on or after 2012 and summed the discounted values to provide the NPV of an efficiency level. An NPV greater than zero shows net savings (*i.e.,* the efficiency level would reduce customer expenditures relative to the base case in present value terms). An NPV that is less than zero indicates that the efficiency level would result in a net increase in customer expenditures in present value terms.

To make the analysis more transparent to all interested parties, DOE used a commercially-available spreadsheet model to calculate the energy savings and the national economic costs and savings from amended standards. Chapter 7 of the NOPR TSD helps explain the models and how to use them. Interested parties can review DOE's analyses by changing various input quantities within the spreadsheet.

Unlike the LCC analysis, the NES spreadsheet does not use distributions for inputs or outputs, but relies on national average first costs and energy costs developed from the LCC spreadsheet. DOE examined sensitivities by applying different scenarios. DOE used the NES spreadsheet to perform calculations of energy savings and NPV using the annual energy consumption and total installed cost data from the LCC analysis. DOE forecasted the energy savings, energy cost savings, equipment costs, and NPV of benefits for equipment sold in each boiler equipment class from 2012 through 2042. The forecasts provided annual and cumulative values for all four output parameters described above.

2. Shipments Analysis

Equipment shipments are an important element in the estimate of the future impact of a standard. DOE developed shipments projections under a base case and each of the standards cases using a shipments model. DOE used the standards-case shipments projection and, in turn, the standards-case equipment stock to determine the NES. The shipments portion of the spreadsheet model forecasts boiler shipments from 2012 to 2042. Chapter 6 of the NOPR TSD provides details of the shipment projections.

DOE developed shipments forecasts by accounting for (1) the growth in the stock of commercial buildings which use boilers; (2) equipment retirements; and (3) equipment lifetimes.

The shipments model assumes that in each year, each existing boiler either ages by one year or breaks down, and that equipment that breaks down is replaced. In addition, new equipment can be shipped into new commercial building floor space, and old equipment can be removed through demolitions. DOE's shipments model is based on current shipments for commercial packaged boilers based on data provided by AHRI, as described above, as well as on an existing boiler survival function consistent with a 30-year equipment life. Shipments are separated into two groups: (1) Shipments to new construction; and (2) shipments for replacements. Total commercial boiler shipment data for 2007 from AHRI was first disaggregated into these two groups using the relative floor space between new construction and existing stock (as determined in the NEMS model for 2007) and assuming the same saturation rate for boiler usage between new and existing buildings. DOE then disaggregated total boiler shipments into shipments by equipment class, based on the relative fraction of models for each equipment class reflected in DOE's market database. This data allowed DOE to allocate sales of equipment to the different equipment classes. Annual shipments to new construction grew in proportion to the annual construction put in place as forecast by the NEMS model. Shipments for replacements in each year are based on a replacement model, which tracks the quantity and types of boilers that must be replaced in the building stock based on the boiler survival function. Chapter 2 of the NOPR TSD summarizes the total shipments data and the market database.

Table V.16 shows the forecasted shipments for the different equipment classes of commercial boilers for selected years from 2012 to 2042 for the base case. As equipment purchase price increases with efficiency, DOE recognizes that higher first costs can result in a drop in shipments. However, DOE had no basis for estimating the elasticity of shipments for commercial packaged boilers as a function of either first costs or operating costs. Therefore, DOE presumed that total shipments do not change with higher standard levels. Table V.16 also shows the cumulative shipments for boilers from 2012 to 2042. Chapter 6 of the NOPR TSD provides additional details on the shipments forecasts, including the standards case forecast.

TABLE V.16—BASE-CASE SHIPMENTS FORECAST FOR COMMERCIAL BOILERS

Equipment	Thousands of units shipped by year and equipment class								
	2012	2015	2020	2025	2030	2035	2040	2042	Cumulative shipments (2012–2042)
Small gas-fired hot water	6,853	7,112	7,494	7,922	8,848	10,343	12,239	12,984	73,795
Small gas-fired steam all except natural draft	2,322	2,410	2,539	2,684	2,998	3,505	4,147	4,399	25,005
Small gas-fired steam natural draft	3,568	3,703	3,902	4,125	4,607	5,385	6,372	6,760	38,422
Small oil-fired hot water	1,926	1,999	2,106	2,226	2,486	2,906	3,439	3,648	20,736
Small oil-fired steam	3,228	3,350	3,530	3,732	4,168	4,872	5,765	6,116	34,763
Large gas-fired hot water	1,104	1,146	1,208	1,277	1,426	1,667	1,972	2092	11,893
Large gas-fired steam all except natural draft	2,011	2,087	2,199	2,324	2,596	3,034	3,591	3,809	21,651
Large gas-fired steam natural draft	2,577	2,674	2,818	2,979	3,327	3,889	4,602	4,882	27,750
Large oil-fired hot water	538	558	588	622	695	812	961	1,019	5,794
Large oil-fired steam	4,248	4,408	4,645	4,910	5,485	6,411	7,586	8,048	45,741
Total	28,376	29,449	31,030	32,801	36,637	42,824	50,675	53,758	305,550

3. Base-Case and Standards-Case Forecasted Distribution of Efficiencies

The annual energy consumption of a commercial boiler unit is inversely related to the thermal efficiency of the unit. Thus, DOE forecasted shipment-weighted average equipment thermal efficiencies that, in turn, enabled a determination of the shipment-weighted annual energy consumption values for the base case and each efficiency level analyzed. DOE determined shipment-weighted average efficiency trends for commercial boilers equipment by first converting the 2008 equipment shipments by equipment class into market shares by equipment class. DOE then reviewed DOE's market database to determine the distribution of efficiency levels for commercially-available models within each equipment class. DOE bundled the efficiency levels into ''efficiency ranges'' and determined the percentage of models within each range. DOE applied the percentages of models within each efficiency range to the total unit shipments for a given equipment class to estimate the distribution of shipments within the base case. To determine the percentage of models in each efficiency range, DOE considered models greater than or equal to the lower bound of the efficiency range and models with efficiencies less than the upper bound of the efficiency range. For example, for the thermal efficiency range of 79–80 percent, DOE considered models with thermal efficiency levels from 79.0 to 79.9 to be within this range. Then, from those market shares and projections of shipments by equipment class, DOE extrapolated future equipment efficiency trends both for a base-case scenario and standards-case scenarios. The difference in equipment efficiency between the base case and standards cases was the basis for determining the reduction in per-unit annual energy consumption that could result from amended standards.

For the base case, DOE assumed that, absent amended standards, forecasted market shares would remain frozen at the 2012 efficiency levels until the end of the forecast period (30 years after the effective date, or 2042). This prediction could cause DOE to overestimate the savings associated with the higher efficiency levels discussed in this notice because historical data indicated boiler efficiencies or relative efficiency class preferences may change voluntarily over time. Therefore, DOE seeks comment on this assumption and the potential significance of any overestimation of savings. In particular, DOE requests data that would allow it to better characterize the likely increases in packaged boiler efficiencies that would occur over the 30-year analysis period absent adoption of either the ASHRAE 90.1–2007 efficiency levels or higher efficiency levels considered in this rule. This is identified as Issue 5 under ''Issues on Which DOE Seeks Comment'' in section VIII.E of today's NOPR.

For each efficiency level analyzed, DOE used a ''roll-up'' scenario to establish the market shares by efficiency level for the year that standards become effective (*i.e.*, 2014 if DOE adopts more-stringent efficiency levels than those in ASHRAE Standard 90.1–2007). DOE collected information that suggests the efficiencies of equipment in the base case that did not meet the standard level under consideration would roll up to meet the standard level. This information also suggests that equipment efficiencies in the base case that were above the standard level under consideration would not be affected.

DOE seeks input on its basis for the NES-forecasted base-case distribution of efficiencies and its prediction of how amended energy conservation standards affect the distribution of efficiencies in the standards case. This is identified as Issue 6 under ''Issues on Which DOE Seeks Comment'' in section VIII.E of today's NOPR.

4. National Energy Savings and Net Present Value

The commercial boiler equipment stock is the total number of commercial boilers in each equipment class purchased or shipped from previous years that have survived until the point at which stock is taken. The NES spreadsheet,[38] through use of the shipments model, keeps track of the total number of commercial boilers shipped each year. For purposes of the NES and NPV analyses, DOE assumes that retirements follow a Weibull [39] distribution with a 30-year mean lifetime. Retired units are replaced until 2042. For units shipped in 2042, any units still remaining at the end of 2085 are retired.

[38] The NES spreadsheet can be found on the DOE's ASHRAE Products Web site at: *http://www1.eere.energy.gov/buildings/appliance_standards/commercial/ashrae_products_docs_meeting.html*.

[39] The Weibull distribution is a continuous probability distribution used to understand the failure and durability of equipment. It is popular because it is extremely flexible and can accurately model various types of failure processes. A two-parameter version of the Weibull was used and is described in chapter 7 of the TSD.

The national annual energy consumption is the product of the annual unit energy consumption and the number of boiler units of each vintage in the stock. This approach accounts for differences in unit energy consumption from year to year. In determining national annual energy consumption, DOE first calculated the annual energy consumption at the site (*i.e.,* million Btus of fuel consumed by commercial boilers) and multiplied that by a conversion factor to account for distribution losses.

To discount future impacts, DOE follows Office of Management and Budget (OMB) guidance in using discount rates of 7 percent and 3 percent in evaluating the impacts of regulations. In selecting the discount rate corresponding to a public investment, OMB directs agencies to use ''the real Treasury borrowing rate on marketable securities of comparable maturity to the period of analysis.'' [40] The 7-percent rate is an estimate of the average before-tax rate of return on private capital in the United States economy, and reflects the returns to real estate and small business capital as well as corporate capital. DOE used this discount rate to approximate the opportunity cost of capital in the private sector, because recent OMB analysis has found the average rate of return on capital to be near this rate. DOE also used the 3-percent discount rate to capture the potential effects of standards on private customers' consumption (*e.g.,* reduced purchasing of equipment due to higher prices and purchase of reduced amounts of energy). This rate represents the rate at which society discounts future consumption flows to their present value. This rate can be approximated by the real rate of return on long-term government debt (*e.g.,* yield on Treasury notes minus annual rate of change in the Consumer Price Index), which has averaged about 3 percent on a pre-tax basis for the last 30 years. Table V.17 summarizes the inputs to the NES spreadsheet model along with a brief description of the data sources. The results of DOE's NES and NPV analysis are summarized in section VI.B.2 below and described in detail in chapter 7 of the NOPR TSD.

TABLE V.17—SUMMARY OF NES AND NPV MODEL INPUTS

Inputs	Description
Shipments	Annual shipments from shipments model (see chapter 6 of the NOPR TSD).
Effective Date of Standard	2014 for adoption of a more-stringent efficiency level than those specified by ASHRAE Standard 90.1–2007. 2012 for adoption of the efficiency levels specified by ASHRAE Standard 90.1–2007.
Base Case Efficiencies	Distribution of base-case shipments by efficiency level.
Standard Case Efficiencies	Distribution of shipments by efficiency level for each standards case. Standards-case annual shipment-weighted market shares remain the same as in the base case and each standard level for all efficiencies above the efficiency level being analyzed. All other shipments are at the efficiency level.
Annual Energy Use per Unit	Annual national weighted-average values are a function of efficiency level. (See chapter 4 of the NOPR TSD.)
Total Installed Cost per Unit	Annual weighted-average values are a function of efficiency level. (See chapter 5 of the NOPR TSD.)
Repair Cost per Unit	Annual weighted-average values increase with manufacturer's cost level. (See chapter 5 of the NOPR TSD.)
Maintenance Cost per Unit	See chapter 5 of the NOPR TSD.
Escalation of Fuel Prices	*AEO2008* forecasts (to 2030) and extrapolation for beyond 2030. (See chapter 5 of the NOPR TSD.)
Site-Source Conversion	Based on average annual site-to-source conversion factor for natural gas from *AEO2008*.
Discount Rate	3 percent and 7 percent real.
Present Year	Future costs are discounted to 2008.

H. Other Issues

1. Effective Date of the Proposed Amended Energy Conservation Standards

Generally, covered equipment to which a new or amended energy conservation standard applies must comply with the standard if such equipment is manufactured or imported on or after a specified date. In today's NOPR, DOE is evaluating whether more-stringent efficiency levels than those in ASHRAE Standard 90.1–2007 would be economically justified and result in a significant amount of energy savings. If DOE were to propose a rule prescribing energy conservation standards at the efficiency levels contained in ASHRAE Standard 90.1–2007, EPCA states that any such standards shall become effective ''on or after a date which is two years after the effective date of the applicable minimum energy efficiency requirement in the amended ASHRAE/IES standard * * *''. (42 U.S.C. 6313(a)(6)(D)) DOE has applied this two-year implementation period to determine the effective date of any energy conservation standard equal to the efficiency levels specified by ASHRAE Standard 90.1–2007 proposed by this rulemaking. Thus, if DOE decides to adopt one of the efficiency levels in ASHRAE Standard 90.1–2007 for the equipment classes where a two-tier standard is set-forth, the effective date of the rulemaking would be dependent upon the effective date specified in ASHRAE Standard 90.1–2007. For example, in certain cases, the effective date in ASHRAE Standard 90.1–2007 is March 2, 2010 for the initial efficiency level (which would require an effective date of 2012), but the effective date is March 2, 2020 for the second tier efficiency level (which would require an effective date of 2022).

If DOE were to propose a rule prescribing energy conservation standards higher than the efficiency levels contained in ASHRAE Standard 90.1–2007, EPCA states that any such standards ''shall become effective for products manufactured on or after a date which is four years after the date such rule is published in the **Federal**

[40] OMB Circular No. A–94, ''Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs'' (Oct. 29, 1992) section 8.c.1.

Register.'' (42 U.S.C. 6313(a)(6)(D)) DOE has applied this 4-year implementation period to determine the effective date of any energy conservation standard higher than the efficiency levels specified by ASHRAE Standard 90.1–2007 that might be prescribed in a future rulemaking. Thus, for products for which DOE might adopt a level more stringent than the ASHRAE efficiency levels, the rule would apply to products manufactured on or after July 2014, which is four years from the date of publication of the final rule.[41]

Table V.18 presents the anticipated effective dates of an amended energy conservation standard for each equipment class for which DOE developed a potential energy savings analysis.

TABLE V.18—ANTICIPATED EFFECTIVE DATE OF AN AMENDED ENERGY CONSERVATION STANDARD FOR EACH EQUIPMENT CLASS OF COMMERCIAL PACKAGED BOILERS

Equipment class	Anticipated effective date for adopting the efficiency levels in ASHRAE standard 90.1–2007	Anticipated effective date for adopting more-stringent efficiency levels than those in ASHRAE standard 90.1–2007
Small Gas-Fired Hot Water Commercial Packaged Boilers	2012	2014
Small Gas-Fired Steam, All Except Natural Draft Commercial Packaged Boilers	2012	2014
Small Gas-Fired Steam Natural Draft Commercial Packaged Boilers	2012 or 2022	2014
Small Oil-Fired Hot Water Commercial Packaged Boilers	2012	2014
Small Oil-Fired Steam Commercial Packaged Boilers	2012	2014
Large Gas-Fired Hot Water Commercial Packaged Boilers	2012	2014
Large Gas-Fired Steam, All Except Natural Draft Commercial Packaged Boilers	2012 or 2022	2014
Large Gas-Fired Steam Natural Draft Commercial Packaged Boilers	2012	2014
Large Oil-Fired Hot Water Commercial Packaged Boilers	2012	2014

VI. Analytical Results

A. Efficiency Levels Analyzed

Table VI.1 presents the baseline efficiency level and the efficiency levels analyzed for each equipment class of commercial packaged boilers subject to today's proposed rule. The baseline efficiency levels correspond to the efficiency levels specified by ASHRAE Standard 90.1–2007. The efficiency levels above the baseline represent efficiency levels above those specified in ASHRAE Standard 90.1–2007 where equipment is currently available on the market.

TABLE VI.1—EFFICIENCY LEVELS ANALYZED

Equipment class	Representative capacity kBtu/h	Efficiency levels analyzed (percent)
Small gas-fired hot water	800	Baseline—80 E_T
		82 E_T
		84 E_T
		86 E_T
		Condensing—92 E_T
Small gas-fired steam all except natural draft	800	Baseline—79 E_T
		80 E_T
		81 E_T
		82 E_T
		83 E_T
Small gas-fired steam natural draft	800	Baseline—77 E_T
		78 E_T
		79 E_T
		80 E_T
Small oil-fired hot water	800	Baseline—82 E_T
		84 E_T
		86 E_T
		88 E_T
Small oil-fired steam	800	Baseline—81 E_T
		82 E_T
		83 E_T
		85 E_T
Large gas-fired hot water	3,000	Baseline—82 E_C
		83 E_C
		84 E_C
		85 E_C
		Condensing—95 E_C

[41] Since ASHRAE published ASHRAE Standard 90.1–2007 on January 10, 2008, EPCA requires that DOE publish a final rule adopting more-stringent standards than those in ASHRAE Standard 90.1–2007 within 30 months of ASHRAE action (*i.e.,* by July 2010). Thus, four years from July 2010 would be July 2014, which would be the anticipated effective date for DOE adoption of more-stringent standards.

TABLE VI.1—EFFICIENCY LEVELS ANALYZED—Continued

Equipment class	Representative capacity kBtu/h	Efficiency levels analyzed (percent)
Large gas-fired steam all except natural draft	3,000	Baseline—79 E_T 80 E_T 81 E_T 82 E_T 83 E_T
Large gas-fired steam natural draft	3,000	Baseline—77 E_T 78 E_T 79 E_T 80 E_T 81 E_T
Large oil-fired hot water	3,000	Baseline—84 E_C 86 E_C 87 E_C 88 E_C
Large oil-fired steam	3,000	Baseline—81 E_T 82 E_T 83 E_T 84 E_T 86 E_T

B. Economic Justification and Energy Savings

1. Economic Impacts on Commercial Customers

a. Life-Cycle Cost and Payback Period

To evaluate the economic impact of the efficiency levels on commercial customers, DOE conducted an LCC analysis for each efficiency level. More efficient commercial packaged boilers would affect these customers in two ways: (1) Annual operating expense would decrease; and (2) purchase price would increase. Inputs used for calculating the LCC include total installed costs (*i.e.*, equipment price plus installation costs), operating expenses (*i.e.*, annual energy savings, energy prices, energy price trends, repair costs, and maintenance costs), equipment lifetime, and discount rates.

The output of the LCC model is a mean LCC savings for each equipment class, relative to the baseline commercial packaged boiler efficiency level. The LCC analysis also provides information on the percentage of customers that are negatively affected by an increase in the minimum efficiency standard.

DOE performed a PBP analysis as part of the LCC analysis. The PBP is the number of years it would take for the customer to recover the increased costs of higher-efficiency equipment as a result of energy savings based on the operating cost savings. The PBP is an economic benefit-cost measure that uses benefits and costs without discounting. Chapter 5 of the NOPR TSD provides detailed information on the LCC and PBP analyses.

DOE's LCC and PBP analyses provided five key outputs for each efficiency level above the baseline (*i.e.*, efficiency levels more stringent than those in ASHRAE Standard 90.1–2007), reported in Table VI.2 through Table VI.11. The first three outputs are the proportion of commercial boiler purchases where the purchase of a commercial packaged boiler that is compliant with the amended energy conservation standard creates a net LCC increase, no impact, or a net LCC savings for the customer. The fourth output is the average net LCC savings from standard-compliant equipment. The fifth output is the average PBP for the customer investment in standard-compliant equipment.

TABLE VI.2—SUMMARY LCC AND PBP RESULTS FOR SMALL GAS-FIRED HOT WATER BOILERS, 800 KBTU/h OUTPUT CAPACITY

Small gas-fired hot water	Efficiency level			
	1	2	3	4
Thermal Efficiency (E_T)	82%	84%	86%	92%
Equipment with Net LCC Increase (%)	11	26	47	66
Equipment with No Change in LCC (%)	77	48	25	18
Equipment with Net LCC Savings (%)	12	27	28	17
Mean LCC Savings ($)	$860	$2,007	($319)	($6,649)
Mean PBP (years)	26.8	30.7	42.5	56.5
Increase in Total Installed Cost ($)	$3,754	$5,936	$9,486	$14,642

Note: Numbers in parentheses indicate negative LCC savings.

TABLE VI.3—SUMMARY LCC AND PBP RESULTS FOR SMALL GAS-FIRED STEAM ALL EXCEPT NATURAL DRAFT, 800 KBTU/h OUTPUT CAPACITY

Small gas-fired steam all except natural draft	Efficiency level			
	1	2	3	4
Thermal Efficiency (E_T)	80%	81%	82%	83%
Equipment with Net LCC Increase (%)	30	60	73	75
Equipment with No Change in LCC (%)	64	19	10	7
Equipment with Net LCC Savings (%)	6	21	17	18
Mean LCC Savings ($)	($1,530)	($1,545)	($3,521)	($4,163)
Mean Payback Period (years)	44.1	42.8	51.2	50.7
Increase in Total Installed Cost ($)	$3,592	$5,350	$8,103	$10,109

Note: Numbers in parentheses indicate negative savings.

TABLE VI.4—SUMMARY LCC AND PBP RESULTS FOR SMALL GAS-FIRED STEAM NATURAL DRAFT BOILERS, 800 KBTU/h OUTPUT CAPACITY

Small gas-fired steam natural draft	Efficiency level		
	1	2	3
Thermal Efficiency (E_T)	78%	79%	80%
Equipment with Net LCC Increase (%)	49	39	51
Equipment with No Change in LCC (%)	32	22	3
Equipment with Net LCC Savings (%)	19	38	46
Mean LCC Savings ($)	($712)	$789	$1,103
Mean PBP (years)	33.5	26.6	28.9
Increase in Total Installed Cost ($)	$3,261	$4,321	$5,972

Note: Numbers in parentheses indicate negative savings.

TABLE VI.5—SUMMARY LCC AND PBP RESULTS FOR SMALL OIL-FIRED HOT WATER BOILERS, 800 KBTU/h OUTPUT CAPACITY

Small oil-fired hot water	Efficiency level		
	1	2	3
Thermal Efficiency (E_T)	84%	86%	88%
Equipment with Net LCC Increase (%)	20	25	37
Equipment with No Change in LCC (%)	39	27	7
Equipment with Net LCC Savings (%)	41	48	56
Mean LCC Savings ($)	$2,441	$5,376	$5,212
Mean PBP (years)	19.2	19.6	26.6
Increase in Total Installed Cost ($)	$3,897	$6,325	$10,185

TABLE VI.6—SUMMARY LCC AND PBP RESULTS FOR SMALL OIL-FIRED STEAM BOILERS, 800 KBTU/h OUTPUT CAPACITY

Small oil-fired hot water	Efficiency level		
	1	2	3
Thermal Efficiency (E_T)	82%	83%	85%
Equipment with Net LCC Increase (%)	29	46	54
Equipment with No Change in LCC (%)	58	24	6
Equipment with Net LCC Savings (%)	13	30	40
Mean LCC Savings ($)	($732)	$88	$864
Mean PBP (years)	35.1	33.7	35.0
Increase in Total Installed Cost ($)	$3,524	$5,142	$8,670

Note: Numbers in parentheses indicate negative savings.

TABLE VI.7—SUMMARY LCC AND PBP RESULTS FOR LARGE GAS-FIRED HOT WATER BOILERS, 3,000 KBTU/h OUTPUT CAPACITY

Large gas-fired hot water	Efficiency level			
	1	2	3	4
Combustion Efficiency (E_C)	83%	84%	85%	95%
Equipment with Net LCC Increase (%)	9	20	34	49
Equipment with No Change in LCC (%)	51	23	17	6

TABLE VI.7—SUMMARY LCC AND PBP RESULTS FOR LARGE GAS-FIRED HOT WATER BOILERS, 3,000 KBTU/h OUTPUT CAPACITY—Continued

Large gas-fired hot water	Efficiency level			
	1	2	3	4
Equipment with Net LCC Savings (%)	40	58	49	46
Mean LCC Savings ($)	$5,254	$9,421	$8,678	$7,637
Mean PBP (years)	16.0	19.3	27.8	37.1
Increase in Total Installed Cost ($)	$4,489	$8,172	$14,043	$37,821

TABLE VI.8—SUMMARY LCC AND PBP RESULTS FOR LARGE GAS-FIRED STEAM, ALL EXCEPT NATURAL DRAFT BOILERS, 3,000 KBTU/h OUTPUT CAPACITY

Large gas-fired steam all except natural draft	Efficiency level			
	1	2	3	4
Thermal Efficiency (E_T)	80%	81%	82%	83%
Equipment with Net LCC Increase (%)	6	5	4	4
Equipment with No Change in LCC (%)	61	26	23	20
Equipment with Net LCC Savings (%)	33	69	73	77
Mean LCC Savings ($)	$6,711	$16,291	$25,415	$34,087
Mean Payback Period (years)	12.5	9.1	8.1	7.7
Increase in Total Installed Cost ($)	$4,364	$6,048	$7,824	$9,697

TABLE VI.9—SUMMARY LCC AND PBP RESULTS FOR LARGE GAS-FIRED STEAM NATURAL DRAFT BOILERS, 3,000 KBTU/h OUTPUT CAPACITY

Large gas-fired steam natural draft	Efficiency level			
	1	2	3	4
Thermal Efficiency (E_T)	78%	79%	80%	81%
Equipment with Net LCC Increase (%)	1	3	6	10
Equipment with No Change in LCC (%)	88	42	24	7
Equipment with Net LCC Savings (%)	11	55	71	82
Mean LCC Savings ($)	$8,339	$17,917	$25,371	$30,669
Mean Payback Period (years)	9.8	8.2	9.1	10.8
Increase in Total Installed Cost ($)	$3,800	$5,893	$9,073	$13,367

TABLE VI.10—SUMMARY LCC AND PBP RESULTS FOR LARGE OIL-FIRED HOT WATER BOILERS, 3,000 KBTU/h OUTPUT CAPACITY

Large oil-fired hot water	Efficiency level		
	1	2	3
Combustion Efficiency (E_C)	86%	87%	88%
Equipment with Net LCC Increase (%)	5	11	15
Equipment with No Change in LCC (%)	52	24	24
Equipment with Net LCC Savings (%)	43	65	61
Mean LCC Savings ($)	$18,874	$23,498	$27,342
Mean PBP (years)	9.3	12.9	15.4
Increase in Total Installed Cost ($)	$7,063	$12,536	$18,256

TABLE VI.11—SUMMARY LCC AND PBP RESULTS FOR LARGE OIL-FIRED STEAM BOILERS, 3,000 KBTU/h OUTPUT CAPACITY

Large oil-fired steam	Efficiency level			
	1	2	3	4
Thermal Efficiency (E_T)	82%	83%	84%	86%
Equipment with Net LCC Increase (%)	4	7	11	12
Equipment with No Change in LCC (%)	66	41	16	11
Equipment with Net LCC Savings (%)	30	53	73	77
Mean LCC Savings ($)	$9,613	$19,472	$26,117	$40,322
Mean Payback Period (years)	9.7	9.3	11.2	12.3
Increase in Total Installed Cost ($)	$4,280	$7,392	$12,189	$20,635

2. National Impact Analysis

a. Amount and Significance of Energy Savings

To estimate the energy savings through 2042 due to amended energy conservation standards, DOE compared the energy consumption of commercial boilers under the base case (*i.e.*, the ASHRAE 90.1–2007 efficiency levels) to energy consumption of boilers under higher efficiency standards. DOE examined up to four efficiency levels higher than those of ASHRAE Standard 90.1–2007. The amount of energy savings depends not only on the potential increase in energy efficiency due to a standard, but also on the rate at which the stock of existing, less-efficient commercial boilers will be replaced over time after implementation of the amended energy conservation standard. Table VI.12 shows the forecasted national energy savings at each of the standard levels. DOE reports both undiscounted and discounted estimates of energy savings. Table VI.13 and Table VI.14 show the magnitude of the energy savings if they are discounted at rates of 7 percent and 3 percent, respectively. Each standard level considered in this rulemaking would result in significant energy savings, and the amount of savings increases with higher energy conservation standards. (See chapter 7 of the NOPR TSD.)

TABLE VI.12—SUMMARY OF CUMULATIVE NATIONAL ENERGY SAVINGS FOR COMMERCIAL BOILERS (ENERGY SAVINGS FOR UNITS SOLD FROM 2012 TO 2042, UNDISCOUNTED)

Equipment class	National energy savings (quads)*			
	Efficiency level 1	Efficiency level 2	Efficiency level 3	Efficiency level 4
Small gas-fired hot water	0.022	0.072	0.140	0.212
Small gas-fired steam, all except natural draft	(0.000)	0.014	0.030	0.045
Small gas-fired steam natural draft	(0.006)	0.016	0.042	....
Small oil-fired hot water	0.015	0.034	0.057	....
Small oil-fired steam	0.009	0.027	0.068	....
Large gas-fired hot water	0.014	0.037	0.061	0.176
Large gas-fired steam, all except natural draft	0.022	0.063	0.105	0.148
Large gas-fired, steam natural draft	(0.022)	0.002	0.032	0.067
Large oil-fired hot water	0.014	0.024	0.034	....
Large oil-fired steam	0.039	0.106	0.198	0.410

* Numbers in parentheses indicate negative potential energy savings due to the delayed implementation of more-stringent efficiency levels compared to the efficiency levels specified in ASHRAE Standard 90.1–2007.

TABLE VI.13—SUMMARY OF CUMULATIVE NATIONAL ENERGY SAVINGS FOR COMMERCIAL BOILERS (ENERGY SAVINGS FOR UNITS SOLD FROM 2012 TO 2042, DISCOUNTED AT SEVEN PERCENT)

Equipment class	National energy savings (quads)*			
	Efficiency level 1	Efficiency level 2	Efficiency level 3	Efficiency level 4
Small gas-fired hot water	0.004	0.015	0.029	0.043
Small gas-fired steam, all except natural draft	(0.000)	0.003	0.006	0.009
Small gas-fired steam natural draft	(0.000)	0.004	0.009	....
Small oil-fired hot water	0.003	0.007	0.012	....
Small oil-fired steam	0.002	0.005	0.014	....
Large gas-fired hot water	0.003	0.008	0.012	0.036
Large gas-fired steam, all except natural draft	0.004	0.013	0.021	0.030
Large gas-fired, steam natural draft	(0.003)	0.002	0.008	0.015
Large oil-fired hot water	0.003	0.005	0.007	....
Large oil-fired steam	0.008	0.022	0.041	0.084

* Numbers in parentheses indicate negative potential energy savings due to the delayed implementation of more-stringent efficiency levels compared to the efficiency levels specified in ASHRAE Standard 90.1–2007.

TABLE VI.14—SUMMARY OF CUMULATIVE NATIONAL ENERGY SAVINGS FOR COMMERCIAL BOILERS (ENERGY SAVINGS FOR UNITS SOLD FROM 2012 TO 2042, DISCOUNTED AT THREE PERCENT)

Equipment class	National energy savings (quads)*			
	Efficiency level 1	Efficiency level 2	Efficiency level 3	Efficiency level 4
Small gas-fired hot water	0.010	0.035	0.068	0.103
Small gas-fired steam, all except natural draft	(0.000)	0.007	0.014	0.022
Small gas-fired, steam natural draft	(0.002)	0.008	0.021	....
Small oil-fired hot water	0.007	0.016	0.027	....
Small oil-fired steam	0.004	0.013	0.033	....
Large gas-fired hot water	0.007	0.018	0.030	0.085
Large gas-fired steam, all except natural draft	0.010	0.031	0.051	0.072
Large gas-fired steam, natural draft	(0.009)	0.002	0.017	0.034
Large oil-fired hot water	0.007	0.012	0.016	....

TABLE VI.14—SUMMARY OF CUMULATIVE NATIONAL ENERGY SAVINGS FOR COMMERCIAL BOILERS (ENERGY SAVINGS FOR UNITS SOLD FROM 2012 TO 2042, DISCOUNTED AT THREE PERCENT)—Continued

Equipment class	National energy savings (quads) *			
	Efficiency level 1	Efficiency level 2	Efficiency level 3	Efficiency level 4
Large oil-fired steam	0.019	0.051	0.096	0.199

* Numbers in parentheses indicate negative potential energy savings due to the delayed implementation of more-stringent efficiency levels compared to the efficiency levels specified in ASHRAE Standard 90.1–2007.

b. Net Present Value

The NPV analysis is a measure of the cumulative benefit or cost of standards to the Nation. In accordance with OMB's guidelines on regulatory analysis (OMB Circular A–4, section E (Sept. 17, 2003)), DOE calculated NPV using both a 7-percent and a 3-percent real discount rate. The 7-percent rate is an estimate of the average before-tax rate of return on private capital in the U.S. economy, and reflects the returns to real estate and small business capital as well as corporate capital. DOE used this discount rate to approximate the opportunity cost of capital in the private sector, because recent OMB analysis has found the average rate of return on capital to be near this rate. DOE also used the 3-percent rate to capture the potential effects of standards on private customers' consumption (*e.g.*, reduced purchasing of equipment due to higher prices for equipment and purchase of reduced amounts of energy). This rate represents the rate at which society discounts future consumption flows to their present value. This rate can be approximated by the real rate of return on long-term government debt (*e.g.*, yield on Treasury notes minus annual rate of change in the Consumer Price Index), which has averaged about 3 percent on a pre-tax basis for the last 30 years. Table VI.15 and Table VI.16 provide an overview of the NPV results. (See chapter 7 of the NOPR TSD.)

TABLE VI.15—SUMMARY OF CUMULATIVE NET PRESENT VALUE FOR BOILERS

[Discounted at seven percent]

Equipment class	Net present value (billion 2008)			
	Efficiency level 1	Efficiency level 2	Efficiency level 3	Efficiency level 4
Small gas-fired hot water	($0.014)	($0.010)	($0.166)	($0.543)
Small gas-fired steam, all except natural draft	($0.038)	($0.041)	($0.081)	($0.114)
Small gas-fired, steam natural draft	($0.037)	($0.016)	($0.028)	
Small oil-fired hot water	($0.008)	($0.000)	($0.041)	
Small oil-fired steam	($0.031)	($0.040)	($0.085)	
Large gas-fired hot water	$0.011	$0.028	$0.003	($0.093)
Large gas-fired steam, all except natural draft	$0.027	$0.127	$0.226	$0.322
Large gas-fired steam, natural draft	($0.054)	($0.021)	($0.013)	($0.045)
Large oil-fired hot water	$0.042	$0.071	$0.063	
Large oil-fired steam	$0.062	$0.184	$0.248	$0.504

* Numbers in parentheses indicate negative NPV.

TABLE VI.16—SUMMARY OF CUMULATIVE NET PRESENT VALUE FOR BOILERS

[Discounted at three percent]

Equipment class	Net present value (billion 2008$)			
	Efficiency level 1	Efficiency level 2	Efficiency level 3	Efficiency level 4
Small gas-fired hot water	$0.077	$0.274	$0.146	($0.510)
Small gas-fired steam, all except natural draft	(0.076)	(0.014)	(0.034)	(0.050)
Small gas-fired steam, natural draft	(0.100)	0.041	0.125	
Small oil-fired hot water	0.053	0.137	0.121	
Small oil-fired steam	(0.023)	0.014	0.049	
Large gas-fired hot water	0.093	0.222	0.259	0.483
Large gas-fired steam, all except natural draft	0.166	0.576	0.984	1.391
Large gas-fired steam, natural draft	(0.257)	(0.081)	0.077	0.174
Large oil-fired hot water	0.146	0.243	0.262	
Large oil-fired steam	0.302	0.830	1.328	2.702

* Numbers in parentheses indicate negative NPV.

C. Proposed Standards for Commercial Packaged Boilers

EPCA specifies that, for any commercial and industrial equipment addressed in section 342(a)(6)(A)(i) of EPCA, DOE may prescribe an energy conservation standard more stringent than the level for such equipment in ASHRAE/IESNA Standard 90.1, as amended, only if ''clear and convincing evidence'' shows that a more-stringent standard ''would result in significant additional conservation of energy and is technologically feasible and economically justified.'' (42 U.S.C. 6313(a)(6)(A)(ii)(II))

In evaluating more-stringent efficiency levels for commercial packaged boilers than those specified by ASHRAE Standard 90.1–2007, DOE reviewed the results in terms of their technological feasibility, economic justification, and significance of energy savings.

DOE first examined the potential energy savings that would result from the efficiency levels specified in ASHRAE Standard 90.1–2007 and compared that to the potential energy savings that would result from proposing efficiency levels more stringent than those in ASHRAE Standard 90.1–2007 as Federal energy conservation standards. All of the efficiency levels examined by DOE resulted in cumulative energy savings, including the efficiency levels in ASHRAE Standard 90.1–2007. DOE estimates that a total of 0.10 quads of energy will be saved if DOE adopts the efficiency levels for each commercial boiler equipment class specified in ASHRAE Standard 90.1–2007. If DOE were to propose efficiency levels more stringent than those specified by ASHRAE Standard 90.1–2007 as Federal minimum standards, the potential additional energy savings ranges from 0.14 quads to 1.26 quads. Associated with proposing more-stringent efficiency levels is a two-year delay in implementation compared to the adoption of energy conservation standards at the level specified in ASHRAE Standard 90.1–2007 (see section V.H.1). This two-year delay in implementation of amended energy conservation standards would result in a small amount of energy savings being lost in the first two years (2012 and 2013) compared to the savings from adopting the levels in ASHRAE Standard 90.1–2007; however, this energy savings may be compensated for by increased savings from higher standards in later years.

In addition to energy savings, DOE also examined the economic justification of proposing efficiency levels more stringent than those specified in ASHRAE Standard 90.1–2007. As shown in section VI.B.1.a, higher efficiency levels result in a positive mean LCC savings for some commercial packaged boiler equipment classes. For example, in the largest commercial packaged boiler equipment class (*i.e.*, small, gas-fired hot water boilers), the mean LCC savings ranges from $860 to a mean LCC cost of $6,649 for efficiency level 1 through efficiency level 4. The total installed cost increases from $3,754 to $14,642 for efficiency level 1 through efficiency level 4 when compared to the baseline. Overall, there would be a wide range of commercial customer LCC impacts based on climate, hydronic system operating temperature, and installation costs, which might place a significant burden on some commercial customers.

In general, there is a large range in the total installed cost of different types of commercial boiler equipment, leading to a high variance and uncertainty in the economic analyses. Many factors affect the cost of a commercial boiler, including the type of commercial packaged boilers, the material of the heat exchanger being used, and the overall design. In addition, the installation costs of boilers vary greatly depending on the efficiency, the location of the boiler, and the venting system. In more-efficient boilers, the flue must be made out of corrosion resistant materials to prevent the possibility of corrosion caused due to condensing flue gases. Because the mean LCC savings can be considered small in comparison to the total installed cost of the equipment, a relatively minor change in the differential installed cost estimate could negate the mean LCC savings realized by proposing more-stringent efficiency levels as Federal minimum standards for commercial packaged boilers.

After examining the potential energy savings and the economic justification of proposing efficiency levels more stringent than those specified in ASHRAE Standard 90.1–2007, DOE believes there are several other factors it should consider before proposing amended energy conservation standards for commercial packaged boilers.

First, DOE reexamined the certainty in its analysis of commercial packaged boilers. As noted in section IV.C.4.a, due to current test procedure requirements, not all manufacturers test for the thermal efficiency of their commercial boiler models, nor do they all report it to the I=B=R Directory or in manufacturers' catalogs. Some manufacturers simply do not report thermal efficiency, and of those manufacturers that do report thermal efficiency, some may estimate the thermal efficiency ratings of their equipment, rather than actually test for the thermal efficiency of their equipment. DOE has no way to determine which thermal efficiency ratings are the result of estimation and which are the result of actual testing. Further, in the case of manufacturers that do test for thermal efficiency, variances in testing facilities and equipment can lead to inconsistent results in the thermal efficiency testing among the manufacturers. The combination of these factors leads to concerns about the viability of using the data from the I=B=R Directory and manufacturers' catalogs as the source for thermal efficiency ratings for the basis of this analysis. Such concerns are heightened the further one moves away from the consensus efficiency levels in ASHRAE Standard 90.1–2007 in the context of this standard-setting rulemaking.

Because ASHRAE Standard 90.1–2007 has switched to a thermal efficiency metric for certain commercial packaged boiler equipment classes, a one-time conversion in the DOE efficiency metric will be required at some point. The transition to a thermal efficiency metric will require manufacturers to test for and report thermal efficiency for 8 out of 10 commercial boiler equipment classes. This would mitigate the problem of uncertainty in the thermal efficiency ratings for those equipment classes, allowing DOE to be able to make more definitive comparisons with future versions of ASHRAE Standard 90.1. DOE believes that an earlier transition to a rated thermal efficiency across the industry will provide additional, near-term benefits covering the entire industry that are not captured in the DOE analysis presented. These benefits may include more rapid exposure of purchasers to the rated thermal efficiency of competing products, which lays the groundwork for assessing the benefits of one boiler against another in the marketplace and will create greater competition among manufacturers to provide customers with additional purchasing choices. DOE has no information with which to calculate this benefit.

Second, DOE notes the efficiency levels in ASHRAE Standard 90.1–2007 are part of a consensus agreement between the trade association representing the manufacturers and several energy-efficiency advocacy groups. DOE strongly encourages stakeholders to work together to propose agreements to DOE. When DOE receives a consensus agreement, DOE takes careful consideration to review the agreement resulting from groups that commonly have conflicting goals. DOE also points out that the Joint Letter submitted by AHRI, ACEEE, ASAP, ASE, and NRDC strongly urged DOE to adopt as Federal minimum energy conservation standards the efficiency levels in ASHRAE Standard 90.1–2007 for commercial packaged boilers. (The Joint Letter, No. 5 at p. 1) DOE believes this negotiated agreement was made in good faith, and DOE is hesitant to second guess the outcome based on a limited analysis with many uncertainties. In light of those considerations, DOE is presenting the results for all the efficiency levels analyzed for commercial packaged boilers for stakeholder feedback.

Third, DOE has not assessed any likely change in the efficiencies of models currently on the boiler market in the absence of setting more-stringent standards. DOE recognizes that manufacturers would continue to make future improvements in the boiler efficiencies even in the absence of mandated energy conservation standards. Such ongoing technological developments could have a disproportionately larger impact on the analytical results for the more-stringent efficiency levels analyzed in terms of reduced energy benefits as compared to the ASHRAE Standard 90.1–2007 efficiency level scenario. When manufacturers introduce a new product line, they typically introduce higher-efficiency models, while maintaining their baseline product offering (*i.e.*, equipment at the ASHRAE Standard 90.1–2007 efficiency levels). Any introduction of higher-efficiency equipment and subsequent purchase by commercial customers, which usually buy higher-efficiency equipment, could reduce the energy savings benefits of more-stringent efficiency levels.

Fourth, DOE believes there could be a possible difference in life expectancy between the commercial packaged boilers at the ASHRAE Standard 90.1–2007 efficiency levels and those at more-stringent efficiency levels, including condensing boilers. DOE did not have any information to quantify these differences and is seeking comments from interested parties regarding these potential differences in expected lifetime.

Finally, DOE also recognizes that commercial packaged boilers are one component in a hydronic system. Unlike most of the other residential appliances and commercial equipment for which DOE mandates energy conservation standards, the design and operation of that hydronic system (*i.e.*, the hot-water distribution system) can result in significant variances in the annual field efficiencies of the commercial packaged boilers compared to the rated efficiency levels of these units. DOE recognizes that as a result, a critical piece of information needed to ensure that the benefits of high nominal efficiency commercial packaged boilers are actually achieved in the field is not captured in the DOE analysis.

After weighing the benefits and burdens of proposing the ASHRAE Standard 90.1–2007 efficiency levels as Federal standards for commercial packaged boilers as compared to those for proposing more-stringent efficiency levels, DOE has tentatively concluded to propose the efficiency levels in ASHRAE 90.1–2007 as amended energy conservation standards for all ten commercial packaged boilers equipment classes. DOE must have ''clear and convincing'' evidence in order to propose efficiency levels more stringent than those specified in ASHRAE 90.1–2007, and for the reasons explained in this notice, the totality of information does not meet the level necessary to support these more-stringent efficiency levels. Given the relatively small mean LCC savings (in comparison to the total installed cost), even a slight alteration in DOE's installation estimates could result in the potential for negative mean LCC savings. In addition, the uncertainty of the thermal efficiency values reported may have resulted in the overstatement or understatement of the efficiency of some equipment, leading to even greater uncertainty in the economic benefits of more-stringent standards.

DOE recognizes that the thermal efficiency metric is superior to the combustion efficiency metric because thermal efficiency is a more complete measure of boiler efficiency than the combustion efficiency metric (thermal efficiency accounts for jacket losses and combustion efficiency does not). DOE believes that once commercial packaged boilers are transitioned from the combustion efficiency metric to the thermal efficiency metric, the thermal efficiency ratings of certified equipment will be more accurate and consistent. The efficiency levels in ASHRAE Standard 90.1–2007 are an acceptable foundation that will allow the commercial boiler industry to begin the transition from using combustion efficiency to a thermal efficiency metric. DOE also takes into account the consensus nature of the efficiency levels in ASHRAE Standard 90.1–2007 for commercial packaged boilers.

Therefore, based on the discussion above, DOE has tentatively concluded that the efficiency levels beyond those in ASHRAE Standard 90.1–2007 for commercial packaged boilers are not economically justified and is proposing as Federal minimum standards the efficiency levels in ASHRAE Standard 90.1–2007 for all ten equipment classes of commercial packaged boilers. DOE seeks comments from interested parties on its proposed amended energy conservation standards for commercial packaged boilers as well as the other efficiency levels considered. Although DOE currently believes that it would be appropriate to adopt the efficiency levels in ASHRAE Standard 90.1–2007 for commercial packaged boilers, DOE would consider the possibility of setting standards at more-stringent efficiency levels if public comments and additional data supply clear and convincing evidence in support of such an approach. Table VI.17 shows the proposed energy conservation standards for commercial packaged boilers.

TABLE VI.17—PROPOSED ENERGY CONSERVATION STANDARDS FOR COMMERCIAL PACKAGED BOILERS

Equipment type	Subcategory	Size category (input)	Efficiency level *	
			Effective date: March 2, 2012	Effective date: March 2, 2022
Hot Water Commercial Packaged Boilers.	Gas-fired	≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h.	80% E_T	80% E_T
Hot Water Commercial Packaged Boilers.	Gas-fired	> 2,500,000 Btu/h	82% E_C	82% E_C
Hot Water Commercial Packaged Boilers.	Oil-fired	≥300,000 Btu/h and ≤ 2,500,000 Btu/h.	82% E_T	82% E_T

TABLE VI.17—PROPOSED ENERGY CONSERVATION STANDARDS FOR COMMERCIAL PACKAGED BOILERS—Continued

Equipment type	Subcategory	Size category (input)	Efficiency level *	
			Effective date: March 2, 2012	Effective date: March 2, 2022
Hot Water Commercial Packaged Boilers.	Oil-fired	> 2,500,000 Btu/h	84% E_C	84% E_C
Steam Commercial Packaged Boilers.	Gas-fired—all, except natural draft	≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h.	79% E_T	79% E_T
Steam Commercial Packaged Boilers.	Gas-fired—all, except natural draft	> 2,500,000 Btu/h	79% E_T	79% E_T
Steam Commercial Packaged Boilers.	Gas-fired—natural draft	≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h.	77% E_T	79% E_T
Steam Commercial Packaged Boilers.	Gas-fired—natural draft	> 2,500,000 Btu/h	77% E_T	79% E_T
Steam Commercial Packaged Boilers.	Oil-fired	≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h.	81% E_T	81% E_T
Steam Commercial Packaged Boilers.	Oil-fired	> 2,500,000 Btu/h	81% E_T	81% E_T

* E_T is the thermal efficiency and E_C is the combustion efficiency.

VII. Procedural Issues and Regulatory Review

A. Review Under Executive Order 12866

Today's proposed rule has been determined not to be a ''significant regulatory action'' under section 3(f)(1) of Executive Order 12866, ''Regulatory Planning and Review.'' 58 FR 51735 (Oct. 4, 1993). Accordingly, this action was not subject to review under that Executive Order by the Office of Information and Regulatory Affairs (OIRA) of the Office of Management and Budget.

B. Review Under the National Environmental Policy Act

DOE plans to prepare an environmental assessment (EA) of the impacts of the proposed rule pursuant to the National Environmental Policy Act of 1969 (42 U.S.C. 4321 *et seq.*), the regulations of the Council on Environmental Quality (40 CFR parts 1500–1508), and DOE's regulations for compliance with the National Environmental Policy Act (10 CFR part 1021). This assessment would include a concise examination of the impacts of emission reductions likely to result from the rule. Most of these impacts are likely to be positive. The EA will be incorporated into the final rule TSD. DOE requests that interested members of the public, Tribes, and States submit any relevant data or other information for DOE to consider when preparing the EA.

C. Review Under the Regulatory Flexibility Act

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

DOE has reviewed today's proposed rule under the provisions of the Regulatory Flexibility Act and the policies and procedures published on February 19, 2003. 68 FR 7990. As part of this rulemaking, DOE examined the existing compliance costs manufacturers already bear and compared them to the revised compliance costs, based on the proposed revisions to the test procedure. Since DOE is proposing to adopt the efficiency levels in ASHRAE Standard 90.1–2007, which are part of the prevailing industry standard and were a result of a consensus agreement, DOE believes that commercial packaged boiler manufacturers are already producing equipment at these efficiency levels. For water-cooled and evaporatively-cooled commercial package air conditioners and heat pumps with a cooling capacity at or above 240,000 Btu/h and less than 760,000 Btu/h, DOE believes the efficiency levels being proposed in today's NOPR are also part of the prevailing industry standard and that manufacturers would experience no impacts, because no such equipment is currently manufactured. Furthermore, DOE believes the industry standard was developed through a process which would attempt to mitigate the impacts on manufacturers, including any small commercial packaged boiler manufacturers, while increasing the efficiency of this equipment. In addition, DOE does not find that the costs imposed by the revisions proposed to the test procedure for commercial packaged boilers in this document would result in any significant increase in testing or compliance costs. DOE requests public comment on the impact of this proposed rule on small entities.

For the reasons stated above, DOE certifies that the proposed rule, if promulgated, would not have a significant economic impact on a substantial number of small entities. Therefore, DOE did not prepare an initial regulatory flexibility analysis for the proposed rule. DOE transmitted its certification and a supporting statement of factual basis to the Chief Counsel for Advocacy of the SBA for review pursuant to 5 U.S.C. 605(b).

D. Review Under the Paperwork Reduction Act

Under the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 *et seq.*) (PRA), a person is not required to respond to a collection of information by a Federal agency, including a requirement to maintain records, unless the collection displays a valid OMB control number. (44 U.S.C. 3506(c)(1)(B)(iii)(V)) This NOPR would not impose any new information or recordkeeping requirements. Accordingly, OMB clearance is not required under the PRA.

E. Review Under the Unfunded Mandates Reform Act of 1995

DOE reviewed this regulatory action under Title II of the Unfunded Mandates Reform Act of 1995 (UMRA) (Pub. L. 104–4), which requires each Federal agency to assess the effects of Federal regulatory actions on State, local, and Tribal governments and the private sector. For proposed regulatory actions likely to result in a rule that may cause expenditures by State, local, and Tribal governments, in the aggregate, or by the private sector of $100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish a written statement assessing the resulting costs, benefits, and other effects of the rule on the national economy (2 U.S.C. 1532(a) and (b)). Section 204 of UMRA requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal governments on a proposed ''significant intergovernmental mandate.'' (2 U.S.C. 1534) Section 203 of UMRA requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments that may be affected before establishing any requirements that might significantly or uniquely affect small governments. (2 U.S.C. 1533) On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA (62 FR 12820) (also available at: *http://www.gc.doe.gov*).

Today's proposed rule contains neither an intergovernmental mandate nor a mandate that may result in the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector, of $100 million or more in any year. Accordingly, no assessment or analysis is required under UMRA.

F. Review Under the Treasury and General Government Appropriations Act, 1999

Section 654 of the Treasury and General Government Appropriations Act, 1999 (Pub. L. 105–277) requires Federal agencies to issue a Family Policymaking Assessment for any proposed rule that may affect family well-being. This rule would not have any impact on the autonomy or integrity of the family as an institution. Accordingly, DOE has concluded that it is unnecessary to prepare a Family Policymaking Assessment.

G. Review Under Executive Order 13132

Executive Order 13132, ''Federalism,'' 64 FR 43255 (August 4, 1999) imposes certain requirements on agencies formulating and implementing policies or regulations that preempt State law or that have Federalism implications. Agencies are required to examine the constitutional and statutory authority supporting any action that would limit the policymaking discretion of the States and to carefully assess the necessity for such actions. The Executive Order also requires agencies to have an accountable process to ensure meaningful and timely input by State and local officials in the development of regulatory policies that have Federalism implications. On March 14, 2000, DOE published a statement of policy describing the intergovernmental consultation process it will follow in the development of such regulations. 65 FR 13735. DOE has examined this proposed rule and has determined that it would not have a substantial direct effect on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. EPCA governs and prescribes Federal preemption of State regulations as to energy conservation for the equipment that are the subject of today's proposed rule. States can petition DOE for exemption from such preemption to the extent, and based on criteria, as set forth in EPCA. (42 U.S.C. 6297(d) and 6316(b)(2)(D)) No further action is required by Executive Order 13132.

H. Review Under Executive Order 12988

With respect to the review of existing regulations and the promulgation of new regulations, section 3(a) of Executive Order 12988, ''Civil Justice Reform'' (61 FR 4729 (Feb. 7, 1996)) imposes on Federal agencies the general duty to adhere to the following requirements: (1) Eliminate drafting errors and ambiguity; (2) write regulations to minimize litigation; (3) provide a clear legal standard for affected conduct rather than a general standard and promote simplification and burden reduction. With regard to the review required by section 3(a), section 3(b) of Executive Order 12988 specifically requires that Executive agencies make every reasonable effort to ensure that the regulation (1) clearly specifies the preemptive effect, if any; (2) clearly specifies any effect on existing Federal law or regulation; (3) provides a clear legal standard for affected conduct while promoting simplification and burden reduction; (4) specifies the retroactive effect, if any; (5) adequately defines key terms; and (6) addresses other important issues affecting clarity and general draftsmanship under any guidelines issued by the Attorney General. Section 3(c) of Executive Order 12988 requires Executive agencies to review regulations in light of applicable standards in sections 3(a) and 3(b) to determine whether they are met or it is unreasonable to meet one or more of them. DOE has completed the required review and determined that, to the extent permitted by law, the proposed rule meets the relevant standards of Executive Order 12988.

I. Review Under the Treasury and General Government Appropriations Act, 2001

Section 515 of the Treasury and General Government Appropriations Act, 2001 (44 U.S.C. 3516 note) provides for agencies to review most disseminations of information to the public under guidelines established by each agency pursuant to general guidelines issued by OMB. OMB's guidelines were published at 67 FR 8452 (Feb. 22, 2002), and DOE's guidelines were published at 67 FR 62446 (Oct. 7, 2002). DOE has reviewed this notice under the OMB and DOE guidelines and has concluded that it is consistent with applicable policies in those guidelines.

J. Review Under Executive Order 13211

Executive Order 13211, ''Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use,'' 66 FR 28355 (May 22, 2001) requires Federal agencies to prepare and submit to OMB, a Statement of Energy Effects for any proposed significant energy action. A ''significant energy action'' is defined as any action by an agency that promulgated or is expected to lead to promulgation of a final rule, and that: (1) Is a significant regulatory action under Executive Order 12866, or any successor order; and (2) is likely to have a significant adverse effect on the supply, distribution, or use of energy; or (3) is designated by the Administrator of OIRA as a significant energy action. For any proposed significant energy action, the agency must give a detailed statement of any adverse effects on energy supply, distribution, or use should the proposal be implemented, and of reasonable alternatives to the action and their expected benefits on energy supply, distribution, and use.

Today's regulatory action would not have a significant adverse effect on the supply, distribution, or use of energy, and, therefore, is not a significant energy action. Furthermore, this regulatory action has not been designated as a significant energy action by the Administrator of OIRA. Accordingly, DOE has not prepared a Statement of Energy Effects.

K. Review Under Executive Order 12630

Pursuant to Executive Order 12630, ''Governmental Actions and Interference With Constitutionally Protected Property Rights,'' 53 FR 8859 (March 15, 1988), DOE has determined that this rule would not result in any takings that might require compensation under the Fifth Amendment to the United States Constitution.

L. Review Under Section 32 of the Federal Energy Administration Act of 1974

Under section 301 of the Department of Energy Organization Act (Pub. L. 95–91), DOE must comply with all laws applicable to the former Federal Energy Administration, including section 32 of the Federal Energy Administration Act of 1974 (Pub. L. 93–275), as amended by the Federal Energy Administration Authorization Act of 1977 (Pub. L. 95–70). 15 U.S.C. 788. Section 32 provides that where a proposed rule authorizes or requires use of commercial standards, the notice of proposed rulemaking must inform the public of the use and background of such standards. In addition, section 32(c) requires DOE to consult with the Department of Justice (DOJ) and the FTC concerning the impact of the commercial or industry standards on competition.

The amendments and revisions to the test procedure for commercial packaged boilers proposed in this notice incorporate updates to commercial standards already codified in the CFR. DOE has evaluated these revised standards and is unable to conclude whether they fully comply with the requirements of section 32(b) of the Federal Energy Administration Act, (*i.e.*, that they were developed in a manner that fully provides for public participation, comment, and review). DOE will consult with the Attorney General and the Chairman of the FTC concerning the impact of these test procedures on competition before prescribing a final rule.

M. Review Under the Information Quality Bulletin for Peer Review

On December 16, 2004, OMB in consultation with the Office of Science and Technology Policy (OSTP), issued its ''Final Information Quality Bulletin for Peer Review'' (Bulletin). 70 FR 2664 (Jan. 14, 2005). The Bulletin establishes that certain scientific information shall be peer reviewed by qualified specialists before it is disseminated by the Federal government, including influential scientific information related to agency regulatory actions. The purpose of the bulletin is to enhance the quality and credibility of the Government's scientific information. Under the Bulletin, the energy conservation standards rulemakings analyses are ''influential scientific information.'' The Bulletin defines ''influential scientific information'' as ''scientific information the agency reasonably can determine will have or does have a clear and substantial impact on important public policies or private sector decisions.'' 70 FR 2664, 2667 (Jan. 14, 2005).

In response to OMB's Bulletin, DOE conducted formal peer reviews of the energy conservation standards development process and analyses, and then prepared a Peer Review Report pertaining to the energy conservation standards rulemaking analyses. Generation of this report involved a rigorous, formal, and documented evaluation process using objective criteria and qualified and independent reviewers to make a judgment as to the technical/scientific/business merit, the actual or anticipated results, and the productivity and management effectiveness of programs and/or projects. The ''Energy Conservation Standards Rulemaking Peer Review Report,'' dated February 2007, has been disseminated and is available at *http://www.eere.energy.gov/buildings/appliance_standards/peer_review.html*.

VIII. Public Participation

A. Attendance at Public Meeting

DOE will hold a public meeting on April 7, 2009, from 9 a.m. to 4 p.m. in Washington, DC. The meeting will be held at the U.S. Department of Energy, Forrestal Building, Room 8E–089, 1000 Independence Avenue, SW., Washington, DC. To attend the public meeting, please notify Ms. Brenda Edwards at (202) 586–2945. As explained in the **ADDRESSES** section, foreign nationals visiting DOE Headquarters are subject to advance security screening procedures. Any foreign national wishing to participate in the meeting should advise DOE of this fact as soon as possible by contacting Ms. Brenda Edwards to initiate the necessary procedures.

B. Procedure for Submitting Requests to Speak

Any person who has an interest in today's notice, or who is a representative of a group or class of persons that has an interest in these issues, may request an opportunity to make an oral presentation. Such persons may hand-deliver requests to speak to the address shown in the **ADDRESSES** section at the beginning of this notice of proposed rulemaking between the hours of 9 a.m. and 4 p.m., Monday through Friday, except Federal holidays. Requests may also be sent e-mail to: *Brenda.Edwards@ee.doe.gov*.

Persons requesting to speak should briefly describe the nature of their interest in this rulemaking and provide a telephone number for contact. DOE requests persons scheduled to make a presentation submit an advance copy of their statements at least two weeks before the public meeting. At its discretion, DOE may permit any person who cannot supply an advance copy of their statement to participate, if that person has made advance alternative arrangements with the Building Technologies Program. The request to give an oral presentation should ask for such alternative arrangements.

C. Conduct of Public Meeting

DOE will designate a DOE official to preside at the public meeting and may use a professional facilitator to aid discussion. The meeting will not be a judicial or evidentiary-type public hearing, but DOE will conduct it in accordance with 5 U.S.C. 553 and section 336 of EPCA (42 U.S.C. 6306). A court reporter will be present to record the proceedings and prepare a transcript. DOE reserves the right to schedule the order of presentations and to establish the procedures governing the conduct of the public meeting. After the public meeting, interested parties may submit further comments on the proceedings as well as on any aspect of the rulemaking until the end of the comment period.

The public meeting will be conducted in an informal, conference style. DOE will present summaries of comments received before the public meeting, allow time for presentations by participants, and encourage all interested parties to share their views on issues affecting this rulemaking. Each participant will be allowed to make a prepared general statement (within time limits determined by DOE), before the discussion of specific topics. DOE will permit other participants to comment briefly on any general statements.

At the end of all prepared statements on a topic, DOE will permit participants to clarify their statements briefly and comment on statements made by others. Participants should be prepared to answer questions by DOE and by other participants concerning these issues. DOE representatives may also ask questions of participants concerning other matters relevant to this rulemaking. The official conducting the public meeting will accept additional comments or questions from those attending, as time permits. The presiding official will announce any further procedural rules or modification of the above procedures that may be needed for the proper conduct of the public meeting.

DOE will make the entire record of this proposed rulemaking, including the transcript from the public meeting, available for inspection at the U.S. Department of Energy, Forrestal Building, Resource Room of the Building Technologies Program, 950 L'Enfant Plaza, SW., 6th Floor, Washington, DC 20024, (202) 586–9127, between 9 a.m. and 4 p.m., Monday through Friday, except Federal holidays. Any person may buy a copy of the transcript from the transcribing reporter.

D. Submission of Comments

DOE will accept comments, data, and information regarding the proposed rule before or after the public meeting, but no later than the date provided at the beginning of this notice of proposed rulemaking. Information submitted should be identified by docket number EERE–2008–BT–STD–0013 and/or RIN 1904–AB83. Please submit comments, data, and information electronically, to the following e-mail address: *ASHRAE_90.1_rulemaking@ee.doe.gov*. Stakeholders should submit electronic comments in WordPerfect, Microsoft Word, PDF, or text (ASCII) file format and avoid the use of special characters or any form of encryption, and whenever possible carry the electronic signature of the author. Comments, data, and information submitted to DOE via mail or hand delivery/courier should include one signed paper original. No telefacsimiles (faxes) will be accepted.

Pursuant to 10 CFR 1004.11, DOE requires any person submitting information that he or she believes to be confidential and exempt by law from public disclosure to submit two copies: one copy of the document including all the information believed to be confidential, and one copy of the document 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.

E. Issues on Which DOE Seeks Comment

DOE is particularly interested in receiving comments and views of interested parties concerning the following issues:

1. DOE's proposed definitions for ''thermal efficiency'' and ''combustion efficiency'' for commercial packaged boilers.
2. The efficiency of dual output boilers in both steam mode and water mode. Specifically, DOE is interested in receiving data or comments, which would allow DOE to convert the steam ratings in the I=B=R Directory and manufacturers' catalogs to hot water ratings.
3. DOE's assumption of fixed installation cost for each equipment class independent of equipment efficiency. DOE seeks data or comment on how installation costs could potentially increase with higher-efficiency commercial boilers due primarily to venting concerns.
4. The potential for a rebound effect to occur in the commercial packaged boiler industry.
5. DOE's assumption and the potential significance of any overestimation of savings. In particular, DOE requests data that would allow it to better characterize the likely increases in packaged boiler efficiencies that would occur over the 30-year analysis period absent amended energy conservation standards.
6. The NES-forecasted base-case distribution of efficiencies and DOE's prediction of how amended energy conservation standards affect the distribution of efficiencies in the standards case.

IX. Approval of the Office of the Secretary

The Secretary of Energy has approved publication of today's Notice of Proposed Rulemaking.

List of Subjects in 10 CFR Part 431

Administrative practice and procedure, Confidential business information, Energy conservation, and Reporting and recordkeeping requirements.

Issued in Washington, DC, on March 10, 2009.

Steven G. Chalk,

Principal Deputy Assistant Secretary, Energy Efficiency and Renewable Energy.

For the reasons set forth in the preamble, DOE proposes to amend Chapter II of Title 10, Code of Federal Regulations, Part 431 to read as set forth below:

PART 431—ENERGY EFFICIENCY PROGRAM FOR CERTAIN COMMERCIAL AND INDUSTRIAL EQUIPMENT

1. The authority citation for part 431 continues to read as follows:

Authority: 42 U.S.C. 6291–6317.

2. In § 431.82, revise the definition ''combustion efficiency'' and add the definition ''thermal efficiency,'' in alphabetical order to read as follows:

§ 431.82 Definitions concerning commercial packaged boilers.

* * * * *

Combustion Efficiency for a commercial packaged boiler is determined using test procedures prescribed under § 431.86 and equals to 100 percent minus percent flue loss (percent flue loss is based on input fuel energy).

* * * * *

Thermal Efficiency for a commercial packaged boiler is determined using test procedures prescribed under § 431.86 and is the ratio of the heat absorbed by the water or the water and steam to the higher heating value in the fuel burned.

3. Revise § 431.85 to read as follows:

§ 431.85 Materials incorporated by reference.

(a) *General*. We incorporate by reference the following standards into Subpart E of Part 431. The material listed has been approved for incorporation by reference by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR 51. Any subsequent amendment to a standard by the standard-setting organization will not affect the DOE regulations unless and until amended by DOE. Material is incorporated as it exists on the date of the approval and a notice of any change in the material will be published in the **Federal Register**. All approved material is available for inspection at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202–741–6030 or go to *http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html*. Also, this material is available for inspection at the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Program, 6th Floor, 950 L'Enfant Plaza, SW., Washington, DC 20024, 202–586–2945, or go to: *http://www1.eere.energy.gov/buildings/appliance_standards/*. Standards can be obtained from the sources listed below. (b) *HI*. Hydronics Institute Division of GAMA, P.O. Box 218, Berkeley Heights, NJ 07922, or *http://www.gamanet.org/publist/hydroordr.htm*.

(1) HI BTS–2000 (Rev06.07), *Method to Determine Efficiency of Commercial Space Heating Boilers*, June 2007, IBR approved for § 431.86.

(2) [Reserved]

4. Revise § 431.86 to read as follows:

§ 431.86 Uniform test method for the measurement of energy efficiency of commercial packaged boilers.

(a) *Scope*. This section provides test procedures that must be followed for measuring, pursuant to EPCA, the steady state combustion efficiency and thermal efficiency of a gas-fired or oil-fired commercial packaged boiler. These test procedures apply to packaged low pressure boilers that have rated input capacities of 300,000 Btu/hr or more and are ''commercial packaged boilers,'' but do not apply under EPCA to ''packaged high pressure boilers.''

(b) *Definitions*. For purposes of this section, the Department incorporates by reference the definitions specified in Section 3.0 of the HI BTS–2000 (Rev06.07) (incorporated by reference, see § 431.85), with the exception of the definition for the terms ''packaged boiler,'' ''condensing boilers,'' and ''packaged low pressure steam'' and ''hot water boiler.''

(c) *Test Method for Commercial Packaged Boilers—General*. Follow the provisions in this paragraph (c) for all testing of packaged low pressure boilers that are commercial packaged boilers.

(1) *Test Setup*—(i) *Classifications*. If employing boiler classification, you must classify boilers as given in Section 4.0 of the HI BTS–2000 (Rev06.07) (incorporated by reference, see § 431.85).

(ii) *Requirements*. (A) Before March 2, 2012, conduct the combustion efficiency test as given in Section 5.2 (Combustion Efficiency Test) of the HI BTS–2000 (Rev06.07) (incorporated by reference, see § 431.85) for all commercial packaged boiler equipment classes.

(B) On or after March 2, 2012, conduct the thermal efficiency test as given in Section 5.1 (Thermal Efficiency Test) of the HI BTS–2000 (Rev06.07) for the following commercial packaged boiler equipment classes: small, gas, hot water; small, gas, steam, all except natural draft; small, gas, steam, natural draft; small, oil, hot water; small, oil, steam; large, gas, steam, all except natural draft; large, gas, steam, natural draft; and large, oil, steam. On or after March 2, 2012, conduct the combustion efficiency test as given in Section 5.2 (Combustion Efficiency Test) of the HI BTS–2000 (Rev06.07) (incorporated by reference, see § 431.85) for the following commercial packaged boiler equipment classes: large, gas-fired, hot water and large, oil-fired, hot water.

(iii) *Instruments and Apparatus*. (A) Follow the requirements for instruments and apparatus in sections 6 (Instruments) and 7 (Apparatus), of the HI BTS–2000 (Rev06.07) (incorporated by reference, see § 431.85), with the exception of section 7.2.5 (flue connection for outdoor boilers) which is replaced with paragraph (c)(1)(iii)(B) of this section.

(B) *Flue Connection for Outdoor Boilers*. For oil-fired and power gas outdoor boilers, the integral venting means may have to be revised to permit connecting the test flue apparatus described in section 7.2.1 of HI BTS–2000 (Rev06.07). A gas-fired boiler for outdoor installation with a venting system provided as part of the boiler must be tested with the venting system in place.

(iv) *Test Conditions*. Use test conditions from Section 8.0 (excluding 8.6.2) of HI BTS–2000 (Rev06.07) (incorporated by reference, see § 431.85) for combustion efficiency testing. Use all of the test conditions from Section 8.0 of HI BTS–2000 (Rev06.07) for thermal efficiency testing.

(2) *Test Measurements*—(i) *Non-Condensing Boilers*. (A) *Combustion Efficiency*. Measure for combustion efficiency according to sections 9.1 (excluding sections 9.1.1.2.3 and 9.1.2.2.3), 9.2 and 10.2 of the HI BTS–2000 (Rev06.07) (incorporated by reference, see § 431.85).

(B) *Thermal Efficiency*. Measure for thermal efficiency according to sections 9.1 and 10.1 of the HI BTS–2000 (Rev06.07) (incorporated by reference, see § 431.85).

(ii) *Procedure for the Measurement of Condensate for a Condensing Boiler*. For the combustion efficiency test, collect flue condensate as specified in Section 9.2.2 of HI BTS–2000 (Rev06.07) (incorporated by reference, see § 431.85). Measure the condensate from the flue gas under steady state operation for the 30 minute collection period during the 30 minute steady state combustion efficiency test. Flue condensate mass shall be measured immediately at the end of the 30 minute collection period to prevent evaporation loss from the sample. The humidity of the room shall at no time exceed 80 percent. Determine the mass of flue condensate for the steady state period by subtracting the tare container weight from the total container and flue condensate weight measured at the end of the test period. For the thermal efficiency test, collect and measure the condensate from the flue gas as specified in Section 9.1.1 and 9.1.2 of HI BTS–2000 (Rev06.07).

(iii) *A Boiler That is Capable of Supplying Either Steam or Hot Water*—(A) *Testing*. For purposes of EPCA, before March 2, 2012, measure the combustion efficiency of any size commercial packaged boiler capable of supplying either steam or hot water either by testing the boiler in the steam mode or by testing it in both the steam and hot water modes. On or after March 2, 2012, measure the combustion efficiency and thermal efficiency of a large (fuel input greater than 2500 kBtu/h) commercial packaged boiler capable of supplying either steam or hot water either by testing the boiler for both efficiencies in steam mode, or by testing the boiler in both steam and hot water modes measuring the thermal efficiency of the boiler in steam mode and the combustion efficiency of the boiler in hot water mode. Measure only the thermal efficiency of a small (fuel input of greater than or equal to 300 kBtu/h and less than or equal to 2500 kBtu/h) commercial packaged boiler capable of supplying either steam or hot water either by testing the boiler for thermal efficiency only in steam mode or by testing the boiler for thermal efficiency in both steam and hot water modes.

(B) *Rating*. If testing a large boiler only in the steam mode, use the efficiencies determined from such testing to rate the thermal efficiency for the steam mode and the combustion efficiency for the hot water mode. If testing a large boiler in both modes, rate the boiler's efficiency for each mode based on the testing in that mode. If testing a small boiler only in the steam mode, use the efficiencies determined from such testing to rate the thermal efficiency for the steam mode and the hot water mode. If testing a small boiler in both modes, rate the boiler's efficiency for each mode based on the testing in that mode.

(3) *Calculation of Efficiency*. (i) *Combustion Efficiency*. Use the calculation procedure for the combustion efficiency test specified in Section 11.2 (including the specified subsections of 11.1) of the HI BTS–2000 (Rev06.07) (incorporated by reference, see § 431.85).

(ii) *Thermal Efficiency*. Use the calculation procedure for the thermal efficiency test specified in Section 11.1 of the HI BTS–2000 (Rev06.07) (incorporated by reference, see § 431.85).

5. Revise § 431.87 to read as follows:

§ 431.87 Energy conservation standards and their effective dates.

(a) Each commercial packaged boiler manufactured on or after January 1, 1994, and before March 2, 2012, must meet the following energy efficiency standard levels.

(1) For a gas-fired packaged boiler with a capacity (rated maximum input) of 300,000 Btu/hr or more, the combustion efficiency at the maximum rated capacity must be not less than 80 percent.

(2) For an oil-fired packaged boiler with a capacity (rated maximum input) of 300,000 Btu/hr or more, the combustion efficiency at the maximum rated capacity must be not less than 83 percent.

(b) Each commercial packaged boiler manufactured on or after the effective date listed in Table 1 to § 431.87, must meet the applicable energy conservation standard in Table 1.

TABLE 1 TO § 431.87—COMMERCIAL PACKAGED BOILER ENERGY EFFICIENCY LEVELS

Equipment type	Subcategory	Size category (input)	Efficiency level	
			Effective date: March 2, 2012*	Effective date: March 2, 2022*
Hot Water Commercial Packaged Boilers.	Gas-fired	≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h.	80.0% E_T	80.0% E_T
Hot Water Commercial Packaged Boilers.	Gas-fired	> 2,500,000 Btu/h	82.0% E_C	82.0% E_C
Hot Water Commercial Packaged Boilers.	Oil-fired	≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h.	82.0% E_T	82.0% E_T
Hot Water Commercial Packaged Boilers.	Oil-fired	> 2,500,000 Btu/h	84.0% E_C	84.0% E_C
Steam Commercial Packaged Boilers.	Gas-fired—all, except natural draft	≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h.	79.0% E_T	79.0% E_T
Steam Commercial Packaged Boilers.	Gas-fired—all, except natural draft	> 2,500,000 Btu/h	79.0% E_T	79.0% E_T
Steam Commercial Packaged Boilers.	Gas-fired—natural draft	≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h.	77.0% E_T	79.0% E_T
Steam Commercial Packaged Boilers.	Gas-fired—natural draft	> 2,500,000 Btu/h	77.0% E_T	79.0% E_T
Steam Commercial Packaged Boilers.	Oil-fired	≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h.	81.0% E_T	81.0% E_T
Steam Commercial Packaged Boilers.	Oil-fired	> 2,500,000 Btu/h	81.0% E_T	81.0% E_T

* Where E_C is combustion efficiency and E_T is thermal efficiency as defined in § 431.82.

6. In § 431.97, add paragraph (d) to read as follows:

§ 431.97 Energy conservation standards and their effective dates.

* * * * *

(d) Each water-cooled and evaporatively-cooled commercial package air conditioning and heating equipment with a cooling capacity at or above 240,000 Btu/h and less than 760,000 Btu/h manufactured on or after January 10, 2011, shall meet the following standard levels:

(1) For equipment that utilizes electric resistance heat or without heating, the energy efficiency ratio must be not less than 11.0.

(2) For equipment that utilizes all other types of heating, the energy efficiency ratio must be not less than 10.8.

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