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Energy Conservation Program for Certain Industrial Equipment: Energy Conservation Standards for Commercial Warm Air Furnaces; Proposed Rule

DEPARTMENT OF ENERGY

10 CFR Part 431

[Docket Number EERE–2013–BT–STD–0021]

RIN 1904–AD11

Energy Conservation Program for Certain Industrial Equipment: Energy Conservation Standards for Commercial Warm Air Furnaces

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, prescribes energy conservation standards for various consumer products and certain commercial and industrial equipment, including commercial warm air furnaces (CWAF). EPCA also requires that every six years, the U.S. Department of Energy (DOE) must consider amending its standards for specified types of commercial heating, air-conditioning, and water-heating equipment in order to determine whether more-stringent, amended standards would be technologically feasible and economically justified, and would save a significant additional amount of energy. DOE has tentatively concluded that there is sufficient record evidence to support more-stringent standards, so DOE is proposing to amend the current energy conservation standards for CWAF. DOE also announces a public meeting to receive comment on these proposed standards and associated analyses and results.

DATES: *Comments:* DOE will accept comments, data, and information regarding this notice of proposed rulemaking (NOPR) before and after the public meeting, but no later than April 6, 2015. See section VII, ''Public Participation,'' for details.

Meeting: DOE will hold a public meeting on Monday, March 2, 2015, from 9:00 a.m. to 4:00 p.m., in Washington, DC. The meeting will also be broadcast as a webinar. See section VII, ''Public Participation,'' for webinar registration information, participant instructions, and information about the capabilities available to webinar participants.

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 20585. To attend, please notify Ms. Brenda Edwards at (202) 586–2945. For more information, refer to section VII, ''Public Participation,'' near the end of this notice.

Instructions: Any comments submitted must identify the NOPR for Energy Conservation Standards for Commercial Warm Air Furnaces, and provide docket number EE–2013–BT–STD–00021 and/or regulatory information number (RIN) number 1904–AD11. Comments may be submitted using any of the following methods:

1. *Federal eRulemaking Portal: www.regulations.gov.* Follow the instructions for submitting comments.

2. *Email: CommWarmAirFurn2013 STD0021@ee.doe.gov.* Include the docket number and/or RIN in the subject line of the message. Submit electronic comments in WordPerfect, Microsoft Word, PDF, or ASCII file format, and avoid the use of special characters or any form of encryption.

3. *Postal Mail:* Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Office, Mailstop EE–2J, 1000 Independence Avenue SW., Washington, DC, 20585–0121. If possible, please submit all items on a compact disc (CD), in which case it is not necessary to include printed copies.

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

Written comments regarding the burden-hour estimates or other aspects of the collection-of-information requirements contained in this proposed rule may be submitted to Office of Energy Efficiency and Renewable Energy through the methods listed above and by email to *Chad_S_Whiteman@omb.eop.gov.*

No telefacsimiles (faxes) will be accepted. For detailed instructions on submitting comments and additional information on the rulemaking process, see section VII of this document (Public Participation).

Docket: The docket is available for review at *www.regulations.gov.* All documents in the docket are listed in the *www.regulations.gov* index. A link to the docket Web page can be found at: *http://www1.eere.energy.gov/buildings/appliance_standards/rulemaking.aspx?ruleid=70.* This Web page contains a link to the docket for this notice on the *http://www.regulations.gov* site. The *www.regulations.gov* Web page contains simple instructions on how to access all documents, including public comments, in the docket.

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

FOR FURTHER INFORMATION CONTACT: Mr. John Cymbalsky, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies, EE–5B, 1000 Independence Avenue SW., Washington, DC 20585–0121. Telephone: (202) 286–1692. Email: *John.Cymbalsky@ee.doe.gov.*

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

SUPPLEMENTARY INFORMATION:

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I. Summary of the Proposed Rule

Title III, Part C [1] of the Energy Policy and Conservation Act of 1975 (EPCA or the Act), Public Law 94–163 (42 U.S.C. 6311–6317, as codified), added by Public Law 95–619, Title IV, § 441(a), established the Energy Conservation Program for Certain Industrial Equipment, which includes the commercial warm air furnaces that are the subject of this rulemaking. CWAF are a type of equipment also covered under the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 90.1 (ASHRAE Standard 90.1), ''Energy Standard for Buildings Except Low-Rise Residential Buildings.'' [2] Pursuant to recent statutory amendments to EPCA, DOE must conduct an evaluation of its standards for CWAF every six years and publish either a notice of determination that such standards do not need to be amended or a notice of proposed rulemaking including proposed amended standards. (42 U.S.C. 6313(a)(6)(C)(i)) EPCA further requires that any new or amended energy conservation standard that DOE prescribes for covered equipment, such as CWAF, shall be designed to achieve the maximum improvement in energy efficiency that is technologically feasible and economically justified. (42 U.S.C. 6313(a)(6)(A)(ii)(II)) Furthermore, the new or amended standard must result in a significant additional conservation of energy. *Id.* Under the applicable statutory provisions, DOE must determine that there is clear and convincing evidence supporting the adoption of more-stringent energy conservation standards than the ASHRAE level. *Id.* Once complete, this rulemaking will satisfy DOE's statutory obligation under 42 U.S.C. 6313(a)(6)(C).

In accordance with these and other statutory provisions discussed in this notice, DOE has examined all of the CWAF equipment classes and has tentatively concluded that there is clear and convincing evidence to support more-stringent standards for both gas-fired and oil-fired CWAF. Accordingly, DOE is proposing amended energy conservation standards for both gas-fired and oil-fired CWAF. The proposed standards, which prescribe the minimum allowable thermal efficiency (TE), are shown in Table I.1. These proposed standards, if adopted, would apply to all equipment listed in Table I.1 and manufactured in, or imported into, the United States on and after the date three years after the publication of the final rule for this rulemaking.

TABLE I.1—PROPOSED ENERGY CONSERVATION STANDARDS FOR COMMERCIAL WARM AIR FURNACES

Equipment class	Input capacity * (Btu/h)	Thermal efficiency **
Gas-Fired Furnaces	≥225,000 Btu/h	82%
Oil-Fired Furnaces	≥225,000 Btu/h	82%

* In addition to being defined by input capacity, a CWAF is ''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.'' CWAF coverage is further discussed in section IV.A.2, ''Scope of Coverage and Equipment Classes.''

** Thermal efficiency is at the maximum rated capacity (rated maximum input), and is determined using the DOE test procedure specified at 10 CFR 431.76.

[1] For editorial reasons, upon codification in the U.S. Code, Part C was re-designated Part A–1.

[2] ASHRAE Standard 90.1–2013 (*i.e.,* the most recent version of ASHRAE Standard 90.1) did not amend the efficiency levels for CWAF. Thus, DOE was not triggered by the statutory provision for ASHRAE equipment. For more information on DOE's review of ASHRAE Standard 90.1–2013, see: *http://www1.eere.energy.gov/buildings/appliance_standards/rulemaking.aspx?ruleid=108.*

A. Benefits and Costs to Commercial Consumers

Table I.2 presents DOE's evaluation of the economic impacts of the proposed energy conservation standards on commercial consumers of CWAF, as measured by the average life-cycle cost (LCC) savings and the median payback period (PBP). The average LCC savings are positive for both equipment classes, and the PBP is less than the average lifetime of the equipment, which is estimated to be 19 years for gas-fired CWAF and 26 years for oil-fired CWAF.

TABLE I.2—IMPACTS OF PROPOSED ENERGY CONSERVATION STANDARDS ON COMMERCIAL CONSUMERS OF COMMERCIAL WARM AIR FURNACES

Equipment class	Average LCC savings (2013$)	Median payback period (years)
Gas-Fired Furnaces	426	0.7
Oil-Fired Furnaces	164	2.8

DOE's analysis of the impacts of the proposed standards on consumers is described in section IV.F of this notice and in chapter 8 of the NOPR TSD.

B. Impact on Manufacturers

The industry net present value (INPV) is the sum of the discounted cash flows to the industry from the base year through the end of the analysis period (2014 to 2047). Using a real discount rate of 8.9 percent, DOE estimates that the INPV for manufacturers of CWAF is $74.7 million in 2013$. Under the proposed standards, DOE expects that INPV may be reduced by approximately $43.3 to $11.1 million, which is −58.0 percent to −14.9 percent.

DOE's analysis of the impacts of the proposed standards on manufacturers is described in section IV.J of this notice.

C. National Benefits [3]

DOE's analyses indicate that the proposed energy conservation standards for CWAF would save a significant amount of energy. The energy savings over the entire lifetime of CWAF equipment installed during the 30-year period that begins in the year of compliance with amended standards (2018–2047), relative to the base case without amended standards, amount to 0.52 quadrillion Btus (quads) of full-fuel-cycle energy.[4] This represents a savings of 1.0 percent relative to the energy use of this equipment in the base case.

The cumulative net present value (NPV) of total consumer costs and savings of the proposed standards for CWAF ranges from $1.0 billion to $2.7 billion at 7-percent and 3-percent discount rates, respectively. This NPV expresses the estimated total value of future operating-cost savings minus the estimated increased product costs for CWAF purchased in 2018–2047.

In addition, the proposed standards would have significant environmental benefits.[5] The energy savings would result in cumulative emission reductions of 27.9 million metric tons (Mt) [6] of carbon dioxide (CO_2), 319.8 thousand tons of methane (CH_4), 0.1 thousand tons of nitrous oxide (N_2O), 2.2 thousand tons of sulfur dioxide (SO_2), 66.84 thousand tons of nitrogen oxides (NO_X) and 0.003 tons of mercury (Hg). The cumulative reduction in CO_2 emissions through 2030 amounts to 4.4 Mt.

The value of the CO_2 reductions is calculated using a range of values per metric ton of CO_2 (otherwise known as the Social Cost of Carbon, or SCC) developed by an interagency process.[7] The derivation of the SCC values is discussed in section IV.L. Using discount rates appropriate for each set of SCC values, DOE estimates the present monetary value of the CO_2 emissions reduction to be between $0.2 billion and $2.6 billion, with a value of $0.8 billion using the central SCC case represented by $40.5/t in 2015.[8] Additionally, DOE estimates the present monetary value of the NO_X emissions reduction to be $34.2 million to $82.0 million at 7-percent and 3-percent discount rates, respectively.[9]

Table I.3 summarizes the national economic costs and benefits expected to result from the proposed standards for CWAF.

TABLE I.3—SUMMARY OF NATIONAL ECONOMIC BENEFITS AND COSTS OF PROPOSED ENERGY CONSERVATION STANDARDS FOR COMMERCIAL WARM AIR FURNACES

Category	Present value *Billion 2013$*	Discount rate
Benefits		
Operating Cost Savings	1.052	7%
	2.721	3
CO_2 Reduction Monetized Value ($12.0/t case) **	0.175	5
CO_2 Reduction Monetized Value ($40.5/t case) **	0.841	3
CO_2 Reduction Monetized Value ($62.4/t case) **	1.347	2.5

[3] All monetary values in this NOPR are expressed in 2013 dollars and are discounted to 2014.

[4] These results include impacts on commercial consumers which accrue after 2048 from the products purchased in 2018–2047.

[5] DOE calculated emissions reductions relative to the *Annual Energy Outlook 2013* (*AEO 2013*) Reference case, which generally represents current legislation and environmental regulations for which implementing regulations were available as of December 31, 2012.

[6] A metric ton is equivalent to 1.1 short tons. Results for emissions other than CO_2 are presented in short tons.

[7] *Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866,* Interagency Working Group on Social Cost of Carbon, United States Government (May 2013; revised November 2013) (Available at: *http://www.whitehouse.gov/sites/default/files/omb/assets/inforeg/technical-update-social-cost-of-carbon-for-regulator-impact-analysis.pdf).*

[8] The values only include CO_2 emissions; CO_2 equivalent emissions from other greenhouse gases are not included.

[9] DOE is investigating monetization of reductions in SO_2 and Hg emissions.

TABLE I.3—SUMMARY OF NATIONAL ECONOMIC BENEFITS AND COSTS OF PROPOSED ENERGY CONSERVATION STANDARDS FOR COMMERCIAL WARM AIR FURNACES—Continued

Category	Present value *Billion 2013$*	Discount rate
CO_2 Reduction Monetized Value $119/t case) **	2.606	3
NO_X Reduction Monetized Value (at $2,684/ton) **	0.034	7
	0.082	3
Total Benefits †	1.928	7
	3.645	3
Costs		
Incremental Installed Costs	0.036	7
	0.062	3
Total Net Benefits		
Including Emissions Reduction Monetized Value †	1.892	7
	3.582	3

* This table presents the costs and benefits associated with CWAF shipped in 2018–2047. These results include impacts on commercial consumers which accrue after 2048 from the products purchased in 2018–2047. The results account for the incremental variable and fixed costs incurred by manufacturers due to the standard, some of which may be incurred in preparation for the rule.

** The interagency group selected four sets of SCC values for use in regulatory analyses. Three sets of values (represented by 2015 values of $12.0/t, $40.5/t, and $62.4/t, in 2013$) are based on the average SCC from the integrated assessment models, at discount rates of 2.5, 3, and 5 percent. The fourth set (represented by 2015 value of $119/t in 2013$), which represents the 95th percentile SCC estimate across all three models at a 3-percent discount rate, is included to represent higher-than-expected impacts from temperature change further out in the tails of the SCC distribution. The values in parentheses represent the SCC in 2015. The SCC time series incorporate an escalation factor. The value for NO_X represents the average of the low and high NO_X values considered in DOE's analysis.

† Total Benefits for both the 3% and 7% cases are derived using the series corresponding to average SCC with 3-percent discount rate.

The benefits and costs of these proposed standards, for products sold in 2018–2047, can also be expressed in terms of annualized values. The annualized monetary values are the sum of: (1) The annualized national economic value of the benefits from consumer operation of equipment that meets the proposed standards (consisting primarily of operating cost savings from using less energy, minus increases in equipment purchase price and installation costs, which is another way of representing commercial consumer NPV), and (2) the annualized monetary value of the benefits of CO_2 and NO_X emission reductions.[10]

Although combining the values of operating savings and CO_2 emission reductions provides a useful perspective, two issues should be considered. First, the national operating savings are domestic U.S. consumer monetary savings that occur as a result of market transactions, whereas the value of CO_2 reductions is based on a global value. Second, the assessments of operating cost savings and CO_2 savings are performed with different methods that use different time frames for analysis. The national operating cost savings is measured for the lifetime of CWAF shipped in 2018–2047. The SCC values, on the other hand, reflect the present value of some future climate-related impacts resulting from the emission of one ton of carbon dioxide in each year. Because CO_2 emissions have a very long residence time in the atmosphere,[11] the SCC values after 2050 reflect future climate-related impacts resulting from the emission of CO_2 that continue beyond 2100.

Estimates of annualized benefits and costs of the proposed standards are shown in Table I.4. The results under the primary estimate are as follows. Using a 7-percent discount rate for benefits and costs other than CO_2 reduction, for which DOE used a 3-percent discount rate along with the average SCC series that uses a 3-percent discount rate, the estimated cost of the proposed CWAF standards is $3.51 million per year in increased equipment costs, while the estimated benefits are $104 million per year in reduced equipment operating costs, $47 million in CO_2 reductions, and $3.38 million in reduced NO_X emissions. In this case, the net benefit would amount to $151 million per year. Using a 3-percent discount rate for all benefits and costs and the average SCC series, the estimated cost of the proposed CWAF standards is $3.48 million per year in increased equipment costs, while the estimated benefits are $152 million per year in reduced equipment operating costs, $47 million in CO_2 reductions, and $4.57 million in reduced NO_X emissions. In this case, the net benefit would amount to $200 million per year.

[10] DOE used a two-step calculation process to convert the time-series of costs and benefits into annualized values. First, DOE calculated a present value in 2013, the year used for discounting the NPV of total consumer costs and savings, for the time-series of costs and benefits using discount rates of three and seven percent for all costs and benefits except for the value of CO_2 reductions. For the latter, DOE used a range of discount rates, as shown in Table I.4. From the present value, DOE then calculated the fixed annual payment over a 30-year period (2018 through 2047) that yields the same present value. The fixed annual payment is the annualized value. Although DOE calculated annualized values, this does not imply that the time-series of cost and benefits from which the annualized values were determined is a steady stream of payments.

[11] The atmospheric lifetime of CO_2 is estimated of the order of 30–95 years. Jacobson, MZ (2005). ''Correction to ''Control of fossil-fuel particulate black carbon and organic matter, possibly the most effective method of slowing global warming.'' '' *J. Geophys. Res.* 110. pp. D14105.

TABLE I.4—ANNUALIZED BENEFITS AND COSTS OF PROPOSED ENERGY CONSERVATION STANDARDS FOR COMMERCIAL WARM AIR FURNACES *

	Discount rate	Million 2013$/year		
		Primary estimate	Low estimate	High estimate
Benefits				
Operating Cost Savings	7%	104	98	111
	3%	152	143	163
CO_2 Reduction Monetized Value ($12.0/t case) **	5%	13	13	14
CO_2 Reduction Monetized Value ($40.5/t case) **	3%	47	45	48
CO_2 Reduction Monetized Value ($62.4/t case) **	2.5%	69	67	72
CO_2 Reduction Monetized Value ($119/t case) **	3%	145	140	150
NO_X Reduction Monetized Value (at $2,684/ton) **	7%	3.38	3.28	3.49
	3%	4.57	4.41	4.72
Total Benefits †	7% plus CO_2 range	120 to 253	114 to 242	128 to 264
	7%	154	147	163
	3% plus CO_2 range	169 to 302	160 to 287	181 to 318
	3%	203	192	216
Costs				
Incremental Equipment Costs	7%	3.51	3.48	3.67
	3%	3.48	3.41	3.68
Net Benefits				
Total †	7% plus CO_2 range	117 to 249	111 to 238	124 to 261
	7%	151	143	159
	3% plus CO_2 range	166 to 298	156 to 283	177 to 314
	3%	200	189	212

* This table presents the annualized costs and benefits associated with CWAF shipped in 2018–2047. These results include benefits to commercial consumers which accrue after 2048 from the products purchased in 2018–2047. The results account for the incremental variable and fixed costs incurred by manufacturers due to the standard, some of which may be incurred in preparation for the rule. The Primary, Low Benefits, and High Benefits Estimates utilize projections of energy prices from the *AEO 2013* Reference case, Low Economic Growth case, and High Economic Growth case, respectively. Incremental equipment costs account for equipment price trends and include, beyond the reference scenario, a low price decline scenario used in the Low Benefits Estimate and a high price decline scenario used in the High Benefits Estimates.

** The interagency group selected four sets of SCC values for use in regulatory analyses. Three sets of values (represented by 2015 values of $12.0/t, $40.5/t, and $62.4/t, in 2013$) are based on the average SCC from the integrated assessment models, at discount rates of 2.5, 3, and 5 percent. The fourth set (represented by 2015 value of $119/t, in 2013$), which represents the 95th percentile SCC estimate across all three models at a 3-percent discount rate, is included to represent higher-than-expected impacts from temperature change further out in the tails of the SCC distribution. The values in parentheses represent the SCC in 2015. The SCC time series incorporate an escalation factor. The value for NO_X represents the average of the low and high values considered in DOE's analysis.

† Total Benefits for both the 3-percent and 7-percent cases are derived using the series corresponding to average SCC with a 3-percent discount rate. In the rows labeled "7% plus CO_2 range" and "3% plus CO_2 range," the operating cost and NO_X benefits are calculated using the labeled discount rate, and those values are added to the full range of CO_2 values.

DOE's analysis of the national impacts of the proposed standards is described in sections IV.H, IV.K and IV.L of this notice.

D. Conclusion

DOE has tentatively concluded that, based upon clear and convincing evidence, the proposed standards represent the maximum improvement in energy efficiency that is technologically feasible and economically justified, and would result in the significant conservation of energy. DOE further notes that equipment achieving these standard levels is already commercially available for the equipment classes covered by this proposal. Based on the analyses described above, DOE has tentatively concluded that the benefits of the proposed standards to the Nation (energy savings, positive NPV of commercial consumer benefits, commercial consumer LCC savings, and emission reductions) would outweigh the burdens (loss of INPV for manufacturers and LCC increases for some commercial consumers).

DOE also considered more-stringent energy efficiency levels as trial standard levels, and is still considering them in this rulemaking. However, DOE has tentatively concluded that the potential burdens of the more-stringent energy efficiency levels would outweigh the projected benefits. Based on consideration of the public comments DOE receives in response to this notice and related information collected and analyzed during the course of this rulemaking effort, DOE may adopt energy efficiency levels presented in this notice that are either higher or lower than the proposed standards, or some combination of level(s) that incorporate the proposed standards in part.

II. Introduction

The following section briefly discusses the statutory authority underlying this proposal, as well as some of the relevant historical background related to the energy conservation standards for CWAF.

A. Authority

Title III, Part C [12] of the Energy Policy and Conservation Act of 1975 (EPCA or the Act), Public Law 94–163 (42 U.S.C. 6311–6317, as codified), added by Public Law 95–619, Title IV, § 441(a), established the Energy Conservation Program for Certain Industrial Equipment, which includes provisions covering the CWAF equipment that is

[12] For editorial reasons, upon codification in the U.S. Code, Part C was re-designated Part A–1.

the subject of this notice.[13] In general, this program addresses the energy efficiency of certain types of commercial and industrial equipment. Relevant provisions of the Act specifically include definitions (42 U.S.C. 6311), energy conservation standards (42 U.S.C. 6313), test procedures (42 U.S.C. 6314), labeling provisions (42 U.S.C. 6315), and the authority to require information and reports from manufacturers (42 U.S.C. 6316).

The initial Federal energy conservation standards for CWAF were added to EPCA by the Energy Policy Act of 1992 (EPACT 1992), Public Law 102–486. (42 U.S.C. 6313(a)(4)) These types of covered equipment have a rated capacity (rated maximum input[14]) greater than or equal to 225,000 Btu/h, can be gas-fired or oil-fired, and are designed to heat commercial buildings. *Id.* Under the Act, DOE is obligated to review its energy conservation standards for certain commercial and industrial equipment (*i.e.,* specified heating, air-conditioning, and water-heating equipment) whenever the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) updates the efficiency levels in ASHRAE Standard 90.1, *Energy Standard for Buildings Except Low-Rise Residential Buildings.* DOE must either adopt the levels contained in ASHRAE Standard 90.1 or adopt levels more stringent than the ASHRAE levels if there is clear and convincing evidence in support of doing so. (42 U.S.C. 6313(a)(6)(A)) Such review is to be conducted in accordance with the procedures established for ASHRAE equipment under 42 U.S.C. 6313(a)(6). In addition, DOE must periodically review and consider amending the energy conservation standards for these specified types of covered commercial and industrial equipment and publish either a notice of proposed rulemaking with amended standards or a determination that the standards do not need to be amended. (42 U.S.C. 6313(a)(6)(C)(i))

In amending EPCA, the American Energy Manufacturing Technical Corrections Act (AEMTCA), Public Law 112–210 (Dec. 18, 2012), in relevant part, modified the manner in which DOE must amend the energy efficiency standards for certain types of commercial and industrial equipment, adding a review requirement that is triggered when ASHRAE adopts a design requirement, even if the standard level remains unchanged. *Id.* AEMTCA also clarified that DOE's periodic review of ASHRAE equipment must occur ''[e]very six years.'' *Id.* AEMTCA further added to this process a requirement that DOE must initiate a rulemaking to consider amending the energy conservation standards for any covered equipment for which more than 6 years has elapsed since the issuance of the most recent final rule establishing or amending a standard for the product as of the date of AEMTCA's enactment (*i.e.,* December 18, 2012), in which case DOE must publish either: (1) A notice of determination that the current standards do not need to be amended, or (2) a notice of proposed rulemaking containing proposed standards by December 31, 2013. (42 U.S.C. 6313(a)(6)(C)(vi)) Because DOE has not issued a standard for commercial warm air furnaces in the past six years, the December 31, 2013 deadline for publication of the applicable rulemaking document applies.

Pursuant to EPCA, DOE's energy conservation program for covered equipment consists essentially of four parts: (1) Testing; (2) labeling; (3) the establishment of Federal energy conservation standards; and (4) certification and enforcement procedures. Subject to certain criteria and conditions, DOE is required to develop test procedures to measure the energy efficiency, energy use, or estimated annual operating cost of covered equipment. (42 U.S.C. 6314) Manufacturers of covered equipment must use the prescribed DOE test procedure as the basis for certifying to DOE that their equipment comply with the applicable energy conservation standards adopted under EPCA and when making representations to the public regarding the energy use or efficiency of such equipment. (42 U.S.C. 6314(d)) Similarly, DOE must use these test procedures to determine whether the equipment comply with standards adopted pursuant to EPCA. The DOE test procedures for CWAF currently appear at title 10 of the Code of Federal Regulations (CFR) part 431.76.

When setting standards for the equipment addressed by the proposed rule, EPCA, as amended by AEMTCA, prescribes specific statutory criteria for DOE to consider. See generally 42 U.S.C. 6313(a)(6)(A)–(C). As indicated above, any amended standard for covered equipment more stringent than the level contained in ASHRAE Standard 90.1 must be designed to achieve the maximum improvement in energy efficiency that is technologically feasible and economically justified. (42 U.S.C. 6313(a)(6)(A)(ii)(II)) Furthermore, DOE may not adopt any standard that would not result in the significant additional conservation of energy. *Id.* In deciding whether a proposed standard is economically justified, DOE must determine whether the benefits of the standard exceed its burdens. DOE must make this determination after receiving comments on the proposed standard, and by considering, to the maximum extent practicable, the following seven statutory factors:

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

(42 U.S.C. 6313(a)(6)(B)(ii))

EPCA, as codified, also contains what is known as an ''anti-backsliding'' provision, which prevents the Secretary from prescribing any amended standard that either increases the maximum allowable energy use or decreases the minimum required energy efficiency of a covered product. (42 U.S.C. 6313(a)(6)(B)(iii)(I)) Also, the Secretary may not prescribe an amended or new standard if interested persons have established by a preponderance of the evidence that the standard is likely to result in the unavailability in the United States of any covered product type (or class) of performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially the same as those generally available in the United States. (42 U.S.C. 6313(a)(6)(B)(iii)(II))

Further, under EPCA's provisions for consumer products, there is a rebuttable presumption that a standard is economically justified if the Secretary finds that the additional cost to the customer of purchasing a product complying with an energy conservation standard level will be less than three times the value of the energy (and, as

[13] All references to EPCA in this document refer to the statute as amended through the American Energy Manufacturing Technical Corrections Act of 2012, Pub. L. 112–210 (enacted Dec. 18, 2012).

[14] Rated maximum input means the maximum gas-burning capacity of a commercial warm-air furnace in Btu per hour, as specified by the manufacturer.

applicable, water) savings during the first year that the consumer will receive as a result of the standard, as calculated under the applicable test procedure. (42 U.S.C. 6295(o)(2)(B)(iii)) For this rulemaking, DOE considered the criteria for rebuttable presumption as part of its analysis.

Additionally, when a type or class of covered equipment has two or more subcategories, DOE often specifies more than one standard level. DOE generally will adopt a different standard level than that which applies generally to such type or class of products for any group of covered products that have the same function or intended use if DOE determines that products within such group: (A) Consume a different kind of energy from that consumed by other covered products within such type (or class); or (B) have a capacity or other performance-related feature which other products within such type (or class) do not have and which justifies a higher or lower standard. In determining whether a performance-related feature justifies a different standard for a group of products, DOE generally considers such factors as the utility to the customer of the feature and other factors DOE deems appropriate. In a rule prescribing such a standard, DOE includes an explanation of the basis on which such higher or lower level was established. DOE considered these criteria for this rulemaking.

Because ASHRAE did not update its efficiency levels for CWAF in any of its most recent updates to ASHRAE Standard 90.1 (*e.g.,* ASHRAE Standard 90.1–2007, ASHRAE Standard 90.1–2010, ASHRAE Standard 90.1–2013), DOE is analyzing amended standards consistent with the procedures defined under 42 U.S.C. 6313(a)(6)(C). Specifically, pursuant to 42 U.S.C. 6313(a)(6)(C)(i)(II), DOE must use the procedures established under subparagraph (B) when issuing a NOPR. As noted above, the statutory provision at 42 U.S.C. 6313(a)(6)(B)(ii), recently amended by AEMTCA, states that in deciding whether 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 maximum extent practicable, the seven factors, as stated above.

After carefully reviewing all CWAF equipment classes, DOE has tentatively concluded that following this rulemaking process will provide ''clear and convincing evidence'' that the proposed standards for gas-fired and oil-fired CWAF which are more stringent than those set forth in ASHRAE Standard 90.1–2013, would result in significant additional conservation of energy and would be technologically feasible and economically justified, as mandated by 42 U.S.C. 6313(a)(6).

B. Background

1. Current Standards

As noted above, EPACT 1992 amended EPCA to set the current minimum energy conservation standards for CWAF. (42 U.S.C. 6313(a)(4)(A) and (B)) These standards apply to all CWAF manufactured on or after January 1, 1994. The current standards are set forth in Table II.1.

TABLE II.1—CURRENT FEDERAL ENERGY CONSERVATION STANDARDS FOR CWAF

Equipment type	Input capacity	Thermal efficiency *	Compliance date
Gas-Fired Furnaces	≥225,000 Btu/h	80%	1/1/1994
Oil-Fired Furnaces	≥225,000 Btu/h	81%	1/1/1994

* At the maximum rated capacity (rated maximum input).

2. History of Standards Rulemaking for CWAF

On October 21, 2004, DOE published a final rule in the **Federal Register** which adopted definitions for ''commercial warm air furnace'' and ''thermal efficiency,'' promulgated test procedures for this equipment, and recodified the energy conservation standards so that the standards are located contiguous with the test procedures in the Code of Federal Regulations (CFR). 69 FR 61916, 61917, 61939–41. In the same final rule, DOE incorporated by reference (see 10 CFR 431.75) a number of industry test standards relevant to commercial warm air furnaces, including: (1) American National Standards Institute (ANSI) Standard Z21.47–1998, ''Gas-Fired Central Furnaces,'' for gas-fired CWAF; (2) Underwriters Laboratories (UL) Standard 727–1994, ''Standard for Safety Oil-Fired Central Furnaces,'' for oil-fired CWAF; (3) provisions from Hydronics Institute (HI) Standard BTS–2000, ''Method to Determine Efficiency of Commercial Space Heating Boilers,'' to calculate flue loss for oil-fired CWAF, and (4) provisions from the American Society of Heating, Refrigerating, and Air-conditioning Engineers (ASHRAE) Standard 103–1993, ''Method of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers,'' to determine the incremental efficiency of condensing furnaces under steady-state conditions. *Id.* at 61940. Then in a final rule published in the **Federal Register** on May 16, 2012, DOE updated the test procedures for commercial warm air furnaces to match the procedures specified in ASHRAE Standard 90.1–2010, which referenced ANSI Z21.47–2006, ''Gas-Fired Central Furnaces,'' for gas-fired CWAF, and UL 727–2006, ''Standard for Safety for Oil-Fired Central Furnaces,'' for oil-fired furnaces. 77 FR 28928, 28987–88.

As noted previously, in accordance with the requirements of EPCA, as amended by AEMTCA, DOE must publish either: (1) A notice of determination that the current standards do not need to be amended, or (2) a notice of proposed rulemaking containing proposed standards for CWAF by December 31, 2013. (42 U.S.C. 6313(a)(6)(C)(i) and (vi)) Consequently, DOE initiated this rulemaking to determine whether to amend the current standards for CWAF.

On May 2, 2013, DOE published a request for information (RFI) and notice of document availability for CWAF. 78 FR 25627. The notice solicited information from the public to help DOE determine whether more-stringent energy conservation standards for CWAF would result in a significant additional amount of energy savings and whether those standards would be technologically feasible and economically justified.

DOE received a number of comments from interested parties in response to the RFI. These commenters are identified in Table II.2. DOE considered these comments in the preparation of the NOPR. Relevant comments, and DOE's responses, are provided in the appropriate sections of this notice.

TABLE II.2—INTERESTED PARTIES PROVIDING WRITTEN COMMENTS ON THE CWAF RFI

Name	Abbreviation	Commenter type *
Air-Conditioning, Heating and Refrigeration Institute	AHRI	IR.
Appliance Standards Awareness Project, American Council for an Energy-Efficient Economy, Natural Resources Defense Council.	ASAP, ACEEE, NRDC (Joint Efficiency Advocates).	EA.
Lennox International Inc.	Lennox	M.
UTC Climate, Controls & Security	Carrier	M.
Goodman Manufacturing Inc.	Goodman	M.
American Society of Heating, Refrigeration, and Air-Conditioning Engineers	ASHRAE	IR.

* ''IR'': Industry Representative; ''M'': Manufacturer; ''EA'': Efficiency/Environmental Advocate.

III. General Discussion

A. Compliance Date

As discussed in section II.A, DOE is analyzing amended standards pursuant to 42 U.S.C. 6313(a)(6)(C)(vi), which requires DOE to publish by December 31, 2013, either a notice of determination that standards for this type of equipment do not need to be amended or a notice of proposed rulemaking for any equipment for which more than 6 years has elapsed since the issuance of the most recent final rule. EPCA requires that an amended standard prescribed under 42 U.S.C. 6313(a)(6)(C) must apply to products manufactured after the date that is the later of: (1) The date 3 years after publication of the final rule establishing a new standard or (2) the date 6 years after the effective date of the current standard for a covered product. (42 U.S.C. 6313(a)(6)(C)(iv)) For CWAF, the date 3 years after the publication of the final rule would be later than the date 6 years after the effective date of the current standard. As a result, compliance with any amended energy conservation standards promulgated in the final rule would be required beginning on the date 3 years after the publication of the final rule.

B. Technological Feasibility

1. General

In each energy conservation standards rulemaking, DOE conducts a screening analysis based on information gathered on all current technology options and prototype designs that could improve the efficiency of the products or equipment that are the subject of the rulemaking. As the first step in such an analysis, DOE develops a list of technology options for consideration in consultation with manufacturers, design engineers, and other interested parties. See chapter 3 of the NOPR TSD for a discussion of the list of technology options that were identified. DOE then determines which of those means for improving efficiency are technologically feasible. DOE considers technologies incorporated in commercially-available equipment or in working prototypes to be technologically feasible. 10 CFR part 430, subpart C, appendix A, section 4(a)(4)(i).

After DOE has determined that particular technology options are technologically feasible, it further evaluates each technology option in light of the following additional screening criteria: (1) Practicability to manufacture, install, and service; (2) adverse impacts on equipment utility or availability; and (3) adverse impacts on health or safety. 10 CFR part 430, subpart C, appendix A, section 4(a)(4)(ii)–(iv). Section IV.B of this notice discusses the results of the screening analysis for CWAF, particularly the designs DOE considered, those it screened out, and those that are the basis for the trial standard levels (TSLs) in this rulemaking. For further details on the screening analysis for this rulemaking, see chapter 4 of the NOPR Technical Support Document (TSD).

Additionally, DOE notes that these screening criteria do not directly address the proprietary status of design options. DOE only considers efficiency levels achieved through the use of proprietary designs in the engineering analysis if they are not part of a unique path to achieve that efficiency level (*i.e.,* if there are other non-proprietary technologies capable of achieving the same efficiency). DOE believes the proposed standards for the equipment covered in this rulemaking would not mandate the use of any proprietary technologies, and that all manufacturers would be able to achieve the proposed levels through the use of non-proprietary designs. DOE seeks comment on this tentative conclusion and requests additional information regarding proprietary designs and patented technologies.

2. Maximum Technologically Feasible Levels

When DOE proposes to adopt an amended standard for a type or class of covered equipment, it must determine the maximum improvement in energy efficiency or maximum reduction in energy use that is technologically feasible for such equipment. Accordingly, in the engineering analysis, DOE determined the maximum technologically feasible (''max-tech'') improvements in energy efficiency for CWAF, using the design parameters for the most efficient equipment available on the market or in working prototypes. (See chapter 5 of the NOPR TSD.) The max-tech levels that DOE determined for this rulemaking are described in section IV.C.2.b of this proposed rule.

C. Energy Savings

1. Determination of Savings

For each TSL, DOE projected energy savings from the equipment that is the subject of this rulemaking purchased in the 30-year period that begins in the year of compliance with potential amended standards (2018–2047). The savings are measured over the entire lifetime of equipment purchased in the 30-year analysis period.[15] DOE quantified the energy savings attributable to each TSL as the difference in energy consumption between each standards case and the base case. The base case represents a projection of energy consumption in the absence of amended mandatory efficiency standards, and it considers market forces and policies that affect demand for more-efficient products.

DOE used its national impact analysis (NIA) spreadsheet model to estimate energy savings from amended standards for the products that are the subject of this rulemaking. The NIA spreadsheet model (described in section IV.H of this notice) calculates energy savings in site energy, which is the energy directly

[15] In the past DOE presented energy savings results for only the 30-year period that begins in the year of compliance. In the calculation of economic impacts, however, DOE considered operating cost savings measured over the entire lifetime of products purchased in the 30-year period. DOE has chosen to modify its presentation of national energy savings to be consistent with the approach used for its national economic analysis.

consumed by products at the locations where they are used. For CWAF, the energy savings are primarily in the form of natural gas, which is considered to be primary energy.[16]

DOE has begun to also estimate full-fuel-cycle energy savings, as discussed in DOE's statement of policy and notice of policy amendment. 76 FR 51281 (August 18, 2011), as amended at 77 FR 49701 (August 17, 2012). The full-fuel-cycle (FFC) metric includes the energy consumed in extracting, processing, and transporting primary fuels (*i.e.,* coal, natural gas, petroleum fuels), which collectively presents a more complete picture of the impacts of energy efficiency standards. DOE's approach is based on calculation of an FFC multiplier for each of the energy types used by covered products and equipment. For more information on FFC energy savings, see section IV.H.

DOE reports both primary energy and FFC energy savings in section V.B.3.a of this NOPR.

2. Significance of Savings

To adopt more-stringent standards for CWAF, DOE must determine that such action would result in significant additional conservation of energy. (42 U.S.C. 6313(a)(6)(A)(ii)(II)) Although the term ''significant'' is not defined in the Act, the U.S. Court of Appeals, in *Natural Resources Defense Council* v. *Herrington,* 768 F.2d 1355, 1373 (D.C. Cir. 1985), indicated that Congress intended ''significant'' energy savings in the context of EPCA to be savings that were not ''genuinely trivial.'' DOE has tentatively concluded that the energy savings associated with the proposed standards—0.52 quads due to CWAFs shipped in 2018–2047—are significant.

D. Economic Justification

1. Specific Criteria

As discussed above, EPCA provides seven factors to be evaluated in determining whether a potential more-stringent energy conservation standard for CWAF is economically justified. (42 U.S.C. 6313(a)(6)(B)(ii)(I)–(VII)) The following sections discuss how DOE has addressed each of those seven factors in this rulemaking.

a. Economic Impact on Manufacturers and Consumers

In determining the impacts of a potential amended standard on manufacturers, DOE conducts a manufacturer impact analysis (MIA), as discussed in section IV.J. (42 U.S.C. 6313(a)(6)(B)(ii)(I)) DOE first uses an annual cash-flow approach to determine the quantitative impacts. This step includes both a short-term assessment—based on the cost and capital requirements during the period between when a regulation is issued and when entities must comply with the regulation—and a long-term assessment over a 30-year period. The industry-wide impacts analyzed include: (1) Industry net present value (INPV), which values the industry on the basis of expected future cash flows; (2) cash flows by year; (3) changes in revenue and income; and (4) other measures of impact, as appropriate. Second, DOE analyzes and reports the impacts on different subgroups of manufacturers, including impacts on small manufacturers. Third, DOE considers the impact of standards on domestic manufacturer employment and manufacturing capacity, as well as the potential for standards to result in plant closures and loss of capital investment. Finally, DOE takes into account cumulative impacts of various DOE regulations and other regulatory requirements on manufacturers.

For individual consumers, measures of economic impact include the changes in life-cycle cost (LCC) and payback period (PBP) associated with new or amended standards. The LCC is discussed further in the following section. For consumers in the aggregate, DOE also calculates the national net present value of the economic impacts applicable to a particular rulemaking. DOE also evaluates the LCC impacts of potential standards on identifiable subgroups of consumers that may be affected disproportionately by a national standard.

b. Life-Cycle Costs

EPCA requires DOE to consider the savings in operating costs throughout the estimated average life of the covered product compared to any increase in the price of the covered product that are likely to result from the imposition of the standard. (42 U.S.C. 6313(a)(6)(B)(ii)(II)) DOE conducts this comparison in its LCC and PBP analysis. The LCC is the sum of the purchase price of a product (including its installation) and the operating expense (including energy, maintenance, and repair expenditures) discounted over the lifetime of the product. The LCC analysis requires a variety of inputs, such as product prices, product energy consumption, energy prices, maintenance and repair costs, product lifetime, and consumer discount rates. To account for uncertainty and variability in specific inputs, such as product lifetime and discount rate, DOE uses a distribution of values, with probabilities attached to each value. For the LCC analysis, DOE assumes that consumers will purchase the covered products in the first year of compliance with amended standards.

The LCC savings and the PBP for the considered efficiency levels are calculated relative to a base case that reflects projected market trends in the absence of amended standards. DOE identifies the percentage of consumers estimated to receive LCC savings or experience an LCC increase, in addition to the average LCC savings associated with a particular standard level. DOE's LCC and PBP analysis is discussed in further detail in section IV.F.

c. Energy Savings

Although significant conservation of energy is a separate statutory requirement for adopting an energy conservation standard, EPCA requires DOE, in determining the economic justification of a standard, to consider the total projected energy savings that are expected to result directly from the standard. (42 U.S.C. 6313(a)(6)(B)(ii)(III)) As discussed in section IV.H, DOE uses the NIA spreadsheet to project national energy savings.

d. Lessening of Utility or Performance of Equipment

In establishing classes of equipment, and in evaluating design options and the impact of potential standard levels, DOE must consider any lessening of the utility or performance of the considered products likely to result from the standard. (42 U.S.C. 6313(a)(6)(B)(ii)(IV)) Based on data available to DOE, the proposed standards would not reduce the utility or performance of the products under consideration in this rulemaking.

e. Impact of Any Lessening of Competition

EPCA directs DOE to consider the impact of any lessening of competition, as determined in writing by the Attorney General, that is likely to result from a proposed standard. (42 U.S.C. 6313(a)(6)(B)(ii)(V)) DOE will transmit a copy of the proposed rule to the Attorney General with a request that the Department of Justice (DOJ) provide its determination on this issue. DOE will publish and respond to the Attorney General's determination in the final rule.

[16] Primary energy consumption refers to the direct use at the source, or supply to users without transformation, of crude energy; that is, energy that has not been subjected to any conversion or transformation process.

f. Need for National Energy Conservation

In evaluating the need for national energy conservation, DOE expects that the energy savings from the proposed standards are likely to provide improvements to the security and reliability of the nation's energy system. (42 U.S.C. 6313(a)(6)(B)(ii)(VI)) Reductions in the demand for electricity also may result in reduced costs for maintaining the reliability of the nation's electricity system. DOE conducts a utility impact analysis to estimate how standards may affect the nation's needed power generation capacity, as discussed in section IV.M.

The proposed standards also are likely to result in environmental benefits in the form of reduced emissions of air pollutants and greenhouse gases associated with energy production. DOE reports the emissions impacts from the proposed standards, and from each TSL it considered, in section IV.K of this notice. DOE also reports estimates of the economic value of some of the emissions reductions resulting from the considered TSLs, as discussed in section IV.L.

g. Other Factors

EPCA allows the Secretary of Energy, in determining whether a standard is economically justified, to consider any other factors that the Secretary deems to be relevant. (42 U.S.C. 6313(a)(6)(B)(ii)(VII)) DOE did not consider other factors for this notice.

2. Rebuttable Presumption

EPCA creates 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 is less than three times the value of the first year's energy savings resulting from the standard, as calculated under the applicable DOE test procedure. DOE's LCC and PBP analyses generate values used to calculate the effects that proposed energy conservation standards would have on the payback period for consumers. These analyses include, but are not limited to, the 3-year payback period contemplated under the rebuttable-presumption test. In addition, DOE routinely conducts an economic analysis that considers the full range of impacts to consumers, manufacturers, the Nation, and the environment. The results of this analysis serve as the basis for DOE's evaluation of the economic justification for a potential standard level (thereby supporting or rebutting the results of any preliminary determination of economic justification). The rebuttable presumption payback calculation is discussed in section IV.F of this proposed rule.

IV. Methodology and Discussion of Related Comments

DOE used four analytical tools to estimate the impact of the proposed standards for CWAF. The first tool is the LCC spreadsheet, a spreadsheet that calculates LCCs and PBPs of potential new energy conservation standards, and the second tool, the LCC inputs spreadsheet, is a spreadsheet that provides detailed inputs to the LCC spreadsheet. The third tool, the NIA spreadsheet, is a spreadsheet that calculates national energy savings and net present value resulting from potential amended energy conservation standards. The fourth spreadsheet tool, the Government Regulatory Impact Model (GRIM), helped DOE to assess manufacturer impacts.

Additionally, DOE used a variant of EIA's National Energy Modeling System (NEMS) for the utility and emissions analyses. NEMS is a public domain, multi-sectored, partial equilibrium model of the U.S. energy sector that EIA uses NEMS to prepare its *Annual Energy Outlook* (*AEO*), a widely known energy forecast for the United States.[17]

A. Market and Technology Assessment

1. General

For the market and technology assessment for CWAF, DOE developed information that provided an overall picture of the market for the equipment concerned, including the purpose of the equipment, the industry structure, market characteristics, and the technologies used in the equipment. This activity included both quantitative and qualitative assessments, based primarily on publicly-available information. The subjects addressed in the market and technology assessment for this rulemaking include scope of coverage, equipment classes, types of equipment sold and offered for sale, manufacturers, and technology options that could improve the energy efficiency of the equipment under examination. The key findings of DOE's market and technology assessment are summarized below. For additional detail, see chapter 3 of the NOPR TSD.

[17] For more information on NEMS, refer to the U.S. Department of Energy, Energy Information Administration documentation. A useful summary is *National Energy Modeling System: An Overview 2003,* DOE/EIA–0581(2003) (March, 2003).

2. Scope of Coverage and Equipment Classes

The proposed energy conservation standards in the NOPR cover commercial warm air furnaces, as defined by EPCA and DOE. EPCA defines ''warm air furnace'' as meaning ''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)) DOE defines ''commercial warm air furnace'' as meaning ''a warm air furnace that is industrial equipment, and that has a capacity (rated maximum input) of 225,000 Btu per hour or more.'' 10 CFR 431.72. Accordingly, this rulemaking covers equipment in these categories having a rated capacity of 225,000 Btu/h or higher and that are designed to supply heated air in commercial buildings via ducts (excluding unit heaters and duct furnaces).

When evaluating and establishing energy conservation standards, DOE divides covered equipment into equipment classes based on the type of energy used or by capacity or other performance-related features that would justify having a higher or lower standard from that which applies to other equipment classes. In determining whether a performance-related feature would justify a different standard, DOE considers such factors as the utility to the consumer of the feature and other factors DOE determines are appropriate.

The current equipment classes for CWAF were defined in the EPACT 1992 amendments to EPCA, and divide this equipment into two classes based on fuel type (*i.e.,* one for gas-fired units, and one for oil-fired units). Table IV.1 shows the current equipment class structure for CWAF.

TABLE IV.1—CURRENT CWAF EQUIPMENT CLASSES

Fuel type	Heating capacity (Btu/h)	Thermal efficiency (%)
Gas-fired	≥225,000	80
Oil-fired	≥225,000	81

In the May 2, 2013 RFI, DOE stated that it planned to use the existing CWAF equipment classes for its analysis of amended energy conservation standards. DOE requested feedback on the current equipment classes and sought information regarding other equipment classes it should consider for inclusion in its analysis. 78 FR 25627, 25629–31.

One particular issue on which DOE sought comment was the need for separate equipment classes for units designed to be installed indoors (*i.e.,* ''non-weatherized'' units) and units designed to be installed outdoors (*i.e.,* ''weatherized'' units). High efficiency, condensing CWAF produce acidic condensate during operation due to the cooling of flue gasses below their dew point. Condensate is more difficult to manage in weatherized CWAF than in non-weatherized CWAF, due to the risk of the condensate freezing after exiting the furnace. For gas-fired models, which represent the large majority of CWAF on the market, most of the models on the market are weatherized units, and a small number are non-weatherized. For oil-fired units, which make up a very small percentage of the CWAF models on the market, all models that DOE identified during the market assessment are non-weatherized.

In response to the RFI, Carrier supported the idea of separate product classes for weatherized and non-weatherized commercial warm air furnaces and stated that unit heaters and duct heaters could potentially fall into these two classifications. (Carrier, No. 2 at p. 1) AHRI asserted that it believes that separate classes are needed for non-weatherized and weatherized CWAF due to issues related to condensate management, but noted that creating separate equipment classes would not lead to any significant energy savings because a majority of the commercial warm air furnace market consists of non-condensing weatherized equipment. (AHRI, No. 7 at p. 4) Similarly, Goodman commented that there is a very small segment of the commercial warm air furnace market that consists of units installed indoors, which would indicate that the costs would far outweigh the benefits of having separate equipment classes (indoor/outdoor). (Goodman, No. 6 at p. 2)

DOE considered these comments and has tentatively decided to continue the use of the existing equipment classes. DOE agrees with AHRI that differentiating between weatherized and non-weatherized CWAF for establishing product classes would provide little opportunity for additional energy savings or benefits as compared to the current equipment class structure. Therefore, DOE is not proposing to adopt separate equipment classes for weatherized and non-weatherized equipment. As to Carrier's assertion that unit heaters and duct heaters could fall into the classification of commercial warm air furnaces, DOE notes that the definition of ''warm air furnace'' in EPCA explicitly excludes such equipment as it defines a warm air furnace 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))

Another specific issue identified in the May 2, 2013 RFI was the potential gap in coverage of DOE's regulations for three-phase commercial furnaces with an input rating below 225,000 Btu/h. 78 FR 25627, 25630–31. Current Federal energy conservation standards for CWAF only cover equipment with an input rating at or above 225,000 Btu/h, and Federal energy conservation standards for residential furnaces cover products with input ratings below 225,000 Btu/h, but only for single-phase products. Thus, there are no Federal standards for furnaces with an input rating below 225,000 Btu/h that use 3-phase electric power.

Carrier stated that weatherized and non-weatherized product classes should be created to cover three-phase commercial warm air furnaces with input ratings below 225,000 Btu/h, and that DOE should adopt the current levels in ASHRAE Standard 90.1 for these products. However, Carrier stated that there would be limited energy savings for new 3-phase, less than 225,000 Btu/h product classes because many of those products share designs with current covered products that already meet efficiency levels set forth in ASHRAE Standard 90.1. (Carrier, No. 2 at p. 2) Lennox supported regulation of three-phase commercial warm air furnaces with input ratings below 225,000 Btu/h, stating that closing this gap would prevent a manufacturer from entering the market with a cost advantage. (Lennox, No. 3 at p. 2) Conversely, AHRI stated that creating an equipment class for three-phase commercial warm air furnaces with an input rating below 225,000 Btu/h would not lead to any additional energy savings since they share the same design as their single-phase counterparts, and consequently have similar thermal efficiencies. (AHRI, No. 7 at p. 4) Goodman reiterated this point, stating that most manufacturers have the same basic design for single- and three-phase products and added that the efficiency of three-phase equipment with an input rating below 225,000 Btu/h generally meet the requirements of single-phase products. Therefore, Goodman argued that any additional regulations would be duplicative and burdensome. (Goodman, No. 6 at p. 3)

Upon considering the comments in response to the RFI on the potential for a new equipment class for three-phase commercial warm air furnaces with an input capacity less than 225,000 Btu/h, DOE has tentatively decided not to extend coverage to this equipment at this time. DOE agrees with commenters who pointed out the limited potential for energy savings due to the fact that equipment with these characteristics already meets efficiency levels specified by ASHRAE Standard 90.1. In its review of the market, DOE did not identify any equipment not meeting or exceeding the ASHRAE Standard 90.1 levels, and thus, has tentatively concluded that a separate equipment class and standard for this equipment may be unnecessarily duplicative and provide little opportunity for energy savings. Further, three-phase commercial warm air furnaces with input ratings below 225,000 Btu/h typically achieve the same efficiency as their single-phase residential counterparts. Thus, the efficiency of this equipment could be expected to be consistent with residential furnace energy conservation standards.

Lastly, in response to the RFI, several commenters suggested that DOE should adopt an upper limit to the input capacity of covered commercial warm air furnaces. Carrier recommended that DOE should consider an upper limit for weatherized furnaces corresponding to DOE's upper limit of 760,000 Btu/h of cooling capacity for commercial air conditioners, and noted that for 760,000 Btu/h air conditioners, the maximum heat input of equipment in their product offering is 1.2 million Btu/h. (Carrier, No. 2 at p. 2) AHRI also recommended an upper limit on input capacity and suggested that the limit be 2,000,000 Btu/h. According to AHRI, this is the maximum input capacity associated with a commercial warm air furnace that is paired with an air conditioner having a cooling capacity of 760,000 Btu/h. (AHRI, No. 7 at p. 5)

DOE notes that neither the statute nor DOE's existing regulations for CWAF specify an upper limit to the input rating of covered equipment. Establishing an upper limit as suggested by interested parties would potentially remove coverage of models that would have otherwise been covered by DOE regulations. As such, DOE sees advantage to leaving the upper end of the range open, such that the standard can accommodate any very large CWAF which may come on the market in the future. Therefore, DOE has tentatively decided not to establish an upper limit on the input capacity of covered CWAF.

DOE requests comment on the proposed scope of coverage and equipment classes for this rulemaking.

3. Technology Options

As part of the market and technology assessment, DOE uses information about existing and past technology options and prototype designs to help identify technologies that manufacturers could use to improve CWAF energy efficiency. Initially, these technologies encompass all those that DOE believes are technologically feasible. Chapter 3 of the NOPR TSD includes the detailed list and descriptions of all technology options identified for this equipment.

In the May 2, 2013 RFI, DOE requested comment on technology options that could be used to improve the thermal efficiency of CWAF. 78 FR 25627, 25631. The comments generally centered on how to improve the efficiency of non-condensing CWAF while still achieving efficiencies in the non-condensing range (*i.e.,* less than 90 percent thermal efficiency), and on how to improve the efficiency of non-condensing CWAF by utilizing condensing operation (which would achieve a thermal efficiency greater than 90 percent).

Carrier stated that raising the thermal efficiency from 80 to 82 percent requires more heat transfer surface. (Carrier, No. 2 at p. 3) Lennox commented that all their warm air furnaces are rated at 80 percent thermal efficiency and are constructed with induced draft combustion system with multiple burners firing into aluminized steel tubes. Lennox explained that these tubes are enhanced on the flue portion to improve heat transfer and balance flow between the parallel flow paths. Further, Lennox expounded that heat exchanger tubes are arranged below or beside the supply blower for optimal coverage of the tube surface area, and the tubes are sloped from the flue outlet back to the burner area to allow any condensate produced by the heat exchanger to drain out in order to prevent heat exchanger corrosion. Lennox stated that 82-percent thermal efficiency furnaces are similar to 80-percent furnaces except that more heat transfer surface is needed, and the amount of excess air required to support complete combustion has to be reduced, and the commenter asserted that the additional flue side pressure drop requires a more powerful combustion inducer (which would draw more electricity). Lennox stated that the lower excess air would reduce the ability for the furnace to operate without derating at high-altitude conditions, and expressed its belief that there would be a risk of corrosion and heat exchanger failure at 82 percent for a very small benefit. (Lennox, No. 3 at p. 4)

To reach 90 percent thermal efficiency, Carrier stated that a secondary heat exchanger is required along with a reliable condensate management system. Carrier described the challenges for achieving thermal efficiencies of greater than 82 percent, including dealing with condensate freezing and disposal of acidic condensate. (Carrier, No. 2 at p. 2) AHRI stated that in order to increase the efficiency of a commercial gas warm air furnace to a condensing level, the heat exchanger surface area must be increased. AHRI further explained that handling acidic condensate would require condensate disposal lines, which cannot be drained on ground or on the roof. (AHRI, No. 7 at p. 3) Lennox commented that condensing furnaces would necessitate a secondary heat exchanger, which would require a much more expensive corrosion-resistant material. Further, Lennox explained that combustion blowers with upgraded housing and stainless steel impellers to protect against corrosion would be required. Lennox reported that it participated in a 1988 Gas Research Institute study on the feasibility of a 90+ percent gas furnace, where condensate was managed by draining it into the building; Lennox explained that incremental product costs were high due to use of a stainless steel secondary heat exchanger, a larger combustion inducer, piping, and thermostatically-controlled heat tape, and that the additional energy used to overcome the pressure drop offset the gas savings. Lennox added that a 90-percent-efficiency gas furnace would have even more barriers in horizontal applications (which make up approximately 15 to 20 percent of the market) because the condensate would have to be pumped into the building. (Lennox, No. 3 at p. 5) Goodman stated that while technology exists that allows condensing operation of commercial warm air furnaces, the application requirements are very onerous, costly, and potentially dangerous. Goodman further stated that many condensate lines today are exposed to extreme weather conditions and are apt to crack or fail at joints, and such a failure would then leak acidic condensate directly onto the building rooftop with a high risk of causing holes in the roof surface. (Goodman, No. 6 at p. 3)

After considering the comments, discussing approaches for improving efficiency with manufacturers during interviews, and reviewing the market for CWAF, DOE primarily considered the following technology options for improving the rated thermal efficiency of CWAF in the development of this NOPR:

- Increased heat exchanger (HX) surface area [18]
- Improved flue side HX enhancements (*e.g.,* dimples, turbulators)
- Secondary HX (stainless steel) [19]

DOE notes that many commenters acknowledged that a secondary heat exchanger for condensing operation is a possible technology option for CWAF, but also that that technology has considerable issues to overcome when used in weatherized equipment. These issues relate specifically to the handling of acidic condensate produced by a condensing furnace in the secondary heat exchanger. Condensate must be drained from the furnace to prevent build-up in the secondary heat exchanger, and properly disposed of after exiting into the external environment. Some building codes limit the disposal of condensate into the municipal sewage system, so the condensate must be passed through a neutralizer to reduce its acidity to appropriate levels prior to disposal. In weatherized installations, it is more difficult to access the municipal sewage system than in non-weatherized installations. Condensate produced by a weatherized condensing furnace must flow naturally or be pumped through pipes to the nearest disposal drain, which may not be in close proximity to the furnace. In cold environments, there is a risk of the condensate freezing as it flows through these pipes, which can cause an eventual back-up of condensate into the heat exchanger, resulting in significant damage to the furnace.

Despite these issues, DOE found in its review of the market that multiple manufacturers offer weatherized HVAC equipment with a condensing furnace heating section. DOE believes that this indicates that many of the issues explained by the commenters can be

[18] This design option includes a larger combustion inducer (to overcome the pressure drop of the increased HX area). The larger combustion inducer does not directly lead to a higher thermal efficiency, but would allow the implementation of other technologies (*i.e.,* HX improvements) that would cause the furnace to operate more efficiently.

[19] This design option includes a larger combustion inducer fan, upgraded housing for combustion blowers, stainless steel impellers, condensate heater, and condensate drainage system that would be required for condensing operation. Although these design changes do not directly lead to a higher thermal efficiency, they allow the implementation of condensing operation, which causes the furnace to operate more efficiently.

overcome, and thus, DOE considered a secondary condensing heat exchanger as a technology option. As discussed in section IV.B and IV.C.2.b, this technology was ultimately passed through the screening analysis and considered in the engineering analysis. Regarding condensate disposal, DOE included the cost of a condensate disposal lines for all condensing installations. For more details, see section IV.F.1.

DOE also identified the following technology options for improving the efficiency of CWAF, which were either removed from the analysis because they were screened out (see section IV.B) or because they did not improve the rated thermal efficiency as measured by the DOE test procedure.

- Pulse combustion
- Low NO_X premix burners
- Low pressure, air-atomized burners
- Burner derating
- Two-stage or modulating burners

DOE requests comment on the technologies identified in this rulemaking, as well as the technologies which were primarily considered as the methods for increasing thermal efficiency of commercial warm air furnaces.

B. Screening Analysis

After DOE identified the technologies that might improve the energy efficiency of CWAF, DOE conducted a screening analysis. The purpose of the screening analysis is to determine which options to consider further and which to screen out. DOE consulted with industry, technical experts, and other interested parties in developing a list of design options. DOE then applied the following set of screening criteria to determine which design options are unsuitable for further consideration in the rulemaking:

- *Technological Feasibility:* DOE will consider only those technologies incorporated in commercial equipment or in working prototypes to be technologically feasible.
- *Practicability to Manufacture, Install, and Service:* If mass production of a technology in commercial equipment and reliable installation and servicing of the technology could be achieved on the scale necessary to serve the relevant market at the time of the effective date of the standard, then DOE will consider that technology practicable to manufacture, install, and service.
- *Adverse Impacts on Equipment Utility or Equipment Availability:* DOE will not further consider a technology if DOE determines it will have a significant adverse impact on the utility of the equipment to significant subgroups of customers. DOE will also not further consider a technology that will result in the unavailability of any covered equipment type with performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially the same as equipment generally available in the United States at the time.
- *Adverse Impacts on Health or Safety:* DOE will not further consider a technology if DOE determines that the technology will have significant adverse impacts on health or safety.

(10 CFR part 430, subpart C, appendix A, 4(a)(4) and 5(b))

Additionally, DOE notes that these screening criteria do not directly address the propriety status of design options. DOE only considers efficiency levels achieved through the use of proprietary designs in the engineering analysis if they are not part of a unique path to achieve that efficiency level (*i.e.,* if there are other non-proprietary technologies capable of achieving the same efficiency). DOE believes the proposed standards for the CWAF equipment covered in this rulemaking would not mandate the use of any proprietary technologies, and that all manufacturers would be able to achieve the proposed levels through the use of non-proprietary designs. DOE seeks comment on this tentative conclusion and requests additional information regarding proprietary designs and patented technologies.

Technologies that pass through the screening analysis are referred to as ''design options'' and are subsequently examined in the engineering analysis for consideration in DOE's downstream cost-benefit analysis. In view of the above factors, DOE screened out the following design options listed below in Table IV.2.

TABLE IV.2—SCREENED TECHNOLOGY OPTIONS

Technology option	Reason for screening out
Pulse Combustion	Adverse impact on utility; potential for adverse impact on safety.
Low NO_X Premix Burner	Technological feasibility.
Burner Derating	Adverse impact on utility.
Low Pressure, Air-Atomized Burner	Technological Feasibility.

Based on the screening analysis, DOE identified the following seven design options for further consideration in the engineering analysis:

- Condensing secondary heat exchanger
- Increased heat exchanger surface area
- Incorporation of heat exchanger surface features (*e.g.,* dimples)
- Use of heat exchanger baffles and turbulators
- Use of concentric venting of flue gases
- Improved combustion air flow (oil-fired)
- High-static oil burner

A full description of each technology option is included in chapter 3 of the TSD, and additional discussion of the screening analysis is included in chapter 4 of the TSD.

C. Engineering Analysis

The engineering analysis establishes the relationship between an increase in energy efficiency of the equipment and the increase in manufacturer selling price (MSP) associated with that efficiency level. This relationship serves as the basis for the cost-benefit calculations for commercial consumers, manufacturers, and the Nation. In determining the cost-efficiency relationship, DOE estimates the increase in manufacturer cost associated with increasing the efficiency of equipment above the baseline up to the maximum technologically feasible (''max-tech'') efficiency level for each equipment class.

1. Methodology

DOE typically structures its engineering analysis using one or more of three identified basic methods for generating manufacturing costs: (1) The design-option approach, which provides the incremental costs of adding individual technology options (from the market and technology assessment) that can be added alone or in combination to a baseline model in order to improve its efficiency (*i.e.,* lower its energy use); (2) the efficiency-level approach, which provides the incremental costs of moving to higher energy efficiency levels, without regard to the particular design option(s) used to achieve such increases; and (3) the reverse-engineering (or cost-assessment) approach, which provides ''bottom-up'' manufacturing cost assessments for achieving various levels of increased efficiency, based on teardown analyses (or physical teardowns) providing detailed data on costs for parts and material, labor, shipping/packaging, and investment for models that operate at particular efficiency levels. A supplementary method called a catalog teardown uses published manufacturer catalogs and supplementary component data to estimate the major physical differences between a piece of equipment that has been physically disassembled and another piece of similar equipment for which catalog data are available to determine the cost of the latter equipment.

In the RFI, DOE stated that in order to create the cost-efficiency relationship for CWAF, it anticipated having to structure its engineering analysis using the reverse-engineering approach, potentially including physical and catalog teardowns. DOE requested comments on the approach outlined in the RFI and on the appropriate representative capacities for each equipment class. 78 FR 25627, 25631 (May 2, 2013).

In response to the RFI, Carrier stated that equipment is available for teardown analysis to develop a cost-efficiency relationship between 80 percent and 82 percent, but noted that it may be difficult to draw clear conclusions from the data. However, Carrier added that it was unclear how to analyze a 90-percent efficiency level through a teardown analysis.

For this NOPR, DOE conducted the engineering analysis using the reverse-engineering approach to estimate the costs of achieving various efficiency levels. DOE selected two gas-fired CWAF in the non-condensing efficiency range for physical teardowns at an input rating of 250,000 Btu/h, which was considered to be the representative input rating for analysis. DOE also performed a physical teardown of an oil-fired CWAF at 81-percent thermal efficiency at an input rating of 400,000 Btu/h, which was subsequently scaled down via cost modeling techniques to represent a unit of the representative 250,000 Btu/h input rating. DOE seeks comment regarding the applicability of these teardown units to represent the range of potential input capacities on the market. Additional detail on the teardowns performed is provided in chapter 5, section 5.6.2, of the proposed rule TSD. In addition, DOE used catalog data and information from physical teardowns to virtually model a gas-fired unit at the max-tech 92-percent thermal efficiency level, as well as two oil-fired furances (at 82 percent and the max-tech 92 percent thermal efficiency).

2. Efficiency Levels

a. Baseline Efficiency Levels

The baseline model is used as a reference point for each equipment class in the engineering analysis and the life-cycle cost and payback-period analyses, which provides a starting point for analyzing potential technologies that provide energy efficiency improvements. Generally, DOE considers ''baseline'' equipment to refer to a model or models having features and technologies that just meet, but do not exceed, the minimum energy conservation standard. In establishing the baseline efficiency level for this analysis, DOE used the existing minimum energy conservation standards for CWAF to identify baseline units. The baseline thermal efficiency levels for each equipment class are presented below in Table IV.3.

TABLE IV.3—BASELINE THERMAL EFFICIENCY LEVELS FOR CWAF

Equipment class	Baseline efficiency level (%)
Gas-fired Commercial Warm Air Furnace	80
Oil-fired Commercial Warm Air Furnace	81

b. Incremental and Max-Tech Efficiency Levels

For each equipment class, DOE analyzes several efficiency levels and determines the incremental cost at each of these levels. For this NOPR, DOE developed efficiency levels based on a review of available equipment. DOE compiled a database of the CWAF market to determine what types of equipment are currently available to commercial consumers. At each representative capacity, DOE surveyed various manufacturers' equipment offerings to identify the commonly-available efficiency levels. By identifying the most prevalent energy efficiencies in the range of available equipment, DOE can establish a technology path that manufacturers would typically use to increase the thermal efficiency of a CWAF and corresponding efficiency levels along that technology path.

DOE established incremental thermal efficiency levels for each equipment class. The incremental thermal efficiency levels are representative of efficiency levels along the technology paths that manufacturers of CWAF commonly use to maintain cost-effective designs while increasing the thermal efficiency. DOE reviewed AHRI's Directory of Certified Product Performance,[20] manufacturer catalogs, and other publicly-available literature to determine which thermal efficiency levels are the most prevalent for each representative equipment class. For gas-fired CWAF, DOE chose two efficiency levels between the baseline and max-tech for analysis (see Table IV.4). For oil-fired CWAF, DOE chose one thermal efficiency level between the baseline and max-tech for analysis (see Table IV.5).

Carrier stated that in the current market, the max-tech efficiency level for gas-fired weatherized furnaces is 81-percent to 82-percent thermal efficiency, pointing out that no AHRI member makes a more efficient gas-fired furnace, and asserting that 90 percent is not currently feasible. (Carrier, No. 2 at p. 2) Lennox described how an 82-percent gas-fired commercial furnace could be designed, but then expressed significant concerns about trying to develop furnaces at 82-percent thermal efficiency. The commenter asserted that there would be an undue risk of corrosion and heat exchanger failure for a very small benefit in gas consumption at this efficiency level. Lennox also commented that the two gas-fired 90-percent thermal efficiency model lines available on the market currently are for makeup air applications,[21] which is a niche market. (Lennox, No. 3 at pp. 4–5) AHRI stated that since January 1, 1994, the efficiency trends for gas-fired commercial warm air furnaces have stayed near a thermal efficiency of 80 percent. As discussed previously in section IV.A.3, many of the commenters also noted concerns regarding issues with condensate management in weatherized furnaces with thermal efficiencies at or above 90 percent.

DOE considered these comments in conjunction with its review of the market. DOE found several manufacturers that offer gas-fired equipment at 81-percent thermal efficiency. In addition, although only one manufacturer has gas-fired equipment rated at 82-percent thermal efficiency, there is equipment available across a wide range of input capacities indicating that the entire product family would be capable of meeting 82-percent

[20] For more information see: *http://cafs.ahrinet.org/gama_cafs/sdpsearch/search.jsp?table=CFurnace.*

[21] Makeup air applications require fresh outdoor air that is brought into a building through the ventilation system, and do not allow air to be recirculated through the building.

thermal efficiency. DOE acknowledges the concerns raised regarding the near-condensing operation at 82-percent thermal efficiency, but believes that the presence of models across a broad range of input ratings demonstrates the feasibility of this efficiency level. Thus, DOE considered 81-percent and 82-percent as incrementally higher thermal efficiency levels for the gas-fired commercial furnace analysis. DOE also considered the max-tech level, which was identified as 92-percent thermal efficiency. The max-tech level is based on a dedicated outdoor air system with a condensing furnace section, which proves the technical feasibility of a weatherized condensing furnace. For oil-fired furnaces, which are typically installed indoors, DOE surveyed the market and found non-condensing equipment with thermal efficiencies in the range of 81 to 82 percent, as well as a condensing model with a thermal efficiency of 92 percent. Therefore, DOE analyzed those three levels in this NOPR analysis. The efficiency levels DOE considered for each equipment class during the NOPR analyses (including the baseline levels) are presented in Table IV.4 and Table IV.5.

TABLE IV.4—EFFICIENCY LEVELS FOR GAS-FIRED CWAF

Efficiency level	Gas-fired CWAF (%)
EL0 (Baseline)	80
EL1	81
EL2	82
Max-Tech	92

TABLE IV.5—EFFICIENCY LEVELS FOR OIL-FIRED CWAF

Efficiency level	Oil-fired CWAF (%)
EL0 (Baseline)	81
EL1	82
Max-Tech	92

DOE requests comment on the efficiency levels analyzed for gas-fired and oil-fired commercial warm air furnaces. In particular, DOE is interested in the feasibility of the max-tech efficiency levels, as well as the 82-percent thermal efficiency level for gas-fired commercial warm air furnaces.

3. Equipment Testing and Reverse Engineering

As discussed above, for the engineering analysis, DOE analyzed a representative input capacity of 250,000 Btu/h for the gas-fired and oil-fired CWAF equipment classes to develop incremental cost-efficiency relationships. The models were selected to represent the efficiency levels available on the market, ranging from the baseline 80-percent thermal efficiency for gas-fired units, and baseline 81-percent thermal efficiency for oil-fired units, up to the max-tech 92-percent thermal efficiency for gas-fired units, and 92-percent thermal efficiency for oil-fired units. DOE based the selection of units for testing and reverse engineering on the efficiency data available in the AHRI certification database [22] and the CEC equipment database.[23] Details of the key features of the tested units are presented in chapter 5 of the NOPR TSD.

DOE conducted physical or virtual teardowns on each test unit to develop a manufacturing cost model and to evaluate key design features (*e.g.,* heat exchangers, blower and inducer fans/fan motors, control strategies).

For gas-fired commercial warm air furnaces, DOE performed two teardowns on weatherized furnaces at non-condensing efficiency levels. Prior to teardown, the units were tested by a third-party test lab and achieved a thermal efficiency of 82 percent. The units were from the same manufacturer and had nearly identical furnace sections with different air conditioner sections. DOE assumed that the repeatability of the test result on both units indicated that the furnace design that was torn down is representative of equipment that would achieve 82-percent thermal efficiency. Using the cost-assessment methodology, DOE determined the cost of the furnace components through reverse-engineering of the furnace section of the weatherized packaged units. Based on discussions with manufacturers, a review of product literature, and experience obtained from examining residential weatherized furnaces, DOE made assumptions regarding how the heat exchanger size would vary between units with 82-percent thermal efficiency and at the baseline (80-percent thermal efficiency) and the 81-percent thermal efficiency intermediate level. At the 80-percent and 81-percent thermal efficiency levels, DOE scaled down the size of the heat exchanger and related components (*e.g.,* inducer fan, cabinet panels, insulation), as applicable, to generate an estimate of the cost to manufacture equipment at those levels. Thus, DOE obtained an estimate of the differential cost of manufacturing a commercial gas furnace section at the baseline (80-percent), 81-percent, and 82-percent thermal efficiency. To develop an estimate of the cost of a max-tech unit at 92-percent thermal efficiency, DOE obtained a sample of commercial HVAC equipment that utilizes a condensing furnace section for analysis, and also used information gathered from a teardown of a condensing weatherized residential furnace. DOE examined the heat exchanger, inducer fan, condensate management system, and other aspects of the furnace section in the commercial equipment sample to develop a cost estimate to manufacture a condensing commercial furnace. DOE then used information from the residential condensing weatherized furnace teardown to refine estimates of the costs of the exhaust assembly, inducer fan assembly, and condensate management system to model the cost of a 92-percent efficient CWAF that is designed for implementation on a broad scale.

For oil-fired commercial furnaces, DOE performed a teardown of a non-weatherized furnace at 81-percent thermal efficiency. DOE used this teardown, along with product literature, prior industry experience, manufacturer feedback, and analysis previously performed on residential furnaces to develop cost estimates at the 82-percent and 92-percent thermal efficiency levels.

In a previous analysis of residential non-weatherized oil-fired furnaces, DOE developed an estimate of the cost-efficiency relationship across a range of efficiency levels. In examining product literature for commercial oil-fired furnaces, DOE found that commercial units are very similar to residential units, except with higher input ratings and overall larger size. Based on information obtained from the physical teardown of the 81-percent thermal efficiency oil furnace, in addition to the information gained from the residential furnace analysis and product literature, DOE was able to conduct a virtual teardown at the 82-percent thermal efficiency level. Key to this model was the growth in heat exchanger size necessary for a 1-percent increase in thermal efficiency, which necessitates a larger cabinet to accommodate it. Sheet metal and other components sensitive to size changes were scaled in order to match the larger size of the unit, while components that are not sensitive to heat exchanger size changes remained unchanged.

Similarly, DOE relied on the physical teardown at the 81-percent thermal efficiency level, as well as prior

[22] Available at: *https://www.ahridirectory.org/ahridirectory/pages/home.aspx.*

[23] Available at: *http://www.appliances.energy.ca.gov/Default.aspx.*

comparisons of residential oil-fired furnaces at condensing and non-condensing efficiency levels, to conduct a virtual teardown at the 92-percent thermal efficiency level. At 92-percent thermal efficiency, a secondary condensing heat exchanger made from a high-grade stainless steel was added in order to withstand the formation of condensate from the flue gases coupled with increased heat extraction into the building airstream (and, thus, higher thermal efficiency). This additional heat exchanger was appropriately sized based on information gathered from the residential furnaces teardowns. To accommodate the secondary heat exchanger, the cabinet was increased in size, and all associated sheet metal, wiring, and other components sensitive to cabinet size changes were also scaled as a result. In addition, the size of the blower fan blade was increased appropriately to account for the additional airflow needed over the secondary heat exchanger (however, based on observations in product literature, the rated fan power was unchanged). The manufacturing costs obtained from these physical and virtual teardowns served as the basis for the cost-efficiency relationship for this equipment class. The teardown analyses are described in further detail in section 5.6 of the proposed rule TSD.

4. Cost Model

DOE developed a manufacturing cost model to estimate the manufacturing production cost of CWAF. The cost model is a spreadsheet model that converts the materials and components in the bills of materials (BOMs) into dollar values based on the price of materials, average labor rates associated with fabrication and assembling, and the cost of overhead and depreciation, as determined based on manufacturer interviews and DOE expertise. To convert the information in the BOMs into dollar values, DOE collected information on labor rates, tooling costs, raw material prices, and other factors. For purchased parts, the cost model estimates the purchase price based on volume-variable price quotations and detailed discussions with manufacturers and component suppliers. For fabricated parts, the prices of raw metal materials (*e.g.,* tube, sheet metal) are estimated on the basis of five-year averages. The cost of transforming the intermediate materials into finished parts is estimated based on current industry pricing. Additional details on the cost model are contained in chapter 5 of the NOPR TSD.

5. Manufacturing Production Costs

Once the cost estimates for all the components in each teardown unit were finalized, DOE totaled the cost of materials, labor, and direct overhead used to manufacture each type of equipment in order to calculate the manufacturing production cost. The total cost of the equipment was broken down into two main costs: (1) The full manufacturing production cost, referred to as MPC; and (2) the non-production cost, which includes selling, general, and administration (SG&A) costs; the cost of research and development; and interest from borrowing for operations or capital expenditures. DOE estimated the MPC at each efficiency level considered for each equipment class, from the baseline through the max-tech level. After incorporating all of the assumptions into the cost model, DOE calculated the percentages attributable to each element of total production costs (*i.e.,* materials, labor, depreciation, and overhead). These percentages are used to validate the assumptions by comparing them to manufacturers' actual financial data published in annual reports, along with feedback obtained from manufacturers during interviews. DOE uses these production cost percentages in the MIA.

Based on the analytical methodology discussed in the sections above, DOE developed the cost-efficiency results shown in Table IV.6 for each thermal efficiency level analyzed. The results shown in Table IV.6 represent the incremental increase in manufacturing cost, relative to the baseline manufacturing cost, needed to produce equipment at each efficiency level above baseline. Details of the cost-efficiency analysis, including descriptions of the technologies DOE analyzed for each thermal efficiency level to develop incremental manufacturing costs, are presented in chapter 5 of the NOPR TSD. DOE seeks comment on the results of the engineering analysis at each efficiency level considered.

TABLE IV.6—INCREMENTAL MANUFACTURING COST INCREASES *

Equipment type	EL0 (baseline)	EL1	EL2 (oil-fired max-tech)	EL3 (gas-fired max-tech)
Gas-fired CWAF	....	$5	$10	$613
Oil-fired CWAF	....	24	660	....

* DOE structures proposed standards in terms of TSLs and analyzed five TSLs for this NOPR. TSL 1 includes EL1 for gas-fired CWAF and EL0 for oil-fired CWAF, TSL 2 includes EL1 for both equipment classes, TSL 3 includes EL2 for gas-fired CWAF and EL0 for oil-fired CWAF, TSL 4 includes EL2 for gas-fired CWAF and EL1 for oil-fired CWAF, and TSL 5 includes EL3 for gas-fired CWAF and EL2 for oil-fired CWAF. For more information on the TSL structure, see section V.A of this NOPR.

6. Manufacturer Markup

To account for manufacturers' non-production costs and profit margin, DOE applies a non-production cost multiplier (the manufacturer markup) to the full MPC. The resulting manufacturer selling price (MSP) is the price at which the manufacturer can recover all production and non-production costs and earn a profit. To meet new or amended energy conservation standards, manufacturers often introduce design changes to their equipment lines that result in increased MPCs. Depending on the competitive pressures, some or all of the increased production costs may be passed from manufacturers to retailers and eventually to customers in the form of higher purchase prices. As production costs increase, manufacturers typically incur additional overhead. The MSP should be high enough to recover the full cost of the equipment (*i.e.,* full production and non-production costs) and yield a profit. The manufacturer markup has an important bearing on profitability. A high markup under a standards scenario suggests manufacturers can readily pass along the increased variable costs and some of the capital and product conversion costs (the one-time expenditure) to customers. A low markup suggests that manufacturers will not be able to recover as much of the necessary investment in plant and equipment. DOE developed the manufacturer markup through an examination of corporate annual reports and Securities and Exchange Commission (SEC) 10–K reports.[24] Additional information is contained in chapter 5 of the TSD.

7. Shipping Costs

Manufacturers of heating, ventilation, and air-conditioning (HVAC) equipment typically pay for shipping to the first step in the distribution chain. Freight is not a manufacturing cost, but because it is a substantial cost incurred by the manufacturer, DOE is accounting for shipping costs of CWAF separately from other non-production costs that comprise the manufacturer markup. To calculate the MSP for CWAF, DOE multiplied the MPC at each efficiency level by the manufacturer markup and added shipping costs for equipment at the given efficiency level. More specifically, DOE calculated shipping costs at each efficiency level based on the average outer dimensions of equipment at the given efficiency and assuming the use of a typical 53-foot straight-frame trailer with a storage volume of 4,240 cubic feet. Gas-fired CWAF equipment is almost exclusively enclosed within a cabinet that also contains a commercial unitary air conditioner (CUAC). Thus, the CUAC components are significant factor in driving the overall cabinet dimensions. DOE found that the changes in CWAF component sizes necessary to achieve the 81 percent and 82 percent thermal efficiency levels are not large enough to add any size to the cabinet, which is driven primarily by the size of the CUAC components. The shipping costs calculated for each efficiency level are shown in Table IV.7. Due to the noted dependence on CUAC components of the overall shipping cost for gas-fired CWAF, DOE presents only the incremental cost change due to increased CWAF efficiency for that equipment. For oil-fired CWAF, DOE presents the full cost of shipping, since this equipment is not packaged with CUAC components, and thus, the shipping cost represents only the oil-fired CWAF. Chapter 5 of the NOPR TSD contains additional details about DOE's shipping cost assumptions and DOE's shipping cost estimates.

TABLE IV.7—CWAF SHIPPING COST ESTIMATES

CWAF equipment class	Thermal efficiency (%)	Shipping costs * (2013$)
Gas-Fired CWAF	80	$0
	81	0
	82	0
	92	39.64
Oil-Fired CWAF	81	63.78
	82	69.60
	92	76.53

* Because gas-fired CWAF are weatherized and are typically included in a cabinet with a commercial unitary air conditioner which affects the shipping cost, the shipping costs for gas-fired CWAF are shown in terms of the incremental increase from the baseline level. Since oil-fired CWAF are normally self-contained non-weatherized units, the shipping costs for oil-fired CWAF are representative of the entire cost to ship the unit.

D. Markups Analysis

The markups analysis develops appropriate markups in the distribution chain to convert the estimates of manufacturer selling price derived in the engineering analysis to commercial consumer prices. (''Commercial consumer'' refers to purchasers of the equipment being regulated.) DOE develops baseline and incremental markups based on the equipment markups at each step in the distribution chain. The markups are multipliers that represent increases above equipment purchase costs for CWAF equipment. The incremental markup relates the change in the manufacturer sales price of higher-efficiency models (the incremental cost increase) to the change in the customer price.

In the RFI, DOE characterized two distribution channels to describe how CWAF equipment passes from the manufacturer to the commercial consumer. 78 FR 25627, 25632 (May 2, 2013). The first distribution channel is characterized as follows:

Manufacturer → Wholesaler → Mechanical Contractor → General Contractor → Consumer

In the second distribution channel, the manufacturer sells the equipment directly to the customer through a national account:

Manufacturer → Consumer (National Account)

Carrier stated that the distribution channels outlined in the RFI are relevant for commercial warm air furnaces. Carrier added that in addition to the two channels described, for very large air-cooled equipment, there is an additional channel that consists of factory employees selling direct to end customers/mechanical contractors. (Carrier, No. 2 at p. 3) Lennox stated that the first example of distribution channels provided by DOE (manufacturer to wholesaler to mechanical contractor to general contractor to customer) is a typical distribution approach. Lennox stated that the second example (where a manufacturer would sell directly to a customer) is not a typical distribution approach, but rather the distribution channel should include the contractor, who must set up and install the system at the building site. (Lennox, No. 3 at p. 6) Goodman stated that the distribution channels should not be significantly different from the analysis performed for the same products being considered for the cooling mode. (Goodman, No. 6 at p. 3)

In response to these comments, DOE modified the second distribution channel to include a wholesaler who purchases the equipment and sells it to the customer. DOE's understanding of this channel is that the contractor who installs the system generally does not purchase and mark up the equipment. Rather, the building owner purchases the equipment and hires the contractor. Thus, for the purposes of DOE's analysis, it would not be appropriate to include the contractor in the distribution channel.

DOE also sought input on the percentage of equipment being distributed through the various types of distribution channels. Carrier stated that approximately 70 percent of equipment flows through the first distribution

[24] U.S. Securities and Exchange Commission, Annual 10–K Reports (Various Years) (Available at: *http://www.sec.gov/edgar/searchedgar/companysearch.html*) (Last Accessed Dec. 13, 2013).

channel described in the RFI, with the remainder split among the other channels. (Carrier, No. 2 at p. 4) Lennox stated that the first distribution approach discussed is the typical approach to equipment sales, accounting for approximately 90–95 percent of sales. (Lennox, No. 3 at p. 6)

DOE assumes that the above responses reflect each company's experience, rather than a characterization of the industry overall. For this NOPR, DOE estimated that the first distribution channel accounts for 83 percent of shipments, and the second distribution channel accounts for 17 percent.

To develop markups for the parties involved in the distribution of the equipment, DOE utilized several sources, including: (1) The Heating, Air-Conditioning & Refrigeration Distributors International (HARDI) 2012 Profit Report [25] to develop wholesaler markups; (2) the 2005 Air Conditioning Contractors of America's (ACCA) financial analysis for the heating, ventilation, air-conditioning, and refrigeration (HVACR) contracting industry [26] to develop mechanical contractor markups, and (3) U.S. Census Bureau's 2007 Economic Census data [27] for the commercial and institutional building construction industry to develop general contractor markups. For mechanical contractors, DOE derived separate markups for small and large contractors.

In addition to the markups, DOE derived State and local taxes from data provided by the Sales Tax Clearinghouse.[28] These data represent weighted average taxes that include county and city rates. DOE derived shipment-weighted average tax values for each CBECS region considered in the analysis.

Chapter 6 of the NOPR TSD provides further detail on the estimation of markups.

E. Energy Use Analysis

The purpose of the energy use analysis is to assess the energy requirements of equipment at different efficiencies in several building types that utilize the equipment and to assess the energy savings potential of increased commercial warm air furnace efficiency. The annual energy consumption includes the natural gas and oil fuel types used for heating and the auxiliary electrical use associated with the furnace electrical components.

DOE based the energy use analysis on Energy Information Administration's 2003 Commercial Building Energy Consumption Survey (CBECS) [29] for the subset that uses the type of equipment covered by the standards. DOE utilized the building types defined in CBECS 2003.[30] Each building was assigned to a specific location, and the approach captured variability in heating loads due to factors such as building activity, schedule, occupancy, local weather, and shell characteristics. Energy use estimates from 2003 CBECS were adjusted for average weather conditions and for projected improvements to the building shell efficiency. DOE also accounted for the energy use of a small fraction of commercial warm air furnaces that are installed in residential housing using data from the 2009 Residential Energy Consumption Survey (RECS 2009).[31]

To determine the energy consumption of commercial warm air furnaces, DOE is using a Thermal Efficiency (TE) rating, along with relevant characteristics for each sample building. DOE assumed that TE is proportional to annual heating energy consumption for any given set of operating conditions. To calculate commercial warm air furnace energy consumption at each considered efficiency level, DOE determined the equipment capacity and the heating load in each CBECS building.

In the RFI, DOE requested comment on its planned method to determine the equipment load profiles. 78 FR 25627, 25632 (May 2, 2013). Carrier stated that DOE should develop equipment load profiles using the 16 benchmark buildings from Pacific Northwest National Laboratories (PNNL) building models.[32] (Carrier, No. 2 at p. 4)

In response, rather than developing detailed load profiles for various building types, DOE decided to use CBECS-reported heating energy use for each sample building. DOE assumed that the CBECS data are representative of the energy use measured in the field for the U.S. commercial building types. CBECS provides information about buildings with a wide range of energy use representing both high-energy-use and low-energy-use buildings. DOE has concluded that the selected approach better reflects the heating energy use of the commercial buildings stock in the U.S. in comparison to using a set of benchmark buildings.

DOE's RFI also sought input from stakeholders on the current distribution of equipment efficiencies in the building population. 78 FR 25627, 25632 (May 2, 2013). Carrier stated that the vast majority of equipment should be in the 80-percent to 82-percent efficiency range based on the ASHRAE 90.1 standard. (Carrier, No. 2 at p. 4) DOE's approach is consistent with Carrier's comment. It utilizes model efficiency information from the 2013 AHRI Certification Directory for Commercial Furnaces.[33]

In the RFI, DOE requested comment on how equipment energy use for a given heating load shape scales as a function of capacity (*i.e.,* whether two commercial furnace units of a certain capacity use the same total heating energy as one commercial furnace unit of twice the capacity). 78 FR 25627, 25632 (May 2, 2013). Carrier stated that it would expect to see no measurable difference in energy use for a given load shape as a function of capacity. (Carrier, No. 2 at p. 4) DOE's approach reflects the statement made by Carrier.

Lennox stated that in its experience, furnaces with higher thermal efficiency ratings may use less gas, but they may use more electricity, offsetting the potential benefits. (Lennox, No. 3 at p. 7) For condensing CWAF, DOE's analysis accounts for the increased blower fan electricity use in the field in both heating and cooling mode due to the presense of the secondary heat exchanger. The increased electricity use of condensing furnaces is expected to be small compared to the potential savings in fuel use. DOE also accounts for

[25] *Heating, Air Conditioning & Refrigeration Distributors International 2012 Profit Report* (Available at: *http://www.hardinet.org/Profit-Report*) (Last accessed April 10, 2013).

[26] Air Conditioning Contractors of America (ACCA), *Financial Analysis for the HVACR Contracting Industry: 2005* (Available at: *https://http://www.acca.org/store/product.php?pid=142*) (Last accessed April 10, 2013).

[27] U.S. Census Bureau, *2007 Economic Census Data* (2007) (Available at: *http://www.census.gov/econ/*) (Last accessed April 10, 2013).

[28] Sales Tax Clearinghouse Inc., State Sales Tax Rates Along with Combined Average City and County Rates, 2013 (Available at: *http://thestc.com/STrates.stm*) (Last accessed Sept. 11, 2013).

[29] Energy Information Administration (EIA), 2003 Commercial Building Energy Consumption Survey (Available at: *http://www.eia.gov/consumption/commercial/*) (Last accessed April 10, 2013). Note: CBECS 2012 is currently in development but was not available in time for this rulemaking.

[30] Definitions of CBECS building types can be found at: *http://www.eia.gov/emeu/cbecs/building_types.html.*

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

[32] Deru, M., K. Field, D. Studer, K. Benne, B. Griffith, P. Torcellini, B. Liu, M. Halverson, D. Winiarski, M. Rosenberg, M. Yazdanian, J. Huang, and D. Crawley, *U.S. Department of Energy Commercial Reference Building Models of the National Building Stock,* 2011 (Available at *http://www.nrel.gov/docs/fy11osti/46861.pdf*) (Last accessed December 6, 2013).

[33] AHRI, 2013 AHRI Certification Directory for Commercial Furnaces (Available at: *http://www.ahridirectory.org/ahridirectory/pages/home.aspx*).

condensate line freeze protection or a condensate pump for a fraction of installations. Condensing CWAF installed outdoors that are located in regions with an outdoor design temperature of ≤32 °F were assumed to require condensate freeze protection. This applies to roughly 90 percent of gas-fired CWAF. All oil-fired CWAFs are assumed to be installed indoors so condensate line freeze protection was assumed to not be needed.

Carrier stated that increasing plug loads (*e.g.,* computers and related equipment) and tighter buildings with higher insulation values will most likely continue to lower the change-over temperature from cooling to heating in commercial buildings. (Carrier, No. 2 at p. 6) Lennox stated that commercial buildings are being required to have higher insulation levels by ASHRAE Standard 90.1 in the future, which will reduce the building load and further reduce the potential energy savings for higher-efficiency furnaces. (Lennox, No. 3 at p. 7) DOE's analysis accounts for improvements in the building shell. The analysis uses the *AEO 2013* building shell efficiency index for commercial buildings to account for these impacts. Although plug loads may increase, decreasing the heating load, the efficiency of the equipment is also likely to improve, which would increase the heating load, so the net effect is uncertain.

In the RFI, DOE requested comment on the fraction of commercial warm air furnaces which are used in residential applications such as multi-family buildings. 78 FR 25627, 25632 (May 2, 2013). Carrier stated that the fraction of commercial furnaces applied in residential applications is negligible. (Carrier, No. 2 at p. 5) Based on RECS 2009 data, DOE estimates that about two percent of commercial furnaces are used in residential applications.[34]

F. Life-Cycle Cost and Payback Period Analysis

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

The LCC is the total consumer expense over the life of the equipment, consisting of equipment and installation costs plus operating costs over the lifetime of the equipment (expenses for energy use, maintenance, and repair). DOE discounts future operating costs to the time of purchase using commercial consumer discount rates. The PBP is the estimated amount of time (in years) it takes commercial consumers to recover the increased total installed cost (including equipment and installation costs) of a more-efficient type of equipment through lower operating costs. DOE calculates the PBP by dividing the change in total installed cost (normally higher) due to a new or amended energy conservation standard by the change in annual operating cost (normally lower) that results from that standard.

For any given efficiency level, DOE measures the PBP and the change in LCC relative to an estimate of the base-case efficiency level. The base-case estimate reflects the market in the absence of amended energy conservation standards, including market trends for equipment that exceeds the current energy conservation standards.

DOE analyzed the potential for variability and uncertainty by performing the LCC and PBP calculations on a nationally-representative sample of individual commercial buildings. More specifically, DOE utilized the sample of buildings developed for the energy use analysis. Within a given building, one or more commercial warm air furnace units may serve the building's space-conditioning needs, depending on the heating load requirements of the building. As a result, the Department also expressed the LCC and PBP results as the percentage of commercial warm air furnace customers experiencing economic impacts of different magnitudes. DOE modeled both the uncertainty and the variability in the inputs to the LCC and PBP analysis using Monte Carlo simulation and probability distributions. As a result, the LCC and PBP results are displayed as distributions of impacts compared to the base-case conditions.

EPCA establishes a rebuttable presumption that a standard is economically justified if the Secretary finds that the additional cost to the consumer of purchasing a product complying with an energy conservation standard level will be less than three times the value of the energy (and, as applicable, water) savings during the first year that the consumer will receive as a result of the standard, as calculated under the test procedure in place for that standard. For each considered efficiency level, DOE typically determines the value of the first year's energy savings by calculating the quantity of those savings in accordance with the applicable DOE test procedure,[35] and multiplying that amount by the average energy price forecast for the year in which compliance with the amended standards would be required.

DOE calculated the LCC and PBP for all commercial consumers of CWAF as if each were to purchase new equipment in the year that compliance with amended standards is required. EPCA directs DOE to publish a final rule amending the standard for the products covered by this NOPR not later than 2 years after a notice of proposed rulemaking is issued. (42 U.S.C. 6313(a)(6)(C)(iii)) At the time of preparation of the NOPR analysis, the expected issuance date was early 2015, leading to an anticipated final rule publication in 2015. EPCA also states that amended standards prescribed under this subsection shall apply to products manufactured after a date that is the later of—(I) the date that is 3 years after publication of the final rule establishing a new standard; or (II) the date that is 6 years after the effective date of the current standard for a covered product. (42 U.S.C. 6313(a)(6)(C)(iv)) The date under clause (I), currently projected to be 2018, is later than the date under clause (II). Therefore, for purposes of its analysis, DOE used January 1, 2018 as the beginning of compliance with potential amended standards for CWAF.

In the RFI, DOE requested comment from stakeholders on the overall method that it intended to use in conducting the LCC and PBP analysis for commercial warm air furnaces. 78 FR 25627, 25632 (May 2, 2013). Carrier stated that DOE should use the procedures as developed by the ASHRAE 90.1 committee and PNNL for evaluating changes to ASHRAE Standard 90.1, because this procedure has defined buildings that can be used for these products. Carrier added that ASHRAE also has a standard work procedure for economic analysis that is similar to the LCC analysis but uses the Scalar Ratio as defined by the ASHRAE 90.1 committee with national average electric and gas rates. (Carrier, No. 2 at p. 5)

DOE reviewed the approach suggested by Carrier. It did not use this approach because, for the reasons explained in section IV.E, DOE is not estimating

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

[35] The DOE test procedure for commercial warm air furnaces a 10 CFR 431.76 does not specify a calculation method for determining energy use. For the rebuttable presumption PBP calculation, DOE used average energy use reported from CBECS 2003 for this equipment.

energy use using whole building simulation, as do the procedures as developed by the ASHRAE 90.1 committee. Furthermore, DOE's methodology allows a better evaluation of variability and uncertainty in key variables, such as equipment lifetime and discount rates, that affect the LCC analysis. The method advocated by Carrier typically uses average values, which do not capture the range of equipment operation and user characteristics found in the field.

Inputs to the LCC and PBP analysis are categorized as: (1) inputs for establishing the purchase expense, otherwise known as the total installed cost, and (2) inputs for calculating the operating expense. These key inputs are discussed in further detail immediately below.

1. Inputs to Installed Cost

The primary inputs for establishing the total installed cost are the baseline commercial consumer equipment price, standard-level customer price increases, and installation costs. Baseline customer prices and standard-level customer price increases were determined by applying markups to manufacturer price estimates. The installation cost is added to the customer price to arrive at a total installed cost.

DOE used the historic trend in the Producer Price Index (PPI) for ''Warm air furnaces'' [36] to estimate the change in price for commercial warm air furnaces between the present and 2018. The PPI for ''Warm air furnaces'' shows a small rate of annual price decline. The price trend in this PPI series shows a small rate of annual price decline.

In the RFI, DOE sought input on its planned approach and the data sources it intended to use to develop installation costs. 78 FR 25627, 25633 (May 2, 2013). Carrier recommended that if RS Means Mechanical Cost Data are to be used to estimate installed cost, it should be based on unit rated cooling capacity for combined air conditioning and commercial furnace equipment.

DOE developed installation costs for commercial warm air furnaces using the most recent RS Means Mechanical Cost Data.[37] In estimating costs, DOE considered the heating and cooling capacity of the combined equipment.

Carrier stated that DOE must factor in additional cost for condensate drainage and treatment if the analysis includes furnaces at condensing efficiencies. (Carrier, No. 2 at p. 5) Goodman expects that application costs would be very significant for the application of condensing technologies, and, therefore, must be thoroughly and completely considered. (Goodman, No. 6 at p. 4)

DOE accounted for additional installation costs for condensate removal, which includes condensate drainage, freeze protection, and treatment for furnaces with condensing designs. On average, the installation cost for condensate removal is $389 for gas-fired CWAF and $180 for oil-fired CWAF. The details about the condensate removal costs are provided in appendix 8–D of DOE's proposed rule TSD. DOE also accounted for meeting the venting requirements for oil-fired commercial warm air furnaces, as well as for the small fraction of gas commercial warm air furnaces installed indoors.

2. Inputs to Operating Costs

The primary inputs for calculating the operating costs are equipment energy consumption, equipment efficiency, energy prices and forecasts, maintenance and repair costs, equipment lifetime, and discount rates.

a. Energy Consumption

The equipment energy consumption is the site energy use associated with providing space-heating to the building. DOE utilized the methodology described in section IV.E to establish equipment energy use.

Lennox cautioned DOE that, as it develops estimates for the operating costs of these systems, DOE should keep in mind that the systems are being applied in a commercial application where the overwhelming majority of the time the system is operating in cooling—not heating—mode. Lennox gave the example that when the outside ambient temperature is 30 °F, the system could be calling for cooling, based on the internal heat gains. (Lennox, No. 3 at p. 7) DOE's analysis accounts for the range of CWAF operating conditions with respect to heating and cooling mode.

b. Energy Prices

In the RFI, DOE sought comment on its approach for developing energy prices. 78 FR 25627, 25633 (May 2, 2013). Carrier stated that DOE's tariff-based approach makes sense, and that the most recent price data available should be used. (Carrier, No. 2 at p. 5)

For the NOPR, DOE determined gas, oil, and electricity prices based on recent or current tariffs from a representative sample of utilities, as well as historical State commercial energy price data from the Energy Information Administration (EIA). This approach calculates energy expenses based on actual energy prices that commercial consumers are paying in different geographical areas of the country. In addition to using tariffs, DOE used data provided in EIA's Form 861 data [38] to calculate commercial electricity prices, EIA's Natural Gas Navigator [39] to calculate commercial natural gas prices, and EIA's State Energy Data System (SEDS) [40] to calculate LPG and fuel oil prices. Future energy prices were projected using trends from the EIA's 2013 *Annual Energy Outlook* (*AEO 2013*).[41]

c. Maintenance and Repair Costs

Maintenance costs are expenses associated with ensuring continued operation of the covered equipment over time. In the RFI, DOE sought input on the approach and data sources it intended to use to develop maintenance costs. 78 FR 25627, 25633 (May 2, 2013). Carrier stated that RS Means might serve as a reasonable guide to assist in developing maintenance costs; however, assuming the issues associated with condensing furnace technology are overcome, it is reasonable to expect increased maintenance costs for these higher-efficiency furnaces. Carrier added that, based on experience with residential 80-percent versus 90-percent AFUE furnaces, it expects the maintenance costs for condensing furnace sections to be at least two to three times the maintenance costs for current non-condensing commercial warm air furnaces. (Carrier, No. 2 at p. 5)

DOE developed maintenance costs for its analysis using the most recent RS Means Facilities Maintenance & Repair Cost Data.[42] DOE included increased maintenance costs for condensing

[36] PCU333415333415C: Warm air furnaces including duct furnaces, humidifiers and electric comfort heating (Available at: *http://www.bls.gov/ppi/*).

[37] RS Means, 2013 Mechanical Cost Data (Available at: *http://rsmeans.reedconstructiondata.com/60023.aspx*) (Last accessed April 10, 2013).

[38] Energy Information Administration (EIA), Survey form EIA–861—Annual Electric Power Industry Report (Available at: *http://www.eia.gov/electricity/data/eia861/index.html*) (Last accessed April 15, 2013).

[39] Energy Information Administration (EIA), Natural Gas Navigator (Available at: *http://tonto.eia.doe.gov/dnav/ng/ng_pri_sum_dcu_nus_m.htm*) (Last accessed April 15, 2013).

[40] Energy Information Administration (EIA), State Energy Data System (SEDS) (Available at: *http://www.eia.gov/state/seds/*) (Last accessed April 15, 2013).

[41] Energy Information Administration (EIA), 2013 *Annual Energy Outlook* (*AEO*) Full Version (Available at: *http://www.eia.gov/forecasts/aeo/*) (Last accessed April 15, 2013).

[42] RS Means, 2013 Facilities Maintenance & Repair Cost Data (Available at: *http://rsmeans.reedconstructiondata.com/60303.aspx*) (Last accessed April 10, 2013).

equipment. For condensing gas-fired commercial warm air furnaces, DOE added labor and material costs to account for checking the condensate withdrawal system, including inspecting, cleaning, and flushing the condensate trap and drain tubes; inspecting the grounding and power connection of heat tape; checking condensate neutralizer; and checking condensate pump for corrosion and proper operation. For gas-fired CWAF, the annualized maintenance cost is $157 for 81- and 82-percent TE units, and $169 for 92 percent TE units. For oil-fired CWAF, the annualized maintenance cost is $289 for 82-percent TE units, and $317 for 92 percent TE units.

For condensing oil-fired commercial warm air furnaces, DOE added additional maintenance for installations in non-low-sulfur regions to account for extra cleaning of the heat exchanger for condensing designs, as well as checking of the condensate withdrawal system. DOE also considered the cases when the equipment is covered by service and/or maintenance agreements.

Repair costs are expenses associated with repairing or replacing components of the covered equipment that have failed. In the RFI, DOE sought comment as to whether repair costs vary as a function of equipment efficiency. 78 FR 25627, 25633 (May 2, 2013). Carrier stated that condensing furnace repair costs will be higher due to a number of factors including: (1) The presence of acidic condensate; (2) potential damage due to condensate expansion during freezing; (3) the presence of a secondary heat exchanger; and (4) the need to add a condensate pump for some applications. (Carrier, No. 2 at p. 6) Goodman stated that as a general rule, due to additional components and additional materials required to achieve higher efficiencies, as well as additional service time for analysis and actual repair time, repair costs will always be higher for higher-efficiency products. (Goodman, No. 6 at p. 4)

DOE developed repair costs for its analysis using the most recent RS Means Facilities Maintenance & Repair Cost Data.[43] It agrees with the comments and, therefore, included additional repair costs for higher efficiency levels (*i.e.,* condensing furnaces). For gas-fired CWAF, the annualized repair cost is $0.57 for 81- and 82-percent TE units, and $1.31 for 92 percent TE units. For gas-fired CWAF, the annualized repair cost is $1.94 for 82-percent TE units, and $2.58 for 92 percent TE units.

See chapter 8 of the NOPR TSD for more details on maintenance and repair costs.

d. Other Inputs

Equipment lifetime is the age at which a unit of covered equipment is retired from service. The average equipment lifetime for commercial warm air furnaces is estimated by ASHRAE to be between 15 and 20 years.[44]

In the RFI, DOE requested any equipment lifetime data and sought comment on its approach of using a Weibull probability distribution to characterize equipment lifetime. 78 FR 25627, 25633 (May 2, 2013). Carrier stated that a 15 to 20 year life expectancy for commercial warm air furnaces is reasonable. (Carrier, No. 2 at p. 6) Lennox stated that the Weibull analysis is the preferred method when evaluating product or component life. (Lennox, No. 3 at p. 7)

For gas-fired commercial warm air furnaces, DOE used the lifetime Weibull probability distribution developed in the NOPR analysis for small, large, and very large air-cooled commercial package air conditioning and heating equipment,[45] which results in a 19-year average lifetime. For oil-fired commercial warm air furnaces, DOE used a lifetime Weibull probability distribution based on a method described in an article in *HVAC&R Research,*[46] which results in a 26-year average lifetime. DOE expects the lifetime of the equipment to not change due to any new energy efficiency standards.

The discount rate is the rate at which future expenditures are discounted to establish their present value. DOE did not receive comments on discount rates. It derived a distribution of discount rates by estimating the cost of capital of companies that purchase commercial warm air furnace equipment.

DOE measures LCC and PBP impacts of potential standard levels relative to a base case that reflects the likely distribution of efficiencies in the market in the absence of amended standards. In the RFI, DOE requested data on current efficiency market shares (of shipments) by equipment class, and also similar historic data. 78 FR 25627, 25633 (May 2, 2013). Carrier stated that these data are not readily available for the industry as a whole. Carrier added that the vast majority of equipment should be in the 80-percent to 82-percent efficiency range based on the standard in place since 1989. (Carrier, No. 2 at p. 6)

Since shipment-weighted efficiency data are not available, DOE developed current market-share efficiency (*i.e.,* the current distribution of equipment shipments by efficiency) for the CWAF equipment classes for 2013 based on the number of models at different efficiency levels from AHRI's Certification Directory for Commercial Furnaces.[47] These data show no market share for condensing CWAF.

In the RFI, DOE also requested information on expected trends in efficiency for commercial warm air furnaces over the next five years. 78 FR 25627, 25633 (May 2, 2013). Carrier added that while there will be continuing pressure on cooling efficiency, it expects that the resultant efficiency trend will be flat for commercial warm air furnaces combined in air conditioning equipment. (Carrier, No. 2 at p. 6) Lennox stated that its weatherized commercial furnaces are at the 80-percent thermal efficiency level and would be expected to remain there for the foreseeable future, as there is little market demand for higher-efficiency furnaces in the commercial sector. (Lennox, No. 3 at p. 7) DOE agrees with the comments with respect to non-condensing CWAF, and it assumed no change from the current distribution of equipment shipments by efficiency. For condensing gas-fired CWAF, however, DOE found that models are just now becoming available, so DOE estimated a market share of one percent by 2018.

A rebound effect occurs when a piece of equipment that is made more efficient is used more intensively, such that the expected energy savings from the efficiency improvement may not fully materialize. In the RFI, DOE sought comments and data on any rebound effect that may be associated with more-efficient commercial warm air furnaces. 78 FR 25627, 25633 (May 2, 2013). Carrier opined that any rebound effect associated with higher-efficiency

[43] RS Means, 2013 Mechanical Cost Data (Available at: *http://rsmeans.reedconstructiondata.com/60023.aspx*) (Last accessed April 10, 2013).

[44] American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE), ASHRAE Handbook of HVAC Systems and Equipment (2008) p. 32.8.

[45] Technical Support Document for Small, Large, and Very Large Commercial Package Air Conditioners and Heat Pumps Notice of Proposed Rulemaking (Available at: *http://www1.eere.energy.gov/buildings/appliance_standards/rulemaking.aspx/ruleid/59*).

[46] Lutz, J., A. Hopkins, V. Letschert, V. Franco, and A. Sturges, Using national survey data to estimate lifetimes of residential appliances. *HVAC&R Research* (2011) 17(5): pp. 28 (Available at: *http://www.tandfonline.com/doi/abs/10.1080/10789669.2011.558166*).

[47] AHRI, 2013 AHRI Certification Directory for Commercial Furnaces (Available at: *http://www.ahridirectory.org/ahridirectory/pages/home.aspx*) (Last accessed Oct. 15, 2013).

commercial equipment would be negligible for commercial buildings. (Carrier, No. 2 at p. 7)

DOE found no evidence for a rebound effect associated with higher-efficiency commercial furnaces. HVAC operation adjustment in commercial buildings is not driven by the occupants but primarily by building managers or owners. In such cases, the comfort conditions are already established in order to satisfy the occupants, and they are unlikely to change due to replacement with higher-efficiency equipment. CWAF installed in residential buildings are mainly in situations similar to commercial buildings, so DOE expects there would be negligible rebound effect.

G. Shipments Analysis

DOE uses projections of product shipments for CWAF to calculate equipment stock over the course of the analysis period, which in turn is used to determine the impacts of amended standards on national energy savings, net present value, and future manufacturer cash flows. DOE develops shipment projections based on historical data and an analysis of key market drivers for each product. Historical shipments data are used to build up an equipment stock and also to calibrate the shipments model.

Historical shipments data for commercial warm air furnace equipment are very limited. DOE used 1994 shipments data from AHRI (previously GAMA) that were presented in a report from PNNL,[48] and the historical shipments of non-heat pump commercial unitary air conditioners (CUAC),[49] which are usually packaged together with CWAF. The ratio of the shipments of non-heat pump CUAC equipment and the shipments of gas-fired commercial warm air furnaces in 1994 was calculated.[50] DOE believes that this ratio should be reasonably stable over time. Therefore, DOE determined the historical shipments of gas-fired CWAF by multiplying this ratio with the historical shipments of non-heat pump CUAC.

Shipments data for oil-fired CWAF is not publically available. DOE used the ratio of oil-fired versus gas-fired residential furnace shipments from AHRI[51] and the historical shipments of gas-fired commercial furnaces to calculate the historical shipment of oil-fired commercial furnaces. DOE estimated that oil-fired CWAF account for about 1 percent of total CWAF shipments.

The CWAF shipments model considers two market segments: (1) new commercial buildings acquiring equipment; (2) existing buildings replacing old equipment.

For new commercial buildings, DOE estimated shipments using forecasts of commercial building and residential housing construction and estimates of the saturation of CWAF equipment in new buildings. DOE determined new commercial building and residential housing construction starts by using recorded data through 2012[52] and projections from *AEO 2013.* DOE developed data on the historic saturation of CWAF equipment in new buildings using CBECS 2003 and RECS 2009. To estimate future saturations in new commercial buildings, DOE used the average saturations in buildings built in 1990–2003 (from CBECS 2003 data) that use each type of CWAF equipment. To estimate future saturations in residential housing, DOE used the average saturations in homes built in 1990–2009 (from RECS 2009 data) that use each type of CWAF equipment.

To estimate shipments to existing buildings replacing old equipment, DOE used a survival function to estimate the fraction of commercial warm air furnaces of a given age still in operation. When a furnace fails, it is removed from the stock or, as explained below, is repaired for extended use. The survival function uses the lifetime values from the LCC analysis and has the form of a cumulative Weibull distribution.

For cases with potential CWAF standards, DOE considered whether the increase in price would cause some commercial consumers to choose to repair rather than replace their commercial furnace equipment. To determine whether a commercial consumer would choose to repair rather than replace their commercial warm air furnace equipment, the shipments model uses a relative price elasticity to account for the combined effects of changes in purchase price and annual operating cost on the purchase versus repair decision. Appendix 9–A of the NOPR TSD describes the method. DOE assumed that the consumers who repair their equipment rather than replace it would extend the life of the product by 6 years. When the extended repaired units fail after the 6-year period, they will be replaced with new ones.

The details of the shipments analysis can be found in chapter 9 of the NOPR TSD.

H. National Impact Analysis

The purpose of the national impact analysis (NIA) is to estimate aggregate impacts of potential energy conservation standards from a national perspective, rather than from the consumer perspective represented by the LCC and PBP analysis. Impacts that DOE reports include the national energy savings (NES) from potential standards and the net present value (NPV) (future amounts discounted to the present) of the total commercial consumer costs and savings that are expected to result from amended or new standards at specific efficiency levels.

To make the analysis more accessible and transparent to all interested parties, DOE used a spreadsheet model to calculate the energy savings and the national commercial consumer costs and savings from each TSL.[53] The NIA calculations are based on the annual energy consumption and total installed cost data from the energy use analysis and the LCC analysis. In the NIA, DOE forecasted the lifetime energy savings, energy cost savings, equipment costs, and NPV of commercial consumer benefits for each equipment class over the lifetime of equipment sold from 2018 through 2047.

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

[48] Pacific Northwest National Laboratory (PNNL), Screening Analysis for EPACT-Covered Commercial HVAC and Water-Heating Equipment, April 2000. (Available at: *http://www.pnl.gov/main/publications/external/technical_reports/PNNL-13232.pdf*) (Last accessed April 10, 2013).

[49] Air-Conditioning and Refrigeration Institute, Commercial Unitary Air Conditioner and Heat Pump Unit Shipments for 1980–2001 (Jan. 2005) (Prepared for Lawrence Berkeley National Laboratory).

[50] The fraction of non-heat pump CUAC equipment that is packaged with commercial furnaces is 80 percent.

[51] Air-Conditioning Heating and Refrigeration Institute, *Furnaces Historical Data (1994–2013).* 2015. (Available at: *http://www.ahrinet.org/site/497/Resources/Statistics/Historical-Data/Furnaces-Historical-Data*). (Last accessed January 7, 2015).

[52] U.S. Department of Commerce—Bureau of the Census, New Privately Owned Housing Units Started: Annual Data 1959–2012 (2013) (Available at: *http://www.census.gov/construction/mhs/mhsindex.html*) (Last accessed March 15, 2013).

U.S. Department of Commerce—Bureau of the Census, Placements of New Manufactured Homes by Region and Size of Home: 1980–2011 (2013) (Available at: *http://www.census.gov/construction/mhs/pdf/placnsa_all.pdf)* (Last accessed March 15, 2013).

[53] DOE's use of spreadsheet models provides interested parties with access to the models within a familiar context. In addition, the TSD and other documentation that DOE provides during the rulemaking help explain the models and how to use them, and interested parties can review DOE's analyses by changing various input quantities within the spreadsheet.

DOE did not incorporate a rebound effect for CWAF.

To develop the national NPV of consumer benefits from potential energy conservation standards, DOE calculates annual energy expenditures and annual equipment expenditures for the base case and the standards cases. DOE calculates annual energy expenditures from annual energy consumption by incorporating forecasted energy prices, using shipment projections and average energy efficiency projections. The per-unit energy savings were derived as described in section IV.E. To calculate future electricity prices, DOE applied the projected trend in national-average commercial electricity price from the *AEO 2013* Reference case (which extends to 2040) to the prices derived in the LCC and PBP analysis. DOE used the trend from 2030 to 2040 to extrapolate beyond 2040. DOE calculates annual equipment expenditures by multiplying the price per unit times the projected shipments.

DOE used the historic trend in the Producer Price Index (PPI) for ''Warm air furnaces'' [54] to estimate the change in price for commercial warm air furnaces over the analysis period. The inflation-adjusted PPI for ''Warm air furnaces'' from 1989 to 2006 shows a small rate of annual price decline. DOE also developed a sensitivity analysis that considered one scenario with a lower rate of price decline than the Reference case and one scenario with a higher rate of price decline than the Reference case.

The aggregate difference each year between energy bill savings and increased equipment expenditures is the net savings or net costs. In calculating the NPV, DOE multiplies the net savings in future years by a discount factor to determine their present value. DOE estimates the NPV using both a 3-percent and a 7-percent real discount rate, in accordance with guidance provided by the Office of Management and Budget (OMB) to Federal agencies on the development of regulatory analysis.[55] The discount rates for the determination of NPV are in contrast to the discount rates used in the LCC analysis, which are designed to reflect a consumer's perspective.

A key component of the NIA is the equipment energy efficiency forecasted over time for the base case and for each of the standards cases. In the RFI, DOE requested information on expected trends in efficiency of commercial warm air furnaces over the long run. 78 FR 25627, 25634 (May 2, 2013). AHRI stated that since January 1, 1994, the efficiency trends for commercial warm air furnaces have stayed near a thermal efficiency of 80 percent. AHRI expects that the efficiency trends for these products will continue to remain flat over the long run. (AHRI, No. 7 at p. 6) DOE agrees with the comment, and it assumed no change in efficiency in the base case for non-condensing CWAF. For condensing gas-fired CWAF, however, it estimated that market interest in efficiency would lead to a modest growth in market share (from one percent in 2018 to five percent in 2047). In addition, for each standards case, DOE assumed no change in efficiency over time, given this long-term efficiency trend.

To estimate the impact that amended energy conservation standards may have in the year compliance becomes required, DOE uses ''roll-up'' or ''shift'' scenarios in its standards rulemakings. Under the ''roll-up'' scenario, DOE assumes equipment efficiencies in the base case that do not meet the new or amended standard level under consideration would ''roll up'' to meet that standard level, and equipment shipments at efficiencies above the standard level under consideration would not be affected. Under the ''shift'' scenario, DOE retains the pattern of the base-case efficiency distribution but re-orients the distribution at and above the new or amended minimum energy conservation standard.

In the RFI, DOE requested comment on whether it should pursue a roll-up or shift approach for potential commercial warm air furnace standards in the NIA. 78 FR 25627, 25634 (May 2, 2013). Lennox stated that given that virtually all commercial warm air furnaces are at or just above the current minimum efficiency requirement, the roll-up approach is the more appropriate choice. (Lennox, No. 3 at p. 8) DOE concurs with the comment, and it used the roll-up approach for the standards cases.

Based on the user samples in the LCC and PBP analysis, DOE estimated that a small fraction of commercial warm air furnaces (1–3 percent) is installed in residential buildings. The national energy savings in the standard cases includes the savings from both commercial and residential furnace users.

DOE has historically presented NES in terms of primary energy savings. In response to the recommendations of a committee on ''Point-of-Use and Full-Fuel-Cycle Measurement Approaches to Energy Efficiency Standards'' appointed by the National Academy of Sciences, DOE announced its intention to use full-fuel-cycle (FFC) measures of energy use and greenhouse gas and other emissions in the national impact analyses and emissions analyses included in future energy conservation standards rulemakings. 76 FR 51281 (August 18, 2011). After evaluating the approaches discussed in the August 18, 2011 notice, DOE published a statement of amended policy in the **Federal Register** in which DOE explained its determination that NEMS is the most appropriate tool for its FFC analysis and its intention to use NEMS for that purpose. 77 FR 49701 (August 17, 2012). The method used to derive the FFC measures is described in appendix 10–B of the NOPR TSD.

I. Consumer Subgroup Analysis

In analyzing the potential impacts of new or amended standards on commercial consumers, DOE evaluates impacts on identifiable groups (*i.e.,* subgroups) of consumers that may be disproportionately affected by a national standard. DOE believes that small businesses could be such a subgroup. Accordingly, for the NOPR, DOE evaluated impacts on a small business subgroup using the LCC and PBP spreadsheet model. To the extent possible, it utilized inputs appropriate for this subgroup. The commercial consumer subgroup analysis is discussed in detail in chapter 11 of the NOPR TSD.

J. Manufacturer Impact Analysis

1. Overview

DOE performed a manufacturer impact analysis (MIA) to estimate the financial impact of amended energy conservation standards on manufacturers of CWAF and to calculate the potential impact of such standards on employment and manufacturing capacity. The MIA has both quantitative and qualitative aspects. The quantitative part of the MIA primarily relies on the Government Regulatory Impact Model (GRIM), an industry cash-flow model with inputs specific to this rulemaking. The key GRIM inputs are data on the industry cost structure, equipment costs, shipments, and assumptions about markups and conversion expenditures. The key output is the industry net present value (INPV). Different sets of assumptions (markup scenarios) will produce different results. The qualitative part of the MIA addresses factors such as equipment characteristics, impacts on particular subgroups of firms, and important industry, market, and equipment trends.

[54] PCU333415333415C: Warm air furnaces including duct furnaces, humidifiers and electric comfort heating (Available at: *http://www.bls.gov/ppi/*).

[55] OMB Circular A–4, section E (Sept. 17, 2003) (Available at: *http://www.whitehouse.gov/omb/circulars_a004_a-4).*

The complete MIA is outlined in chapter 12 of the NOPR TSD.

DOE conducted the MIA for this rulemaking in three phases. In Phase 1 of the MIA, DOE prepared a profile of the CWAF industry that includes a top-down manufacturer cost analysis that DOE used to derive preliminary financial inputs for the GRIM (*e.g.,* sales, general, and administration (SG&A) expenses; research and development (R&D) expenses; and tax rates). DOE used public sources of information, including company Securities and Exchange Commission (SEC) 10–K filings, corporate annual reports, the U.S. Census Bureau's Economic Census,[56] and Hoover's reports.[57]

In Phase 2 of the MIA, DOE prepared an industry cash-flow analysis to quantify the potential impacts of an amended energy conservation standard. In general, new or more-stringent energy conservation standards can affect manufacturer cash flow in three distinct ways: (1) Create a need for increased investment; (2) raise production costs per unit; and (3) alter revenue due to higher per-unit prices and possible changes in sales volumes.

In Phase 3 of the MIA, DOE conducted structured, detailed interviews with a representative cross-section of manufacturers. During these interviews, DOE discussed engineering, manufacturing, procurement, and financial topics to validate assumptions used in the GRIM and to identify key issues or concerns. See section IV.J.2.c for a description of the key issues manufacturers raised during the interviews.

Additionally, in Phase 3, DOE evaluated subgroups of manufacturers that may be disproportionately impacted by new standards or that may not be accurately represented by the average cost assumptions used to develop the industry cash-flow analysis. For example, small manufacturers, niche players, or manufacturers exhibiting a cost structure that largely differs from the industry average could be more negatively affected. DOE identified one subgroup (*i.e.,* small manufacturers) for a separate impact analysis.

DOE applied the small business size standards published by the Small Business Administration (SBA) to determine whether a company is considered a small business. 65 FR 30836, 30848 (May 15, 2000), as amended at 65 FR 53533, 53544 (Sept. 5, 2000) and codified at 13 CFR part 121. To be categorized as a small business under North American Industry Classification System (NAICS) code 333415, ''Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing,'' a CWAF manufacturer and its affiliates may employ a maximum of 750 employees. The 750-employee threshold includes all employees in a business's parent company and any other subsidiaries. Based on this classification, DOE identified two manufacturers that qualify as small businesses under the SBA definition. The CWAF small manufacturer subgroup is discussed in chapter 12 of the NOPR TSD and in sections V.B.2.d and VI.B of this notice.

2. Government Regulatory Impact Model

DOE uses the GRIM to quantify the changes in cash flow due to new standards that result in a higher or lower industry value. The GRIM analysis uses a standard, annual, discounted cash-flow methodology that incorporates manufacturer costs, markups, shipments, and industry financial information as inputs. The GRIM models changes in costs, distribution of shipments, investments, and manufacturer margins that could result from an amended energy conservation standard. The GRIM spreadsheet uses the inputs to arrive at a series of annual cash flows, beginning in 2014 (the base year of the analysis) and continuing to 2047. DOE calculated INPVs by summing the stream of annual discounted cash flows during this period. For CWAF manufacturers, DOE used a real discount rate of 8.9 percent, which was derived from industry financials and then modified according to feedback received during manufacturer interviews.

The GRIM calculates cash flows using standard accounting principles and compares changes in INPV between a base case and each standards case. The difference in INPV between the base case and a standards case represents the financial impact of the amended energy conservation standard on manufacturers. As discussed previously, DOE collected this information on the critical GRIM inputs from a number of sources, including publicly-available data and interviews with a number of manufacturers (described in the next section). The GRIM results are shown in section V.B.2. Additional details about the GRIM, the discount rate, and other financial parameters can be found in chapter 12 of the NOPR TSD.

a. Government Regulatory Impact Model Key Inputs

Manufacturer Production Costs

Manufacturing higher-efficiency equipment is typically more expensive than manufacturing baseline equipment due to the use of more complex components, which are typically more costly than baseline components. The changes in the manufacturer production cost (MPC) of the analyzed equipment can affect the revenues, gross margins, and cash flow of the industry, making these equipment cost data key GRIM inputs for DOE's analysis.

In the MIA, DOE used the MPCs for each considered efficiency level calculated in the engineering analysis, as described in section IV.C and further detailed in chapter 5 of the NOPR TSD. In addition, DOE used information from its teardown analysis, described in chapter 5 of the TSD, to disaggregate the MPCs into material, labor, and overhead costs. To calculate the MPCs for equipment above the baseline, DOE added the incremental material, labor, and overhead costs from the engineering cost-efficiency curves to the baseline MPCs. These cost breakdowns and equipment markups were validated and revised based on manufacturer comments received during MIA interviews.

Shipments Forecasts

The GRIM estimates manufacturer revenues based on total unit shipment forecasts and the distribution of these values by equipment class and efficiency level. Changes in sales volumes and efficiency mix over time can significantly affect manufacturer finances. For this analysis, the GRIM uses the NIA's annual shipment forecasts derived from the shipments analysis from 2014 (the base year) to 2047 (the end year of the analysis period). The NIA shipments forecasts are, in part, based on a roll-up scenario. The forecast assumes that product in the base case that does not meet the standard under consideration would ''roll up'' to meet the new standard beginning in the compliance year of 2018. See section IV.G. above and chapter 9 of the NOPR TSD for additional details.

b. Government Regulatory Impact Model Scenarios

Markup Scenarios

As discussed above, MSPs include direct manufacturing production costs (*i.e.,* labor, materials, and overhead

[56] U.S. Census Bureau, Annual Survey of Manufacturers: General Statistics: Statistics for Industry Groups and Industries (Available at: *http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t*).

[57] Hoovers Inc., Company Profiles, Various Companies (Available at: *http://www.hoovers.com*). Last Accessed December 13, 2013.

estimated in DOE's MPCs) and all non-production costs (*i.e.,* SG&A, R&D, and interest), along with profit. To calculate the MSPs in the GRIM, DOE applied non-production cost markups to the MPCs estimated in the engineering analysis for each equipment class and efficiency level. Modifying these markups in the standards case yields different sets of impacts on manufacturers. For the MIA, DOE modeled two standards-case markup scenarios to represent the uncertainty regarding the potential impacts on prices and profitability for manufacturers following the implementation of amended energy conservation standards: (1) A preservation of gross margin percentage markup scenario; and (2) a preservation of per-unit operating profit markup scenario. These scenarios lead to different markups values that, when applied to the inputted MPCs, result in varying revenue and cash flow impacts.

Under the preservation of gross margin percentage scenario, DOE applied a single uniform ''gross margin percentage'' markup across all efficiency levels, which assumes that manufacturers would be able to maintain the same amount of profit as a percentage of revenues at all efficiency levels within an equipment class. As production costs increase with efficiency, this scenario implies that the absolute dollar markup will increase as well. Based on publicly-available financial information for manufacturers of CWAF as well as comments from manufacturer interviews, DOE assumed the average non-production cost markup—which includes SG&A expenses, R&D expenses, interest, and profit—to be the following for each CWAF equipment class:

TABLE IV.8—MANUFACTURER MARKUP FOR BASELINE EQUIPMENT IN THE BASE CASE

Equipment	Markup
Gas-fired Commercial Warm Air Furnaces ≥225,000 Btu/h	1.31
Oil-fired Commercial Warm Air Furnaces ≥225,000 Btu/h	1.28

Because this markup scenario assumes that manufacturers would be able to maintain their gross margin percentage markups as production costs increase in response to an amended energy conservation standard, it represents a high bound to industry profitability.

In the preservation of operating profit scenario, manufacturer markups are set so that operating profit one year after the compliance date of the amended energy conservation standard is the same as in the base case. Under this scenario, as the costs of production increase under a standards case, manufacturers are generally required to reduce their markups to a level that maintains base-case operating profit. The implicit assumption behind this markup scenario is that the industry can only maintain its operating profit in absolute dollars after compliance with the new or amended standard is required. Therefore, operating margin in percentage terms is reduced between the base case and standards case. DOE adjusted (*i.e.,* lowered) the manufacturer markups in the GRIM at each TSL to yield approximately the same earnings before interest and taxes in the standards case as in the base case. This markup scenario represents a low bound to industry profitability under an amended energy conservation standard.

TABLE IV.9—MARKUPS FOR BASELINE EQUIPMENT AT THE PROPOSED STANDARD LEVELS

Equipment	Markup
Gas-fired Commercial Warm Air Furnaces ≥225,000 Btu/h	1.30
Oil-fired Commercial Warm Air Furnaces ≥225,000 Btu/h	1.28

Conversion Cost Scenarios

An amended energy conservation standard would cause manufacturers to incur one-time conversion costs to bring their production facilities and equipment designs into compliance. DOE evaluated the level of conversion-related expenditures that would be needed to comply with each considered efficiency level in each equipment class. For the MIA, DOE classified these conversion costs into two major groups: (1) Product conversion costs; and (2) capital conversion costs. Product conversion costs are one-time investments in research, development, testing, marketing, and other non-capitalized costs necessary to make product designs comply with the amended energy conservation standard. Capital conversion costs are one-time investments in property, plant, and equipment necessary to adapt or change existing production facilities such that equipment with new, compliant designs can be fabricated and assembled.

DOE based its estimates of the conversion costs for each efficiency level on information obtained from manufacturer interviews and the design pathways analyzed in the engineering analysis. Two methodologies were used to develop conversion cost estimates: (1) A Top-Down approach using feedback from manufacturer interviews to gather data on the level of costs expected at each efficiency level, and (2) a Bottom-Up approach using engineering analysis inputs derived from the equipment teardown analysis and engineering model described in chapter 5 of the TSD to evaluate the investment required to design, manufacturer, and release equipment that meets a higher energy conservation standard.

For estimating capital conversion costs, the Top-Down approach took available feedback from manufacturers and market share weighted the responses to arrive at an approximation representative of the industry as a whole. Responses from manufacturers with the greatest market share were given the greatest weight, while responses from manufacturers with the lowest market share were given the lowest weight. The Bottom-Up approach took capital conversion costs from the engineering analysis on a per-manufacturer basis to develop an industry-wide cost estimate. This analysis included the expected equipment, tooling, conveyor, and plant costs associated with CWAF production, as estimated by DOE based on product tear-down and manufacturers' plant tours. The results of the two methodologies were integrated to create high and low capital conversion cost scenarios.

Product conversion costs for CWAFs are primarily driven by re-development and testing expenses. As the standard increases, increasing levels of re-development effort would be required to meet the efficiency requirements, as more equipment models would require redesign. Additionally, expected product conversion costs would ramp up significantly where DOE expects condensing technology to be necessary to meet a revised energy conservation standard.

To estimate costs for product R&D, the Top-Down approach developed average costs per product platform based on feedback from manufacturers. Manufacturer feedback focused on the human capital investments, such as engineering and lab technician time necessary to update designs. In the Bottom-Up approach, DOE used vendor quotes, industry product information, and engineering cost model data to estimate the expenses associated with thermal efficiency testing, heat limit testing, product safety testing, reliability testing, and engineering effort. The results of the two methodologies were integrated to create high and low product conversion cost scenarios.

In general, DOE assumes that all conversion-related investments occur between the year of publication of the final rule and the year by which manufacturers must comply with the amended standard. The conversion cost figures used in the GRIM can be found in section V.B.2.a of this notice. For additional information on the estimated product and capital conversion costs, see chapter 12 of the NOPR TSD.

DOE requests comment on the product and capital conversion costs required to meet the range of energy conservation standard levels being considered by DOE.

c. Manufacturer Interviews

DOE interviewed manufacturers representing over 80 percent of the domestic CWAF market by revenue in order to discuss the potential impacts of amended energy conservation standards on the industry. The information gathered during these interviews enabled DOE to tailor the GRIM to reflect the unique financial characteristics of the CWAF industry. In interviews, DOE asked manufacturers to describe their major concerns with the rulemaking involving CWAF equipment. This section (IV.J.2.c) highlights manufacturers' interview statements that helped shaped DOE's understanding of the potential impacts of an amended standard on the industry. Manufacturers raised a range of general issues to consider (but did not necessarily provide a specific recommendation), including condensate disposal concerns, increased operating risks for end-users, and a change in the repair rate of older units. Below, DOE summarizes these issues, which were informally raised in manufacturer interviews, in order to obtain public comment and related data.

Condensate Disposal

The primary concern among the interview participants centered on condensate formation at efficiency levels above 81 to 82 percent. Nearly all interviewed CWAF manufacturers raised this issue as a serious problem for both the industry and customers in terms of cost and implementation. The major drawbacks mentioned relate to the management and disposal of acidic condensate created by high-efficiency furnaces. In most commercial rooftop units, condensate would need to be removed in electrically-heated piping or channeled directly into the building to avoid freezing. Manufacturers argued that such infrastructure would be required for condensing furnaces to safely dispose of the acidic runoff in both cold and warm climates. Solutions for condensate management systems would be a separate and additional cost to the consumer beyond the cost of the higher-efficiency furnace. Manufacturers stated that a simple, packaged solution for disposal of acidic condensate is not available and that the design of the condensate management system will be highly dependent on the design of the building, local building codes, waste water disposal requirements, and the expertise of the installer.

DOE agrees with manufacturers that the formation and disposal of corrosive condensate is a concern for CWAF achieving efficiencies greater than 82-percent. DOE considered this factor in its engineering analysis and when developing the installation costs for the LCC analysis. See sections IV.C and IV.F of this NOPR for more information about how DOE addressed these concerns.

Increased Operating Risks for the End User

Many interview participants expressed concerns about risk associated with installation and equipment for reliable management of caustic effluent from condensing CWAF. They believe there are risks in installation, as condensate management systems must often be installed around other rooftop equipment and contractor ability varies widely. They cited problems with power outages, which tend to happen during winter and can impair even well-designed effluent management systems. Manufacturers stated than any leak or failure of the condensate management system could result in costly roofing repairs for the end user. The interview participants were of the opinion that effluent management would be a significant expense for end-users and that the risk and cost of roof damage would outweigh any benefits of high-efficiency condensing units.

DOE acknowledges the potential issues that could be associated with an improperly installed condensing rooftop furnace, which could cause reliability issues for end-users of this equipment. DOE believes that the technical challenges of installing a condensing rooftop furnace can be overcome, and this has been demonstrated by the dedicated outdoor air systems that are currently on the market, which are installed on rooftops and have reliable condensate management systems. Nevertheless, DOE believes significant installer training and education would be required to ensure reliable installation of outdoor furnaces using condensing technology.

Repair and Replacement Rates

During interviews, most manufacturers expressed concerns that an increase in energy conservation standards for CWAF may make customers more likely to repair an old unit rather than replace it. According to manufacturers, the main reason an amended standard may lead to a drop in shipments is the price sensitivity of end users. Manufacturers added that some customers would need to make significant alterations to the layout of rooftop equipment in order to accommodate larger CWAF units and condensate management systems. The higher total installed cost of more-efficient CWAF units and the possible risk of damage to existing roofing could deter customers from purchasing new units. The lower cost of fixing an old unit may become a more attractive option. Furthermore, manufacturers indicated that there could be a reduction in national energy savings from a higher standard due to an increased number of older, less-efficient units that are repaired rather than replaced with newer, more-efficient units. Manufacturers expressed concern over a potential contraction in the overall market size resulting from amended standards, because commercial consumers may decide to turn to other space-conditioning options entirely.

DOE agrees with manufacturers that for certain equipment, such as CWAF, the higher total installed cost of more-efficient equipment may lead end-users to delay purchasing new equipment and to repair rather than to replace this equipment. DOE accounts for this effect at higher efficiency levels in the shipments analysis by examining the cost of higher-efficiency equipment as compared to the operating savings, and this is discussed further in chapter 9 of the TSD (shipments analysis).

K. Emissions Analysis

In the emissions analysis, DOE estimates the reduction in power sector emissions of carbon dioxide (CO_2), nitrogen oxides (NO_X), sulfur dioxide (SO_2), and mercury (Hg) from potential energy conservation standards for CWAF. In addition, DOE estimates emissions impacts in production activities (extracting, processing, and transporting fuels) that provide the energy inputs to power plants. These are referred to as ''upstream'' emissions. Together, these emissions account for the full-fuel-cycle (FFC). In accordance with DOE's FFC Statement of Policy (76 FR 51281 (Aug. 18, 2011)), the FFC analysis includes impacts on emissions of methane (CH_4) and nitrous oxide (N_2O), both of which are recognized as greenhouse gases.

The proposed standards would reduce use of fuel at the site and slightly reduce electricity use, thereby reducing power sector emissions. However, the highest efficiency levels (*i.e.,* the max-tech levels) considered for CWAF would increase the use of electricity by the furnace. For the considered TSLs, DOE estimated the change in power sector and upstream emissions of CO_2, NO_X, SO_2, and mercury (Hg).[58]

DOE primarily conducted the emissions analysis using emissions factors for CO_2 and most of the other gases derived from data in EIA's *Annual Energy Outlook 2013* (*AEO 2013*). Combustion emissions of CH_4 and N_2O were estimated using emissions intensity factors published by the Environmental Protection Agency (EPA) through its GHG Emissions Factors Hub.[59] Site emissions of CO_2 and NO_X were estimated using emissions intensity factors from an EPA publication.[60] DOE developed separate emissions factors for power sector emissions and upstream emissions. The method that DOE used to derive emissions factors is described in chapter 13 of the NOPR TSD.

For CH_4 and N_2O, DOE calculated emissions reduction in tons and also in terms of units of carbon dioxide equivalent (CO_2eq). Gases are converted to CO_2eq by multiplying by the gas' global warming potential (GWP) over a 100-year time horizon. Based on the Fourth Assessment Report of the Intergovernmental Panel on Climate Change,[61] DOE used GWP values of 25 for CH_4 and 298 for N_2O.

EIA prepares the *Annual Energy Outlook* using NEMS. Each annual version of NEMS incorporates the projected impacts of existing air quality regulations on emissions. *AEO 2013* generally represents current legislation and environmental regulations, including recent government actions, for which implementing regulations were available as of December 31, 2012.

Because the on-site operation of CWAF requires use of fossil fuels and results in emissions of CO_2, NO_X, and SO_2 at the sites where these appliances are used, DOE also accounted for the reduction in these site emissions and the associated upstream emissions due to potential standards.

SO_2 emissions from affected electric generating units (EGUs) are subject to nationwide and regional emissions cap-and-trade programs. Title IV of the Clean Air Act sets an annual emissions cap on SO_2 for affected EGUs in the 48 contiguous States and the District of Columbia (DC). SO_2 emissions from 28 eastern States and DC were also limited under the Clean Air Interstate Rule (CAIR; 70 FR 25162 (May 12, 2005)), which created an allowance-based trading program that operates along with the Title IV program. CAIR was remanded to the U.S. Environmental Protection Agency (EPA) by the U.S. Court of Appeals for the District of Columbia Circuit, but it remained in effect.[62] In 2011 EPA issued a replacement for CAIR, the Cross-State Air Pollution Rule (CSAPR). 76 FR 48208 (August 8, 2011). On August 21, 2012, the DC Circuit issued a decision to vacate CSAPR.[63] The court ordered EPA to continue administering CAIR. The emissions factors used for the NOPR, which are based on AEO 2013 assume that CAIR remains a binding regulation through 2040.[64]

The attainment of emissions caps is typically flexible among EGUs and is enforced through the use of emissions allowances and tradable permits. Under existing EPA regulations, any excess SO_2 emissions allowances resulting from the lower electricity demand caused by the adoption of an efficiency standard could be used to permit offsetting increases in SO_2 emissions by any regulated EGU. In past rulemakings, DOE recognized that there was uncertainty about the effects of efficiency standards on SO_2 emissions covered by the existing cap-and-trade system, but it concluded that negligible reductions in power sector SO_2 emissions would occur as a result of standards.

Beginning in 2015, however, SO_2 emissions will decline significantly as a result of the Mercury and Air Toxics Standards (MATS) for power plants. 77 FR 9304 (Feb. 16, 2012). In the final MATS rule, EPA established a standard for hydrogen chloride as a surrogate for acid gas hazardous air pollutants (HAP), and also established a standard for SO_2 (a non-HAP acid gas) as an alternative equivalent surrogate standard for acid gas HAP. The same controls are used to reduce HAP and non-HAP acid gas; thus, SO_2 emissions will be reduced as a result of the control technologies installed on coal-fired power plants to comply with the MATS requirements for acid gas. *AEO 2013* assumes that, in order to continue operating, coal plants must have either flue gas desulfurization or dry sorbent injection systems installed by 2015. Both technologies, which are used to reduce acid gas emissions, also reduce SO_2 emissions. Under the MATS, NEMS shows a reduction in SO_2 emissions when electricity demand decreases (*e.g.,* as a result of energy efficiency standards). Emissions will be far below the cap established by CAIR, so it is likely that excess SO_2 emissions allowances resulting from the lower electricity demand would be needed or used to permit offsetting increases in SO_2 emissions by any regulated EGU. Therefore, DOE believes that energy efficiency standards will reduce SO_2 emissions in 2015 and beyond.

CAIR established a cap on NO_X emissions in 28 eastern States and the District of Columbia. Energy conservation standards are expected to have little effect on NO_X emissions in those States covered by CAIR because excess NO_X emissions allowances resulting from the lower electricity demand could be used to permit offsetting increases in NO_X emissions. However, standards would be expected to reduce NO_X emissions in the States not affected by the caps, so DOE estimated NO_X emissions reductions from the standards considered in the NOPR for these States.

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

[58] Note that in these cases the reduction in site emissions of CO_2, NO_X, and SO_2 is larger than the increase in power sector emissions.

[59] See *http://www.epa.gov/climateleadership/guidance/ghg-emissions.html.*

[60] U.S. Environmental Protection Agency, Compilation of Air Pollutant Emission Factors, AP–42, Fifth Edition, Volume I: Stationary Point and Area Sources (1998) (Available at: *http://www.epa.gov/ttn/chief/ap42/index.html*).

[61] Forster, P., V. Ramaswamy, P. Artaxo, T. Berntsen, R. Betts, D.W. Fahey, J. Haywood, J. Lean, DC Lowe, G. Myhre, J. Nganga, R. Prinn,G. Raga, M. Schulz and R. Van Dorland. 2007: Changes in Atmospheric Constituents and in Radiative Forcing. In *Climate Change 2007: The Physical Science Basis.* Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller, Editors. 2007. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. p. 212.

[62] See *North Carolina* v. *EPA,* 550 F.3d 1176 (D.C. Cir. 2008); *North Carolina* v. *EPA,* 531 F.3d 896 (D.C. Cir. 2008).

[63] See *EME Homer City Generation, LP* v. *EPA,* 696 F.3d 7, 38 (D.C. Cir. 2012).

[64] On April 29, 2014, the U.S. Supreme Court reversed the judgment of the DC Circuit and remanded the case for further proceedings consistent with the Supreme Court's opinion. The Supreme Court held in part that EPA's methodology for quantifying emissions that must be eliminated in certain states due to their impacts in other downwind states was based on a permissible, workable, and equitable interpretation of the Clean Air Act provision that provides statutory authority for CSAPR. See *EPA* v. *EME Homer City Generation,* No 12–1182, slip op. at 32 (U.S. April 29, 2014). Because DOE is using emissions factors based on *AEO 2013* for NOPR, the analysis assumes that CAIR, not CSAPR, is the regulation in force. The difference between CAIR and CSAPR is not relevant for the purpose of DOE's analysis of SO_2 emissions.

would likely reduce Hg emissions. DOE estimated mercury emissions reduction using emissions factors based on *AEO 2013,* which incorporates the MATS.

L. Monetizing Carbon Dioxide and Other Emissions Impacts

As part of the development of this proposed rule, DOE considered the estimated monetary benefits from the reduced emissions of CO_2 and NO_X that are expected to result from each of the TSLs considered. In order to make this calculation similar to the calculation of the NPV of consumer benefit, DOE considered the reduced emissions expected to result over the lifetime of equipment shipped in the forecast period for each TSL. This section summarizes the basis for the monetary values used for each of these emissions and presents the values considered in this rulemaking.

For this NOPR, DOE is relying on a set of values for the social cost of carbon (SCC) that was developed by an interagency process. A summary of the basis for these values is provided below, and a more detailed description of the methodologies used is provided as an appendix to chapter 14 of the NOPR TSD.

1. Social Cost of Carbon

The SCC is an estimate of the monetized damages associated with an incremental increase in carbon emissions in a given year. It is intended to include (but is not limited to) changes in net agricultural productivity, human health, property damages from increased flood risk, and the value of ecosystem services. Estimates of the SCC are provided in dollars per metric ton of carbon dioxide. A domestic SCC value is meant to reflect the value of damages in the United States resulting from a unit change in carbon dioxide emissions, while a global SCC value is meant to reflect the value of damages worldwide.

Under section 1(b)(6) of Executive Order 12866, ''Regulatory Planning and Review,'' 58 FR 51735 (Oct. 4, 1993), agencies must, to the extent permitted by law, assess both the costs and the benefits of the intended regulation and, recognizing that some costs and benefits are difficult to quantify, propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs. The purpose of the SCC estimates presented here is to allow agencies to incorporate the monetized social benefits of reducing CO_2 emissions into cost-benefit analyses of regulatory actions. The estimates are presented with an acknowledgement of the many uncertainties involved and with a clear understanding that they should be updated over time to reflect increasing knowledge of the science and economics of climate impacts.

As part of the interagency process that developed the SCC estimates, technical experts from numerous agencies met on a regular basis to consider public comments, explore the technical literature in relevant fields, and discuss key model inputs and assumptions. The main objective of this process was to develop a range of SCC values using a defensible set of input assumptions grounded in the existing scientific and economic literatures. In this way, key uncertainties and model differences transparently and consistently inform the range of SCC estimates used in the rulemaking process.

a. Monetizing Carbon Dioxide Emissions

When attempting to assess the incremental economic impacts of carbon dioxide emissions, the analyst faces a number of challenges. A recent report from the National Research Council points out that any assessment will suffer from uncertainty, speculation, and lack of information about: (1) Future emissions of greenhouse gases; (2) the effects of past and future emissions on the climate system; (3) the impact of changes in climate on the physical and biological environment; and (4) the translation of these environmental impacts into economic damages. As a result, any effort to quantify and monetize the harms associated with climate change will raise questions of science, economics, and ethics and should be viewed as provisional.

Despite the limits of both quantification and monetization, SCC estimates can be useful in estimating the social benefits of reducing carbon dioxide emissions. The agency can estimate the benefits from reduced emissions in any future year by multiplying the change in emissions in that year by the SCC value appropriate for that year. The net present value of the benefits can then be calculated by multiplying the future benefits by an appropriate discount factor and summing across all affected years.

It is important to emphasize that the interagency process is committed to updating these estimates as the science and economic understanding of climate change and its impacts on society improves over time. In the meantime, the interagency group will continue to explore the issues raised by this analysis and consider public comments as part of the ongoing interagency process.

b. Development of Social Cost of Carbon Values

In 2009, an interagency process was initiated to offer a preliminary assessment of how best to quantify the benefits from reducing carbon dioxide emissions. To ensure consistency in how benefits are evaluated across agencies, the Administration sought to develop a transparent and defensible method, specifically designed for the rulemaking process, to quantify avoided climate change damages from reduced CO_2 emissions. The interagency group did not undertake any original analysis. Instead, it combined SCC estimates from the existing literature to use as interim values until a more comprehensive analysis could be conducted. The outcome of the preliminary assessment by the interagency group was a set of five interim values: global SCC estimates for 2007 (in 2006$) of $55, $33, $19, $10, and $5 per metric ton of CO_2. These interim values represented the first sustained interagency effort within the U.S. government to develop an SCC for use in regulatory analysis. The results of this preliminary effort were presented in several proposed and final rules.

c. Current Approach and Key Assumptions

After the release of the interim values, the interagency group reconvened on a regular basis to generate improved SCC estimates. Specifically, the group considered public comments and further explored the technical literature in relevant fields. The interagency group relied on three integrated assessment models commonly used to estimate the SCC: the FUND, DICE, and PAGE models. These models are frequently cited in the peer-reviewed literature and were used in the last assessment of the Intergovernmental Panel on Climate Change. Each model was given equal weight in the SCC values that were developed.

Each model takes a slightly different approach to model how changes in emissions result in changes in economic damages. A key objective of the interagency process was to enable a consistent exploration of the three models while respecting the different approaches to quantifying damages taken by the key modelers in the field. An extensive review of the literature was conducted to select three sets of input parameters for these models: climate sensitivity, socio-economic and emissions trajectories, and discount rates. A probability distribution for climate sensitivity was specified as an input into all three models. In addition, the interagency group used a range of scenarios for the socio-economic parameters and a range of values for the discount rate. All other model features were left unchanged, relying on the model developers' best estimates and judgments.

In 2010, the interagency group selected four sets of SCC values for use in regulatory analyses.[65] Three sets of values are based on the average SCC from three integrated assessment models, at discount rates of 2.5 percent, 3 percent, and 5 percent. The fourth set, which represents the 95th-percentile SCC estimate across all three models at a 3-percent discount rate, is included to represent higher-than-expected impacts from climate change further out in the tails of the SCC distribution. The values grow in real terms over time. Additionally, the interagency group determined that a range of values from 7 percent to 23 percent should be used to adjust the global SCC to calculate domestic effects, although preference is given to consideration of the global benefits of reducing CO_2 emissions. Table IV.10 presents the values in the 2010 interagency group report,[66] which is reproduced in appendix 14–A of the NOPR TSD.

TABLE IV.10—ANNUAL SCC VALUES FROM 2010 INTERAGENCY REPORT, 2010–2050

[In 2007 dollars per metric ton CO_2]

Year	Discount rate %			
	5	3	2.5	3
	Average	Average	Average	95th Percentile
2010	4.7	21.4	35.1	64.9
2015	5.7	23.8	38.4	72.8
2020	6.8	26.3	41.7	80.7
2025	8.2	29.6	45.9	90.4
2030	9.7	32.8	50.0	100.0
2035	11.2	36.0	54.2	109.7
2040	12.7	39.2	58.4	119.3
2045	14.2	42.1	61.7	127.8
2050	15.7	44.9	65.0	136.2

The SCC values used for this NOPR were generated using the most recent versions of the three integrated assessment models that have been published in the peer-reviewed literature.[67] Table IV.11 shows the updated sets of SCC estimates from the 2013 interagency update in five-year increments from 2010 to 2050. Appendix 14–B of the NOPR TSD provides the full set of values. The central value that emerges is the average SCC across models at 3-percent discount rate. However, for purposes of capturing the uncertainties involved in regulatory impact analysis, the interagency group emphasizes the importance of including all four sets of SCC values.

TABLE IV.11—ANNUAL SCC VALUES FROM 2013 INTERAGENCY UPDATE, 2010–2050

[in 2007 dollars per metric ton CO_2]

Year	Discount rate %			
	5	3	2.5	3
	Average	Average	Average	95th Percentile
2010	11	32	51	89
2015	11	37	57	109
2020	12	43	64	128
2025	14	47	69	143
2030	16	52	75	159
2035	19	56	80	175
2040	21	61	86	191
2045	24	66	92	206
2050	26	71	97	220

It is important to recognize that a number of key uncertainties remain, and that current SCC estimates should be treated as provisional and revisable since they will evolve with improved scientific and economic understanding. The interagency group also recognizes that the existing models are imperfect and incomplete. The National Research Council report mentioned above points out that there is tension between the goal of producing quantified estimates of the economic damages from an incremental ton of carbon and the limits of existing efforts to model these effects. There are a number of analytical challenges that are being addressed by the research community, including

[65] *Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866,* Interagency Working Group on Social Cost of Carbon, United States Government (February 2010) (Available at: *http://www.whitehouse.gov/sites/default/files/omb/inforeg/for-agencies/Social-Cost-of-Carbon-for-RIA.pdf).*

[66] *Id.*

[67] Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866, Interagency Working Group on Social Cost of Carbon, United States Government (May 2013; revised November 2013) (Available at: *http://www.whitehouse.gov/sites/default/files/omb/assets/inforeg/technical-update-social-cost-of-carbon-for-regulator-impact-analysis.pdf).*

research programs housed in many of the Federal agencies participating in the interagency process to estimate the SCC. The interagency group intends to periodically review and reconsider those estimates to reflect increasing knowledge of the science and economics of climate impacts, as well as improvements in modeling.

In summary, in considering the potential global benefits resulting from reduced CO_2 emissions, DOE used the values from the 2013 interagency report, adjusted to 2013$ using the Gross Domestic Product price deflator. For each of the four SCC cases specified, the values used for emissions in 2015 were $12.0, $40.5, $62.4, and $119 per metric ton avoided (values expressed in 2013$). For the years after 2050, DOE applied the average annual growth rate of the SCC estimates in 2040 − 2050 associated with each of the four sets of values.[68]

DOE multiplied the CO_2 emissions reduction estimated for each year by the SCC value for that year in each of the four cases. To calculate a present value of the stream of monetary values, DOE discounted the values in each of the four cases using the specific discount rate that had been used to obtain the SCC values in each case.

2. Valuation of Other Emissions Reductions

As noted above, DOE has taken into account how amended energy conservation standards would reduce site NO_X emissions nationwide and increase power sector NO_X emissions in those 22 States not affected by the CAIR. DOE estimated the monetized value of net NO_X emissions reductions resulting from each of the TSLs considered for this NOPR based on estimates found in the relevant scientific literature. Estimates of monetary value for reducing NO_X from stationary sources range from $476 to $4,893 per ton in 2013$.[69] DOE calculated monetary benefits using a medium value for NO_X emissions of $2,684 per short ton (in 2013$), and NO_X real discount rates of 3 percent and 7 percent.

DOE is evaluating appropriate monetization of avoided SO_2 and Hg emissions in energy conservation standards rulemakings. It has not included monetization in the current analysis.

[68] The post-2050 annual growth rates for the four SCC cases are 2.6%, 1.6%, 1.3%, and 1.5%.

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

M. Utility Impact Analysis

The utility impact analysis estimates several effects on the electricity generation industry that would result from the adoption of amended energy conservation standards. In the utility impact analysis, DOE analyzes the changes in installed electricity capacity and generation that would result for each trial standard level. The utility impact analysis used a variant of NEMS. The analysis consists of a comparison between model results for the most recent *AEO* Reference Case and for cases in which energy use is decremented to reflect the impact of potential standards. The energy savings inputs associated with each TSL come from the NIA. Chapter 15 of the NOPR TSD describes the utility impact analysis in further detail.

N. Employment Impact Analysis

Employment impacts from new or amended energy conservation standards include direct and indirect impacts. Direct employment impacts are any changes in the number of employees of manufacturers of the equipment subject to standards; the MIA addresses those impacts. Indirect employment impacts are changes in national employment that occur due to the shift in expenditures and capital investment caused by the purchase and operation of more-efficient equipment. Indirect employment impacts from standards consist of the jobs created or eliminated in the national economy, other than in the manufacturing sector being regulated, due to: (1) Reduced spending by end users on energy; (2) reduced spending on new energy supply by the utility industry; (3) increased consumer spending on the purchase of new equipment; and (4) the effects of those three factors throughout the economy.

One method for assessing the possible effects on the demand for labor of such shifts in economic activity is to compare sector employment statistics developed by the Labor Department's Bureau of Labor Statistics (BLS). BLS regularly publishes its estimates of the number of jobs per million dollars of economic activity in different sectors of the economy, as well as the jobs created elsewhere in the economy by this same economic activity. Data from BLS indicate that expenditures in the utility sector generally create fewer jobs (both directly and indirectly) than expenditures in other sectors of the economy.[70] There are many reasons for these differences, including wage differences and the fact that the utility sector is more capital-intensive and less labor-intensive than other sectors. Energy conservation standards have the effect of reducing consumer utility bills. Because reduced consumer expenditures for energy likely lead to increased expenditures in other sectors of the economy, the general effect of efficiency standards is to shift economic activity from a less labor-intensive sector (*i.e.,* the utility sector) to more labor-intensive sectors (*e.g.,* the retail and service sectors). Thus, based on the BLS data alone, DOE believes net national employment may increase because of shifts in economic activity resulting from amended standards for CWAF.

[70] *See* Bureau of Economic Analysis, ''Regional Multipliers: A Handbook for the Regional Input-Output Modeling System (RIMS II),'' U.S. Department of Commerce (1992).

For the amended standard levels considered in the NOPR, DOE estimated indirect national employment impacts using an input/output model of the U.S. economy called Impact of Sector Energy Technologies, Version 3.1.1 (ImSET).[71] ImSET is a special-purpose version of the ''U.S. Benchmark National Input-Output'' (I–O) model, which was designed to estimate the national employment and income effects of energy-saving technologies. The ImSET software includes a computer-based I–O model having structural coefficients that characterize economic flows among the 187 sectors. ImSET's national economic I–O structure is based on a 2002 U.S. benchmark table, specially aggregated to the 187 sectors most relevant to industrial, commercial, and residential building energy use. DOE notes that ImSET is not a general equilibrium forecasting model, and understands the uncertainties involved in projecting employment impacts, especially changes in the later years of the analysis. Because ImSET does not incorporate price changes, the employment effects predicted by ImSET may over-estimate actual job impacts over the long run. For the NOPR, DOE used ImSET only to estimate short-term (through 2023) employment impacts.

For more details on the employment impact analysis, see chapter 16 of the NOPR TSD.

V. Analytical Results and Conclusions

The following section addresses the results from DOE's analyses with respect to potential amended energy conservation standards for CWAF in this rulemaking. It addresses the trial

[71] M.J. Scott, O.V. Livingston, P.J. Balducci, J.M. Roop, and R.W. Schultz, *ImSET 3.1: Impact of Sector Energy Technologies,* PNNL–18412, Pacific Northwest National Laboratory (2009) (Available at: *www.pnl.gov/main/publications/external/technical_reports/PNNL-18412.pdf*).

standard levels (TSLs) examined by DOE, the projected impacts of each of these levels if adopted as energy conservation standards for CWAF, and the proposed standard levels that DOE sets forth in the NOPR. Additional details regarding DOE's analyses are contained in the TSD supporting this notice.

A. Trial Standard Levels

At the NOPR stage, DOE develops TSLs for consideration. TSLs are formed by grouping different efficiency levels, which are potential standard levels for each equipment class. DOE analyzed the benefits and burdens of the TSLs developed for this proposed rule. Table V.1 presents the TSLs analyzed and the corresponding efficiency level for each CWAF equipment class. TSL 5 represents the max-tech efficiency levels, which use condensing technology. For non-condensing efficiency levels, DOE considered all gas-fired and oil-fired efficiency level combinations as part of the TSL structure.

TABLE V.1—SUMMARY OF TRIAL STANDARD LEVELS FOR COMMERCIAL WARM AIR FURNACES

Equipment class	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
	Thermal efficiency (TE)				
Gas-fired Furnaces	81%	81%	82%	82%	92%
Oil-fired Furnaces	81%	82%	81%	82%	92%

B. Economic Justification and Energy Savings

As discussed in section II.A, EPCA provides seven factors to be evaluated in determining whether a more-stringent standard for CWAF is economically justified. (42 U.S.C. 6313(a)(6)(B)(ii)) The following sections generally discuss how DOE is addressing each of those factors in this rulemaking.

1. Economic Impacts on Individual Commercial Consumers

DOE analyzed the economic impacts on CWAF consumers by looking at the effects standards would have on the LCC and PBP. DOE also examined the impacts of potential standards on commercial consumer subgroups. These analyses are discussed below.

a. Life-Cycle Cost and Payback Period

To evaluate the net economic impact of potential amended energy conservation standards on commercial consumers of CWAF, DOE conducted LCC and PBP analyses for each TSL. In general, higher-efficiency equipment would affect customers in two ways: (1) Annual operating expense would decrease, and (2) purchase price would increase. Inputs used for calculating the LCC and PBP include total installed costs (*i.e.,* equipment price plus installation costs), operating costs (*i.e.,* annual energy savings, energy prices, energy price trends, repair costs, and maintenance costs), equipment lifetime, and discount rates.

The key outputs of the LCC analysis are a mean LCC savings (or cost) and a median PBP relative to the base case for each equipment class, as well as the percentage of consumers for which the LCC under an amended standard would decrease (net benefit), increase (net cost), or exhibit no change (no impact) relative to the base-case equipment forecast. No impacts occur when the base-case efficiency equals or exceeds the efficiency at a given TSL.

DOE also performed a PBP analysis as part of the consumer impact analysis. The PBP is the number of years it would take for the consumer of this commercial equipment 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 8 of the NOPR TSD provides detailed information on the LCC and PBP analyses.

Table V.2 and Table V.3 show the key LCC and PBP results for each equipment class.

TABLE V.2—SUMMARY LIFE-CYCLE COST AND PAYBACK PERIOD RESULTS FOR GAS-FIRED COMMERCIAL WARM AIR FURNACES

Trial standard level	Thermal efficiency	Life-cycle cost *2013$*			Life-cycle cost savings				Median payback period *years*
		Total installed cost	Discounted operating cost	LCC	Average savings *2013$**	% of Customers that experience			
						Net cost	No impact	Net benefit	
Baseline	80%	$2,262	$26,623	$28,885	NA	0%	100%	0%	NA
1, 2	81%	2,271	26,343	28,613	$186	1%	33%	66%	0.6
3, 4	82%	2,280	26,069	28,349	$426	2%	10%	88%	0.7
5	92%	3,848	23,898	27,746	$1,025	48%	1%	51%	12.2

* Rounding may cause some items to not total 100 percent.

TABLE V.3—SUMMARY LIFE-CYCLE COST AND PAYBACK PERIOD RESULTS FOR OIL-FIRED COMMERCIAL WARM AIR FURNACES

Trial standard level	Thermal efficiency	Life-cycle cost *2013$*			Life-cycle cost savings				Median payback period *years*
		Total installed cost	Discounted operating cost	LCC	Average savings *2013$**	% of Customers that experience: Net cost	No impact	Net benefit	
Baseline, 1, 3	81%	$6,504	$67,313	$73,817	NA	0%	100%	0%	NA
2, 4	82%	6,556	73,310	73,310	$164	8%	69%	23%	2.8
5	92%	8,008	62,187	70,195	$3,278	47%	0%	53%	7.5

* Rounding may cause some items to not total 100 percent.

b. Consumer Subgroup Analysis

In the consumer subgroup analysis, DOE estimated the impacts of the considered TSLs on small business consumers. The LCC savings and payback periods for small business consumers are shown in Table V.4. Chapter 11 of the NOPR TSD presents detailed results of the commercial consumer subgroup analysis.

TABLE V.4—SUMMARY CONSUMER SUBGROUP (SMALL BUSINESS CONSUMERS) RESULTS FOR COMMERCIAL WARM AIR FURNACES

Trial standard level	Gas-fired		Oil-fired	
	Average LCC savings*	Median PBP	Average LCC savings*	Median PBP
1	$158	0.6	NA	NA
2	158	0.6	$132	2.3
3	365	0.7	NA	NA
4	365	0.7	$132	2.3
5	708	12.6	$2,454	8.8

* LCC savings are net savings (*i.e.,* savings over the life time net of any costs incurred).

c. Rebuttable Presumption Payback

As discussed in section III.C.2, EPCA establishes a rebuttable presumption that an energy conservation standard is economically justified if the increased purchase cost for equipment that meets the standard is less than three times the value of the first-year energy savings resulting from the standard. DOE calculated a rebuttable-presumption PBP for each TSL to determine whether DOE could presume that a standard at that level is economically justified.

DOE based the calculations on average usage profiles. As a result, DOE calculated a single rebuttable-presumption payback value, and not a distribution of PBPs, for each TSL. Table V.5 shows the rebuttable-presumption PBPs for the considered TSLs. The rebuttable presumption is fulfilled in those cases where the PBP is three years or less. However, DOE routinely conducts an economic analysis that considers the full range of impacts to the customer, manufacturer, Nation, and environment, as required by EPCA. The results of that 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 three-year PBP analysis). Section V.C addresses how DOE considered the range of impacts to select these proposed standards.

TABLE V.5—REBUTTABLE-PRESUMPTION PAYBACK PERIODS (YEARS) FOR COMMERCIAL WARM AIR FURNACES*

Equipment class	Trial standard level				
	1	2	3	4	5
Gas-fired	0.02	0.02	0.02	0.02	0.44
Oil-fired	....	0.14	....	0.14	0.63

* The rebuttable PBP is based on DOE's test procedure and uses single-point values, while the LCC analysis presented in Table V.2 and Table V.3 reflects energy use under actual field conditions and uses a distribution of values.

2. Economic Impacts on Manufacturers

As noted above, DOE performed an MIA to estimate the impact of amended energy conservation standards on manufacturers of CWAF. The following section describes the expected impacts on manufacturers at each considered TSL. Chapter 12 of the NOPR TSD explains the analysis in further detail.

a. Industry Cash-Flow Analysis Results

Table V.6. and Table V.7 depict the estimated financial impacts (represented by changes in INPV) of amended energy standards on manufacturers of CWAF, as well as the conversion costs that DOE expects manufacturers would incur for all equipment classes at each TSL. To evaluate the range of cash flow impacts on the CWAF industry associated with potential amended energy conservation standards, DOE modeled two different mark-up scenarios and two different conversion cost scenarios, as described in section IV.J.b (Government Regulatory Impact Model Scenarios). The combination of markup scenarios and conversion costs scenarios results in 4 sets of results: (1) Preservation of Gross Margin Percentage and Low Conversion Costs scenario, (2) Preservation of Gross Margin Percentage and High Conversion Costs scenario, (3) Preservation of Operating Profit and Low Conversion Costs scenario, (4) Preservation of Operating Profit and High Conversion Costs scenario. Each of the modeled scenarios results in a unique set of cash flows and corresponding industry values at each TSL. DOE presents the highest and lowest INPV results from the combined scenarios to portray the range of potential impacts on the industry. The low end of the range of impacts is the Preservation of Gross Margin Percentage and Low Conversion Costs scenario. The high end of the range of impacts is the Preservation of Operating Profit and High Conversion Costs scenario.

In the following discussion, the INPV results refer to the difference in industry value between the base case and each standards case that results from the sum of discounted cash flows from the base year 2014 through 2047, the end of the analysis period. To provide perspective on the short-run cash flow impact, DOE includes in the discussion of the results below a comparison of free cash flow between the base case and the standards case at each TSL in the year before new standards would take effect. This figure provides an understanding of the magnitude of the required conversion costs relative to the cash flow generated by the industry in the base case.

The set of results below shows potential INPV impacts for CWAF manufacturers; Table V.6. reflects the lower bound of impacts, and Table V.7 represents the upper bound.

TABLE V.6—MANUFACTURER IMPACT ANALYSIS FOR CWAF—PRESERVATION OF GROSS MARGIN PERCENTAGE/LOW CONVERSION COST SCENARIO SCENARIO*

	Units	Base case	Trial standard level				
			1	2	3	4	5
INPV	2013$ M	74.67	67.9	67.5	64.0	63.5	89.4
Change in INPV	2013$ M		(6.7)	(7.2)	(10.7)	(11.1)	14.8
	%		−9%	−10%	−14%	−15%	−20%
Product Conversion Costs	2013$ M		11.1	11.5	18.0	18.4	28.2
Capital Conversion Costs	2013$ M		0.6	0.9	1.2	1.5	61.3
Total Conversion Costs	2013$ M		11.7	12.4	19.2	19.9	89.4
Free Cash Flow	2013$ M	6.3	2.4	2.2	(0.1)	(0.3)	(31.3)
Change in Free Cash Flow	2013$ M		3.9	4.1	6.4	6.7	37.6
	% Change		61.4	65.6	101.4	105.5	596.0

* Parentheses indicate negative values.

TABLE V.7—MANUFACTURER IMPACT ANALYSIS FOR CWAF—PRESERVATION OF OPERATING PROFIT SCENARIO/HIGH CONVERSION COSTS SCENARIO: CHANGES SCENARIO*

	Units	Base case	Trial standard level				
			1	2	3	4	5
INPV	2013$ M	74.67	64.2	60.1	36.7	31.4	(23.7)
Change in INPV	2013$ M		(10.5)	(14.5)	(38.0)	(43.3)	(98.3)
	%		14%	19%	51%	58%	132%
Product Conversion Costs	2013$ M		11.3	17.2	48.8	54.7	81.0
Capital Conversion Costs	2013$ M		4.4	5.0	4.5	5.0	71.5
Total Conversion Costs	2013$ M		15.7	22.2	53.2	59.7	152.5
Free Cash Flow	2013$ M	6.3	0.7	(1.5)	(14.8)	(17.7)	(59.2)
Change in							
Free Cash Flow	2013$ M		5.7	7.8	21.1	24.0	65.5
	% Change		89.6	124.3	334.7	380.4	1038.6

* Parentheses indicate negative values.

As noted in section IV.J.a (Government Regulatory Impact Model Key Inputs), the MIA uses the Engineering Analysis's manufacturer production costs and the Shipments Analysis's sales forecasts as inputs. Two key trends in these inputs help drive the MIA results. First, the increase in efficiency at TSLs below max-tech can be accomplished with very little incremental production cost. This is highlighted in Table IV.6. At levels below TSL 5, gas-fired equipment MPCs increase by 4% at most and oil-fired MPC increase by 1% at most. Furthermore, at levels below TSL 5, total industry shipments over the analysis period remain the same across TSLs. Since DOE's analysis indicates there are no significant changes to variable production costs and no significant changes in total shipments below max-tech, manufacturer markups are also unlikely to vary significantly at those TSLs and have limited impact on the change in industry value between the base case and standards cases.

However, anticipated conversion costs provided by manufacturers in interviews were quite high relative to industry value. As a result, conversion costs would have a significant impact on industry value. In particular, product conversion costs and time requirements were a concern for the industry. Manufacturer input during interviews indicated higher product conversion costs than initially expected by DOE. As a result, the Department modeled a sensitivity related to conversion costs. DOE applied two different methodologies to estimate conversion costs. A Top-Down methodology relied on manufacturer feedback, AHRI listing data, and market share estimates. A Bottom-Up methodology was also used to estimate industry conversion costs, under which DOE relied on test lab pricing quotes, industry product literature, and the engineering cost model data to estimate the expenses associated with thermal efficiency testing, heat limit testing, product safety testing, reliability testing, and engineering effort. DOE assumed these items comprised the bulk of product conversion costs.

In its analysis, DOE ran 4 scenarios based on combinations from 2 markup scenarios and 2 conversion cost scenarios. The results presented below represent the upper-bound and lower-bound of results from those scenarios.

TSL 1 represents EL 1 (81 percent) for gas-fired CWAF and baseline (81 percent) for oil-fired CWAF. At this level, DOE estimates 54% of the industry platforms would require redesign at a total industry conversion cost of $11.7 million to $15.7 million. DOE estimates impacts on INPV for CWAF manufacturers to range from a change in INPV of −14.0 percent to −9.0 percent, or $10.5 million to −$6.7 million. At this potential standard level, industry free cash flow is estimated to decrease by as much as 89.6 percent to −$0.7 million, compared to the base-case value of $6.3 million in 2017, the year before the compliance date (2018).

TSL 2 represents EL 1 (81 percent for gas-fired and 82 percent for oil-fired) across all equipment classes. At this level, DOE estimates 60% of the industry platforms would require redesign at a total industry conversion cost of $12.4 million to $22.2 million. DOE estimates impacts on INPV for CWAF manufacturers to range from a change in INPV of −19.5 percent to −9.6 percent, or a change of −$14.5 million to −$7.2 million. At this potential standard level, industry free cash flow is estimated to decrease by as much as 124.3 percent to −$1.5 million, compared to the base-case value of $6.3 million in the year before the compliance date (2018).

TSL 3 represents EL 2 (82 percent) for gas-fired CWAF and baseline (81 percent) for oil-fired CWAF. At this level, DOE estimates 77% of the industry platforms would require redesign at a total industry conversion cost of $19.2 million to $53.2 million DOE estimates impacts on INPV for CWAF manufacturers to range from a change in INPV of −50.8 percent to −14.3 percent, or −$38.0 million to −$10.7 million. At this potential standard level, industry free cash flow is estimated to decrease by as much as 334.7 percent to −$14.8 million, compared to the base-case value of $6.3 million in the year before the compliance date (2018).

TSL 4 represents EL 2 (82 percent) for gas-fired CWAF and EL 1 (82 percent) for oil-fired CWAF. At this level, DOE estimates 83% of the industry platforms would require redesign at a total industry conversion cost of $19.9 million to $59.7 million. DOE estimates impacts on INPV for CWAF manufacturers to range from a change in INPV of −58.0 percent to −14.9 percent, or −$43.3 million to −$11.1 million. At this potential standard level, industry free cash flow is estimated to decrease by as much as 380.4 percent to −$17.7 million, compared to the base-case value of $6.3 million in the year before the compliance date (2018)

TSL 5 represents max-tech across all equipment classes (*i.e.,* EL 3 (92 percent) for gas-fired CWAF and EL 2 (92 percent) for oil-fired CWAF). At this level, DOE estimates 92% of the industry platforms would require redesign at a total industry conversion cost of $89.4 million to $152.5 million. Conversion costs more than double from TSL 4 to TSL 5. The vast majority of the industry does not offer condensing commercial furnaces today and would need to develop condensing technology for commercial applications. Implementing a condensing commercial furnace would likely have design implication for the cooling side of the HVAC product and for the chassis that houses both the cooling and heating components. DOE estimates impacts on INPV for CWAF manufacturers to range from a change in INPV of −131.7 percent to 19.8 percent, or −$98.3 million to $14.8 million. The loss of more than 100% of INPV reflects the fact that conversion expenses extend beyond the commercial furnace and affect commercial air conditioners and heat pumps, which tend to be the more expensive and complex component of commercial HVAC products. At this potential standard level, industry free cash flow is estimated to decrease by as much as 1,038.6 percent to −$59.2 million relative to the base-case value of $6.3 million in the year before the compliance date (2018).

b. Impacts on Direct Employment

To quantitatively assess the potential impacts of amended energy conservation standards on direct employment in the CWAF industry, DOE used the GRIM to estimate the domestic labor expenditures and number of employees in the base case and at each TSL from 2014 through 2047. DOE used statistical data from the U.S. Census Bureau's 2011 Annual Survey of Manufacturers (ASM),[72] the results of the engineering analysis, and interviews with manufacturers to determine the inputs necessary to calculate industry-wide labor expenditures and domestic employment levels. Labor expenditures related to manufacturing of the product are a function of the labor intensity of the product, the sales volume, and an assumption that wages remain fixed in real terms over time. The total labor expenditures in each year are calculated by multiplying the MPCs by the labor percentage of MPCs. DOE estimates that 99 percent of CWAF units are produced domestically.

The total labor expenditures in the GRIM were then converted to domestic production employment levels by dividing production labor expenditures by the annual payment per production worker (production worker hours times the labor rate found in the U.S. Census Bureau's 2011 ASM). The estimates of production workers in this section cover workers, including line-supervisors who are directly involved in fabricating and assembling a product within the manufacturing facility. Workers performing services that are closely associated with production operations, such as materials handling tasks using forklifts, are also included as production labor. DOE's estimates only account for production workers who manufacture the specific products covered by this rulemaking. The total direct employment impacts calculated in the GRIM are the changes in the number of production workers resulting from the amended energy conservation standards for CWAF, as compared to the base case. In general, more-efficient equipment is larger, more complex, and more labor-intensive to build. Per unit labor requirements and production time requirements increase with a higher energy conservation standard. As a result, the total labor calculations described in this paragraph are considered an upper bound to direct employment forecasts.

Using the GRIM, DOE estimates that in the absence of amended energy conservation standards, there would be 235 domestic production workers for CWAF equipment. DOE estimates that 99 percent of CWAF units sold in the United States are manufactured domestically. The employment impact estimates in Table V.8 below show a

[72] "Annual Survey of Manufactures (ASM)," U.S. Census Bureau (2011) (Available at: *http://www.census.gov/manufacturing/asm/*).

range of potential production employment levels that could exist following the compliance date of amended energy conservation standards. These direct employment impacts shown are independent of the employment impacts to the broader U.S. economy, which are documented in the section IV.N (Employment Impact Analysis) and chapter 13 of the NOPR TSD.

TABLE V.8—RANGE OF POTENTIAL CHANGES IN CWAF PRODUCTION WORKERS IN 2018

	Trial standard level				
	1	2	3	4	5
Total Number of Domestic Production Workers in 2018 (no production location change)	235 to 190	235 to 189	235 to 142	235 to 141	521 to 136
Change from Base Case Estimate of 235 Domestic Production Workers in 2018	0 to (45)	0 to (46)	0 to (93)	0 to (94)	286 to (99)

The upper bound of the range assumes that manufacturers would continue to produce the same scope of covered equipment within the United States, and assumes that domestic production would not shift to countries with lower labor costs. At TSL 1 through 4, the upper bound shows no change in employment from the baseline due to a constant level of production labor expenditure. The major costs and changes for increasing product efficiency at lower levels would be for capital, not labor. On the other hand, the max-tech level at TSL 5 would require significant increases in both capital and labor expenditure due to increased complexity and size of condensing furnaces.

The lower bound assumes that as the standard increases, manufacturers choose to retire sub-standard product lines rather than invest in manufacturing facility conversions and product redesigns. DOE assumes manufacturers take the lowest investment option and do not relocate any production facilities to lower-cost countries. In this scenario, there is a loss of employment because manufacturers consolidate and operate fewer production lines. Since this is intended to be a worst-case scenario for employment, there is no consideration given to the fact that there may be employment growth in higher-efficiency lines.

c. Impacts on Manufacturing Capacity

According to the certain CWAF manufacturers interviewed, amended energy conservation standards could lead to decreased production capacity. Most manufacturers indicated there would be little to no production capacity decrease at 81-percent and 82-percent efficiency levels, but at 91-percent and 92-percent levels, there would be significant capacity shortfall. This feedback is consistent with the engineering analysis, which found there would be sufficient capacity at current levels to meet slightly higher efficiency standards, but that significant investment would be required to support production of higher-efficiency, condensing furnace standards.

d. Impacts on Subgroups of Manufacturers

Small manufacturers, niche equipment manufacturers, and manufacturers exhibiting a cost structure substantially different from the industry average could be affected disproportionately. For CWAF, DOE identified and evaluated the impact of amended energy conservation standards on one subgroup: small manufacturers. The Small Business Administration (SBA) defines a ''small business'' as having 750 employees or less for NAICS 333415, ''Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing.'' Based on this definition, DOE identified 2 manufacturers in the CWAF industry that are small businesses.

As discussed in section IV.J, using average cost assumptions to develop an industry cash-flow estimate is inadequate to assess differential impacts among manufacturer subgroups. Therefore, for a more detailed discussion of DOE's assessment of the impacts on the small manufacturer subgroup, see the regulatory flexibility analysis in section VI.B of this notice and chapter 12 of the NOPR TSD. DOE requests stakeholder input on the number of small business CWAF manufacturers and the potential for disproportionate impacts to those small manufacturers.

e. Cumulative Regulatory Burden

While any one regulation may not impose a significant burden on manufacturers, the combined effects of recent or impending regulations may have serious consequences for some manufacturers, groups of manufacturers, or an entire industry. Assessing the impact of a single regulation may overlook this cumulative regulatory burden. In addition to energy conservation standards, other regulations can significantly affect manufacturers' financial operations. Multiple regulations affecting the same manufacturer can strain profits and lead companies to abandon product lines or markets with lower expected future returns than competing products. For these reasons, DOE conducts an analysis of cumulative regulatory burden as part of its rulemakings pertaining to appliance efficiency.

For the cumulative regulatory burden analysis, DOE looks at other regulations that could affect CWAF manufacturers that will take effect approximately three years before or after the 2018 compliance date of amended energy conservation standards for these products. In interviews, manufacturers cited Federal regulations on equipment other than CWAF that contribute to their cumulative regulatory burden. The compliance years and expected industry conversion costs of relevant amended energy conservation standards are indicated in Table V.9 below.

TABLE V.9—COMPLIANCE DATES AND EXPECTED CONVERSION EXPENSES OF FEDERAL ENERGY CONSERVATION STANDARDS AFFECTING CWAF MANUFACTURERS

Federal energy conservation standards	Approximate compliance date	Estimated total industry conversion expense
2007 Residential Furnaces & Boilers *—72 FR 65136 (Nov. 19, 2007)	2015	$88M (2006$)
2011 Residential Furnaces **—76 FR 37408 (June 27, 2011); 76 FR 67037 (Oct. 31, 2011)	2015	$2.5M (2009$)
2011 Residential Central Air Conditioners and Heat Pumps **—76 FR 37408 (June 27, 2011); 76 FR 67037 (Oct. 31, 2011)	2015	$26.0M (2009$)
2010 Gas Fired and Electric Storage Water Heaters—75 FR 20112 (April 16, 2010)	2015	$95.4M (2009$)
2014 Walk-in Coolers and Freezers—79 FR 32049 (June 3, 2014)	2017	$35.2M (2012$)
Commercial Packaged Air-Conditioning and Heating Equipment †—79 FR 58948 (September 30, 2014)	2018	$226.4M (2013$)
Commercial and Industrial Fans and Blowers †—2014 Furnace Fans—79 FR 37937 (July 3, 2014)	2018 2019	TBD $40.6M (2013$)
Packaged Terminal Air Conditioners and Heat Pumps †—79 FR 55538 (September 16, 2014).	2019	$7.6M (2013$)
Single Package Vertical Units †—79 FR 78614 (December 30, 2014)	2019	$16.1M (2013$)
Residential Boilers †	2019	TBD
Commercial Boilers †	2019	TBD

* Conversion expenses for manufacturers of oil-fired furnaces and for manufacturers of gas-fired and oil-fired boilers associated with the November 2007 final rule for residential furnaces and boilers are excluded from this figure. With regard to oil-fired furnaces, the 2011 direct final rule for residential furnaces sets a higher standard and earlier compliance date for oil-fired furnaces than the 2007 final rule. As a result, manufacturers will be required to design to the 2011 direct final rule standard. The conversion costs associated with the 2011 direct final rule are listed separately in this table. With regard to gas-fired and oil-fired boilers, EISA 2007 legislated higher standards and earlier compliance dates for residential boilers than were in the November 2007 final rule. As a result, gas-fired and oil-fired boiler manufacturers were required to design to the EISA 2007 standard beginning in 2012.

** Estimated industry conversion expense and approximate compliance date reflect a court-ordered May 1, 2013 stay of the residential non-weatherized and mobile home gas furnaces standards set in the 2011 Energy Conservation Standards for Residential Furnaces and Residential Central Air Conditioners and Heat Pumps.

† The final rule for this energy conservation standard has not been published. For energy conservation standards which have published a NOPR, DOE lists the compliance date and conversion costs for the proposed standard level. However, standard level and analytic results are not finalized until the publication of the final rule. For energy conservation standards which have not yet reached the NOPR publication phase of the rulemaking, information is not yet available.

In addition to Federal energy conservation standards, DOE identified other Federal regulatory burdens that would affect manufacturers of CWAF:

EPA Phase-out of Hydrochlorofluorocarbons (HCFCs)

The U.S. is obligated under the Montreal Protocol to limit production and consumption of HCFCs through incremental reductions, culminating in a complete phase-out of HCFCs by 2030.[73] On December 15, 2009, the U.S. Environmental Protection Agency (EPA) published a final rule commonly referred to as the ''2010 HCFC Allocation Rule,'' which allocates production and consumption allowances for HCFC–22 for each year between 2010 and 2014. 74 FR 66412. On January 4, 2012, EPA published the ''2012 HCFC Allocation Proposed Rule,'' which proposes to lift the regulatory ban on the production and consumption of HCFC–22 (following a court decision[74] in August 2010 to vacate a portion of the ''2010 HCFC Allocation Rule'') by establishing company-by-company HCFC–22 baselines and allocating allowances for 2012–2014. 77 FR 237.

HCFC–22, which is also known as R–22, is a popular refrigerant that is commonly used in air-conditioning products. Many manufacturers of CWAF also manufacture air-conditioning products, and would be impacted by the HCFC phase-out. Manufacturers of CWAF that make air-conditioning equipment must comply with the allowances established by the allocation rule, thereby facing a cumulative regulatory burden.

DOE requests comment on the cumulative regulatory burden that may be imposed on industry by regulations that go into effect in the 3 years before and the 3 years after the proposed CWAF standards year of 2018.

3. National Impact Analysis

a. Significance of Energy Savings

For each TSL, DOE projected energy savings for CWAF purchased in the 30-year period that begins in the year of anticipated compliance with amended standards (2018–2047). The savings are measured over the entire lifetime of equipment purchased in the 30-year period. DOE quantified the energy savings attributable to each TSL as the difference in energy consumption between each standards case and the base case. Table V.10 presents the estimated primary energy savings for each considered TSL, and Table V.11 presents the estimated FFC energy savings for each TSL. The approach for estimating national energy savings is further described in section IV.H.

[73] ''Montreal Protocol,'' *United Nations Environment Programme,* Web. 26 (August 2010) (Available at: *http://ozone.unep.org/new_site/en/montreal_protocol.php*) (Last accessed 12/13/13).

[74] *See Arkema* v. *EPA,* 618 F.3d 1 (D.C. Cir. 2010).

TABLE V.10—CUMULATIVE NATIONAL PRIMARY ENERGY SAVINGS FOR COMMERCIAL WARM AIR FURNACE TRIAL STANDARD LEVELS FOR UNITS SOLD IN 2018–2047 *

Equipment class	Trial standard level				
	1	2	3	4	5
	quads				
Gas-fired Furnaces	0.203	0.203	0.471	0.471	3.040
Oil-fired Furnaces	0.000	0.001	0.000	0.001	0.031
Total All Classes	0.203	0.204	0.471	0.472	3.071

* **Note:** Components may not sum due to rounding.

TABLE V.11—CUMULATIVE NATIONAL FULL-FUEL-CYCLE ENERGY SAVINGS FOR COMMERCIAL WARM AIR FURNACE TRIAL STANDARD LEVELS FOR UNITS SOLD IN 2018–2047 *

Equipment class	Trial standard level				
	1	2	3	4	5
	quads				
Gas-fired Furnaces	0.222	0.222	0.516	0.516	3.338
Oil-fired Furnaces	0.000	0.001	0.000	0.001	0.036
Total All Classes	0.222	0.223	0.516	0.517	3.374

* **Note:** Components may not sum due to rounding.

Circular A–4 [75] requires agencies to present analytical results, including separate schedules of the monetized benefits and costs that show the type and timing of benefits and costs. Circular A–4 also directs agencies to consider the variability of key elements underlying the estimates of benefits and costs. For this rulemaking, DOE undertook a sensitivity analysis using nine, rather than 30, years of equipment shipments. The choice of a nine-year period is a proxy for the timeline in EPCA for the review of certain energy conservation standards and potential revision of and compliance with such revised standards.[76] The review timeframe established in EPCA is generally not synchronized with the equipment lifetime, equipment manufacturing cycles, or other factors specific to CWAF. Thus, this information is presented for informational purposes only and is not indicative of any change in DOE's analytical methodology. The NES results based on a nine-year analytical period are presented in Table V.12. The impacts are counted over the lifetime of CWAF purchased in 2018–2026.

TABLE V.12—CUMULATIVE NATIONAL PRIMARY ENERGY SAVINGS FOR COMMERCIAL WARM AIR FURNACE TRIAL STANDARD LEVELS FOR UNITS SOLD IN 2018–2026

Equipment class	Trial standard level				
	1	2	3	4	5
	quads				
Gas-fired Furnaces	0.059	0.059	0.136	0.136	0.937
Oil-fired Furnaces	0.000	0.000	0.000	0.000	0.013
Total All Classes	0.059	0.059	0.136	0.137	0.950

b. Net Present Value of Commercial Consumer Costs and Benefits

DOE estimated the cumulative NPV of the total costs and savings for commercial consumers that would result from the TSLs considered for CWAF. In accordance with OMB's guidelines on regulatory analysis,[77] DOE calculated the 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 on real estate and small business capital as well as corporate capital. This discount rate approximates the opportunity cost of capital in the private sector (OMB analysis has found the average rate of return on capital to be near this rate).

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

[76] EPCA requires DOE to review its energy conservation standards at least once every 6 years, and requires, for certain products, a 3-year period after any new standard is promulgated before compliance is required, except that in no case may any new standards be required within 6 years of the compliance date of the previous standards. (42 U.S.C. 6313(a)(6)(C)(iv)) While adding a 6-year review to the 3-year compliance period adds up to 9 years, DOE notes that it may undertake reviews at any time within the 6 year period and that the 3-year compliance date may yield to the 6-year backstop. A 9-year analysis period may not be appropriate given the variability that occurs in the timing of standards reviews and the fact that for some consumer products, the compliance period is 5 years rather than 3 years.

[77] OMB Circular A–4, section E (Sept. 17, 2003) (Available at: *http://www.whitehouse.gov/omb/circulars_a004_a-4).*

The 3-percent rate reflects the potential effects of standards on private consumption (*e.g.,* through higher prices for equipment and reduced purchases of energy). This rate represents the rate at which society discounts future consumption flows to their present value. It can be approximated by the real rate of return on long-term government debt (*i.e.,* yield on United States Treasury notes), which has averaged about 3 percent for the past 30 years.

Table V.13 shows the commercial consumer NPV results for each TSL considered for CWAF. In each case, the impacts cover the lifetime of equipment purchased in 2018–2047.

TABLE V.13—CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR COMMERCIAL WARM AIR FURNACE TRIAL STANDARD LEVELS FOR UNITS SOLD IN 2018–2047

Equipment class	Discount rate (percent)	Trial standard level				
		1	2	3	4	5
		billion 2013$				
Gas-fired Furnaces	3	1.1391	1.1391	2.6432	2.6432	10.0083
Oil-fired Furnaces		0.0000	0.0157	0.0000	0.0157	0.3756
Total All Classes *		1.1391	1.1548	2.6432	2.6589	10.3839
Gas-fired Furnaces	7	0.4361	0.4361	1.0111	1.0111	2.7799
Oil-fired Furnaces		0.0000	0.0057	0.0000	0.0057	0.1220
Total All Classes *		0.4361	0.4417	1.0111	1.0168	2.9019

* **Note:** Components may not sum due to rounding.

The NPV results based on the aforementioned nine-year analytical period are presented in Table V.14. The impacts are counted over the lifetime of equipment purchased in 2018–2026. As mentioned previously, this information is presented for informational purposes only and is not indicative of any change in DOE's analytical methodology or decision criteria.

TABLE V.14—CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR COMMERCIAL WARM AIR FURNACE TRIAL STANDARD LEVELS FOR UNITS SOLD IN 2018–2026

Equipment class	Discount rate (percent)	Trial standard level				
		1	2	3	4	5
		billion 2013$				
Gas-fired Furnaces	3	0.366	0.366	0.849	0.849	2.978
Oil-fired Furnaces		0.000	0.007	0.000	0.007	0.177
Total All Classes		0.366	0.373	0.849	0.856	3.156
Gas-fired Furnaces	7	0.199	0.199	0.461	0.461	1.139
Oil-fired Furnaces		0.000	0.003	0.000	0.003	0.073
Total All Classes		0.199	0.202	0.461	0.464	1.212

The above results reflect the use of the historic trend in the inflation-adjusted PPI for ''Warm air furnaces'' to estimate the change in price for CWAF over the analysis period (see section IV.H). The trend shows a small rate of annual price decline. DOE also developed sensitivity analyses using two price trends that have rates of price decline that are less than and greater than the Reference trend. The results of these alternative cases are presented in appendix 10–C of the NOPR TSD.

c. Indirect Impacts on Employment

DOE expects that amended energy conservation standards for CWAF would reduce energy costs for equipment owners, with the resulting net savings being redirected to other forms of economic activity. Those shifts in spending and economic activity could affect the demand for labor. As described in section IV.N, DOE used an input/output model of the U.S. economy to estimate indirect employment impacts of the TSLs that DOE considered in this rulemaking. DOE understands that there are uncertainties involved in projecting employment impacts, especially changes in the later years of the analysis. Therefore, DOE generated results for near-term time frames (2018 – 2023), where these uncertainties are reduced.

The results suggest that the proposed standards would be likely to have a negligible impact on the net demand for labor in the economy. The net change in jobs is so small that it would be imperceptible in national labor statistics and might be offset by other, unanticipated effects on employment. Chapter 16 of the NOPR TSD presents detailed results regarding indirect employment impacts.

4. Impact on Utility or Performance of Equipment

DOE has tentatively concluded that the amended standards it is proposing in the NOPR would not lessen the utility or performance of CWAF.

5. Impact of Any Lessening of Competition

DOE considers any lessening of competition that is likely to result from new or amended standards. The Attorney General determines the impact, if any, of any lessening of competition likely to result from a proposed standard, and transmits such determination in writing to the Secretary, together with an analysis of the nature and extent of such impact.

To assist the Attorney General in making such determination, DOE has provided DOJ with copies of this NOPR and the TSD for review. DOE will consider DOJ's comments on the proposed rule in preparing the final rule, and DOE will publish and respond to DOJ's comments in that document.

6. Need of the Nation to Conserve Energy

Enhanced energy efficiency, where economically justified, improves the Nation's energy security, strengthens the economy, and reduces the environmental impacts (costs) of energy production. Energy savings from amended standards for the CWAF equipment classes covered in today's NOPR could also produce environmental benefits in the form of reduced emissions of air pollutants and greenhouse gases associated with electricity production. Table V.15 provides DOE's estimate of cumulative emissions reductions projected to result from the TSLs considered in this rulemaking. This table includes both site and upstream emissions. DOE reports annual emissions reductions for each TSL in chapter 13 of the NOPR TSD.

TABLE V.15—CUMULATIVE EMISSIONS REDUCTION ESTIMATED FOR COMMERCIAL WARM AIR FURNACE TRIAL STANDARD LEVELS

	Trial standard level				
	1	2	3	4	5
Site and Power Sector Emissions*					
CO_2 (million metric tons)	10.7	10.8	24.8	24.9	162.8
SO_2 (thousand tons)	0.9	0.9	2.2	2.2	4.6
NO_X (thousand tons)	9.2	9.3	21.3	21.4	141.9
Hg (tons)	0.001	0.001	0.003	0.003	0.005
CH_4 (thousand tons)	0.3	0.3	0.6	0.6	3.7
N_2O (thousand tons)	0.033	0.035	0.077	0.079	0.435
Upstream Emissions					
CO_2 (million metric tons)	1.3	1.3	3.0	3.0	19.8
SO_2 (thousand tons)	0.0	0.0	0.0	0.0	0.2
NO_X (thousand tons)	19.5	19.6	45.3	45.4	302.3
Hg (tons)	0.000	0.000	0.000	0.000	0.000
CH_4 (thousand tons)	137.4	137.5	319.0	319.2	2107.1
N_2O (thousand tons)	0.002	0.003	0.006	0.006	0.038
Total Emissions					
CO_2 (million metric tons)	12.0	12.1	27.8	27.9	182.5
SO_2 (thousand tons)	0.9	1.0	2.2	2.2	4.8
NO_X (thousand tons)	28.7	28.9	66.6	66.8	444.1
Hg (tons)	0.001	0.001	0.003	0.003	0.005
CH_4 (thousand tons)	137.6	137.8	319.7	319.8	2110.8
N_2O (thousand tons)	0.036	0.038	0.083	0.085	0.472
CH_4 (million tons CO_2eq) **	3.4	3.4	8.0	8.0	52.8
N_2O (thousand tons CO_2eq) **	10.6	11.2	24.7	25.2	140.7

* Primarily site emissions. Values include the increase in power sector emissions from higher electricity use at TSL 5.
** CO_2eq is the quantity of CO_2 that would have the same global warming potential (GWP).

As part of the analysis for this proposed rule, DOE estimated monetary benefits likely to result from the reduced emissions of CO_2 and NO_X that DOE estimated for each of the TSLs considered for CWAF. As discussed in section IV.L, DOE used the most recent values for the SCC developed by an interagency process. The four sets of SCC values for CO_2 emissions reductions in 2015 resulting from that process (expressed in 2013$) are represented by $12.0/metric ton (the average value from a distribution that uses a 5-percent discount rate), $40.5/metric ton (the average value from a distribution that uses a 3-percent discount rate), $62.4/metric ton (the average value from a distribution that uses a 2.5-percent discount rate), and $119/metric ton (the 95th-percentile value from a distribution that uses a 3-percent discount rate). The values for later years are higher due to increasing damages (emissions-related costs) as the projected magnitude of climate change increases.

Table V.16 presents the global value of CO_2 emissions reductions at each TSL. For each of the four cases, DOE calculated a present value of the stream of annual values using the same discount rate as was used in the studies upon which the dollar-per-ton values are based. DOE calculated domestic values as a range from 7 percent to 23 percent of the global values, and these results are presented in chapter 14 of the NOPR TSD.

TABLE V.16—ESTIMATES OF GLOBAL PRESENT VALUE OF CO_2 EMISSIONS REDUCTION UNDER COMMERCIAL WARM AIR FURNACE TRIAL STANDARD LEVELS

TSL	SCC case*			
	5% Discount rate, average	3% Discount rate, average	2.5% Discount rate, average	3% Discount rate, 95th percentile
	Million 2013$			
Site and Power Sector Emissions**				
1	67.3	323	517	1,000
2	67.7	325	520	1,007
3	156	750	1,200	2,322
4	157	752	1,204	2,329
5	1,032	4,932	7,890	15,271
Upstream Emissions				
1	7.99	38.4	61.4	119
2	8.06	38.7	62.0	120
3	18.6	89.1	143	276
4	18.6	89.4	143	277
5	125	598	957	1,852
Total Emissions				
1	75.2	361	578	1,119
2	75.8	364	582	1,127
3	175	839	1,343	2,598
4	175	841	1,347	2,606
5	1,157	5,530	8,847	17,123

* For each of the four cases, the corresponding SCC value for emissions in 2015 is $12.0, $40.5, $62.4, and $119 per metric ton (2013$).
** Includes the increase in power sector emissions from higher electricity use at TSL 5.

DOE is well aware that scientific and economic knowledge about the contribution of CO_2 and other greenhouse gas (GHG) emissions to changes in the future global climate and the potential resulting damages to the world economy continues to evolve rapidly. Thus, any value placed on reducing CO_2 emissions in this rulemaking is subject to change. DOE, together with other Federal agencies, will continue to review various methodologies for estimating the monetary value of reductions in CO_2 and other GHG emissions. This ongoing review will consider the comments on this subject that are part of the public record for this and other rulemakings, as well as other methodological assumptions and issues. However, consistent with DOE's legal obligations, and taking into account the uncertainty involved with this particular issue, DOE has included in this proposed rule the most recent values and analyses resulting from the interagency process.

DOE also estimated the cumulative monetary value of the economic benefits associated with NO_X emissions reductions anticipated to result from amended standards for the CWAF equipment that is the subject of this notice. The dollar-per-ton values that DOE used are discussed in section IV.L. Table V.17 presents the cumulative present values for NO_X emissions reductions for each TSL calculated using the average dollar-per-ton values and seven-percent and three-percent discount rates.

TABLE V.17—ESTIMATES OF PRESENT VALUE OF NO_X EMISSIONS REDUCTION UNDER COMMERCIAL WARM AIR FURNACE TRIAL STANDARD LEVELS

TSL	3% Discount rate	7% Discount rate
	Million 2013$	
Site and Power Sector Emissions*		
1	11.3	4.72
2	11.4	4.76
3	26.2	11.0
4	26.3	11.0
5	176	74.9
Upstream Emissions		
1	23.9	9.98
2	24.1	10.0
3	55.5	23.2
4	55.7	23.2

TABLE V.17—ESTIMATES OF PRESENT VALUE OF NO_X EMISSIONS REDUCTION UNDER COMMERCIAL WARM AIR FURNACE TRIAL STANDARD LEVELS—Continued

TSL	3% Discount rate	7% Discount rate
	Million 2013$	
5	375	159
Total Emissions		
1	35.2	14.7
2	35.4	14.8
3	81.7	34.1
4	82.0	34.2
5	551	234

* Includes the increase in power sector emissions from higher electricity use at TSL 5.

7. Other Factors

The Secretary of Energy, in determining whether a standard is economically justified, may consider any other factors that the Secretary deems to be relevant. (42 U.S.C. 6313(a)(6)(B)(ii)(VII)) No other factors were considered in this analysis.

8. Summary of Other National Economic Impacts

The NPV of the monetized benefits associated with emissions reductions can be viewed as a complement to the NPV of the commercial consumer savings calculated for each TSL considered in this rulemaking. Table V.18. presents the NPV values that result from adding the estimates of the potential economic benefits resulting from reduced CO_2 and NO_X emissions in each of four valuation scenarios to the NPV of commercial consumer savings calculated for each TSL considered in this rulemaking, at both a seven-percent and three-percent discount rate. The CO_2 values used in the columns of each table correspond to the four sets of SCC values discussed above.

TABLE V.18—CWAF TSLS: NET PRESENT VALUE OF CONSUMER SAVINGS COMBINED WITH PRESENT VALUE OF MONETIZED BENEFITS FROM CO_2 AND NO_X EMISSIONS REDUCTIONS

TSL	Consumer NPV at 3% discount rate added with:			
	SCC Case $12.0/metric ton CO_2 * and medium value for NO_X	SCC Case $40.5/metric ton CO_2 * and medium value for NO_X	SCC Case $62.4/metric ton CO_2 * and medium value for NO_X	SCC Case $119/metric ton CO_2 * and medium value for NO_X
	Billion 2013$			
1	1.2	1.5	1.8	2.3
2	1.3	1.6	1.8	2.3
3	2.9	3.6	4.1	5.3
4	2.9	3.6	4.1	5.3
5	12.1	16.5	19.8	28.1
TSL	Consumer NPV at 7% discount rate added with:			
	SCC Case $12.0/metric ton CO_2 *	SCC Case $40.5/metric ton CO_2 *	SCC Case $62.4/metric ton CO_2 *	SCC Case $119/metric ton CO_2 *
	Billion 2013$			
1	0.5	0.8	1.0	1.5
2	0.5	0.8	1.0	1.6
3	1.2	1.9	2.4	3.6
4	1.2	1.9	2.4	3.7
5	4.3	8.7	12.0	20.3

* These label values represent the global SCC in 2015, in 2013$. For NO_X emissions, each case uses the medium value, which corresponds to $2,684 per ton.

Although adding the value of consumer savings to the values of emission reductions provides a valuable perspective, two issues should be considered. First, the national operating cost savings are domestic U.S. consumer monetary savings that occur as a result of market transactions, while the value of CO_2 reductions is based on a global value. Second, the assessments of operating cost savings and the SCC are performed with different methods that use different time frames for analysis. The national operating cost savings is measured for the lifetime of equipment shipped in 2018–2047. The SCC values, on the other hand, reflect the present value of future climate-related impacts resulting from the emission of one metric ton of CO_2 in each year. These impacts continue well beyond 2100.

C. Proposed Standards

To adopt national standards more stringent than the current standards for CWAF, DOE must determine that such action would result in significant additional conservation of energy and is technologically feasible and economically justified. (42 U.S.C. 6313(a)(6)(A)(ii)) As discussed previously, EPCA provides seven factors to be evaluated in determining whether a more-stringent standard for CWAF is economically justified. (42 U.S.C. 6313(a)(6)(B)(ii)(I)–(VII))

For this NOPR, DOE considered the impacts of amended standards for CWAF at each TSL, beginning with the maximum technologically feasible level, to determine whether that level was economically justified. Where the max-tech level was not justified, DOE then considered the next most efficient level and undertook the same evaluation until it reached the highest efficiency level that is both technologically feasible and economically justified and saves a significant additional amount of energy.

To aid the reader in understanding the benefits and/or burdens of each TSL, tables in this section summarize the quantitative analytical results for each TSL, based on the assumptions and methodology discussed herein. The efficiency levels contained in each TSL are described in section V.A. In addition to the quantitative results presented in the tables, DOE also considers other burdens and benefits that affect economic justification. These include the impacts on subgroups of consumer who may be disproportionately affected by a national standard (see section V.B.1.b), and impacts on employment. DOE discusses the impacts on direct employment in CWAF manufacturing in section V.B.2.b, and discusses the indirect employment impacts in section V.B.3.c.

1. Benefits and Burdens of Trial Standard Levels Considered for CWAF

Table V.19 and Table V.20 summarize the quantitative impacts estimated for each TSL for CWAF. The national impacts are measured over the lifetime of CWAF purchased in the 30-year period that begins in the year of compliance with amended standards (2018–2047). The energy savings, emissions reductions, and value of emissions reductions refer to full-fuel-cycle results.

TABLE V.19—SUMMARY OF ANALYTICAL RESULTS FOR COMMERCIAL WARM AIR FURNACES: NATIONAL IMPACTS

Category	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
National FFC Energy Savings (quads)					
	0.22	0.22	0.52	0.52	3.37
NPV of Consumer Benefits (2013$ billion)					
3% discount rate	1.1	1.2	2.6	2.7	10.4
7% discount rate	0.4	0.4	1.0	1.0	2.9
Cumulative Emissions Reduction (Total FFC Emissions)*					
CO_2 (*million metric tons*)	12.0	12.1	27.8	27.9	182.5
SO_2 (*thousand tons*)	0.9	1.0	2.2	2.2	4.8
NO_X (*thousand tons*)	28.7	28.9	66.6	66.8	444.1
Hg (*tons*)	0.001	0.001	0.003	0.003	0.005
CH_4 (*thousand tons*)	137.6	137.8	319.7	319.8	2110.8
N_2O (*thousand tons*)	0.04	0.04	0.08	0.08	0.47
CH_4 (*million tons CO_2eq***)	3.4	3.4	8.0	8.0	52.8
N_2O (*thousand tons CO_2eq***)	10.6	11.2	24.7	25.2	140.7
Value of Emissions Reduction (Total FFC Emissions)					
CO_2 (*2013$ billion*)†	0.1 to 1.1	0.1 to 1.1	0.2 to 2.6	0.2 to 2.6	1.2 to 17.1
NO_X – 3% discount rate (*2013$ million*)	35.2	35.4	81.7	82.0	550.9
NO_X – 7% discount rate (*2013$ million*)	14.7	14.8	34.1	34.2	234.3

* Includes the increase in power sector emissions from higher electricity use at TSL 5.
** CO_2eq is the quantity of CO_2 that would have the same global warming potential (GWP).
† Range of the economic value of CO_2 reductions is based on estimates of the global benefit of reduced CO_2 emissions.

TABLE V.20—SUMMARY OF ANALYTICAL RESULTS FOR COMMERCIAL WARM AIR FURNACES: MANUFACTURER AND CONSUMER IMPACTS*

Category	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
Manufacturer Impacts					
Industry NPV (2013$ million)	64.2 to 67.9	60.1 to 67.5	36.7 to 64.0	31.4 to 63.5	(23.7) to 89.4
Change in Industry NPV (%)†	(14.0) to (9.0)	(19.5) to (9.6)	(50.8) to (14.3)	(58.0) to (14.9)	(131.7) to 19.8††
Commercial Consumer Mean LCC Savings (2013$)					
Gas-fired Furnaces	$186	$186	$426	$426	$1,025
Oil-fired Furnaces	NA	$164	NA	$164	$3,278
Commercial Consumer Median PBP (years)					
Gas-fired Furnaces	0.6	0.6	0.7	0.7	12.2
Oil-fired Furnaces	NA	2.8	NA	2.8	7.5
Distribution of Commercial Consumer LCC Impacts					
Gas-fired Furnaces**					
Customers with Net Cost (%)	1%	1%	2%	2%	48%

TABLE V.20—SUMMARY OF ANALYTICAL RESULTS FOR COMMERCIAL WARM AIR FURNACES: MANUFACTURER AND CONSUMER IMPACTS*—Continued

Category	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
Customers with Net Benefit (%)	66%	66%	88%	88%	51%
Customers with No Impact (%)	33%	33%	10%	10%	1%
Oil-fired Furnaces **					
Customers with Net Cost (%)	0%	8%	0%	8%	47%
Customers with Net Benefit (%)	0%	23%	0%	23%	53%
Customers with No Impact (%)	100%	69%	100%	69%	0%

* Weighted by shares of each equipment class in total projected shipments in 2018.
** Rounding may cause some items to not total 100 percent.
† Parentheses indicate negative values.
†† At max tech, the standard will likely require commercial furnace manufacturers to make design changes to the cooling components of commercial HVAC products and to the chassis that houses the heating and cooling components. Since these cooling system changes are triggered by the CWAF standard, they are taken into account in the MIA's estimate of conversion costs. The additional expense of updating the commercial cooling product contributes to an INPV loss that is greater than 100%.

First, DOE considered TSL 5, the most efficient level (max-tech), which would save an estimated total of 3.37 quads of energy, an amount DOE considers significant. TSL 5 has an estimated NPV of commercial consumer benefit of $2.9 billion using a 7-percent discount rate, and $10.4 billion using a 3-percent discount rate.

The cumulative emissions reductions at TSL 5 are 182.5 million metric tons of CO_2, 444.12 thousand tons of NO_X, 4.80 thousand tons of SO_2, and 0.005 tons of Hg. The estimated monetary value of the CO_2 emissions reductions at TSL 5 ranges from $1.2 billion to $17.1 billion.

At TSL 5, the average LCC savings are $1025.2 for gas-fired CWAF and $3278.3 for oil-fired CWAF. The median PBP is 12.2 years for gas-fired CWAF and 7.5 years for oil-fired CWAF. The share of commercial consumers experiencing a net LCC benefit is 51 percent for gas-fired CWAF and 53 percent for oil-fired CWAF.

At TSL 5, the projected change in INPV ranges from a decrease of $98.3 million to an increase of $14.8 million, depending on the manufacturer markup scenario. If the larger decrease is realized, TSL 5 could result in a net loss of 131.7 percent in INPV to manufacturers of covered CWAF.

Accordingly, the Secretary tentatively concludes that, at TSL 5 for CWAF, the benefits of energy savings, positive NPV of total commercial consumer benefits, commercial consumer LCC savings, emission reductions, and the estimated monetary value of the emissions reductions would be outweighed by the very large reduction in industry value at TSL 5, as well as the potential for loss of domestic manufacturing. Consequently, DOE has concluded that TSL 5 is not economically justified.

Next, DOE considered TSL 4, which would save an estimated total of 0.52 quads of energy, an amount DOE considers significant. TSL 4 has an estimated NPV of commercial consumer benefit of $1.0 billion using a 7-percent discount rate, and $2.7 billion using a 3-percent discount rate.

The cumulative emissions reductions at TSL 4 are 27.9 million metric tons of CO_2, 66.84 thousand tons of NO_X, 2.21 thousand tons of SO_2, and 0.003 tons of Hg. The estimated monetary value of the CO_2 emissions reductions at TSL 4 ranges from $0.2 billion to $2.6 billion.

At TSL 4, the average LCC savings are $425.9 for gas-fired CWAF and $163.9 for oil-fired CWAF. The median PBP is 0.7 years for gas-fired CWAF and 2.8 years for oil-fired CWAF. The share of commercial consumers experiencing a net LCC benefit is 88 percent for gas-fired CWAF and 23 percent for oil-fired CWAF.

At TSL 4, projected change in INPV ranges from a decrease of $43.3 million to a decrease of $11.1 million. If the larger decrease is realized, TSL 4 could result in a net loss of 58 percent in INPV to manufacturers of covered CWAF.

After considering the analysis and weighing the benefits and the burdens, DOE has tentatively concluded that at TSL 4 for CWAFs, the benefits of energy savings, positive NPV of commercial consumer benefit, positive impacts on consumers (as indicated by positive average LCC savings, favorable PBPs, and the large percentage of commercial consumers who would experience LCC benefits), emission reductions, and the estimated monetary value of the emissions reductions would outweigh the potential reductions in INPV for manufacturers. The Secretary of Energy has concluded that TSL 4 would save a significant additional amount of energy, is technologically feasible and economically justified, and is supported by clear and convincing evidence.

Based on the above considerations, DOE today proposes to adopt the energy conservation standards for CWAFs at TSL 4. Table V.21 presents the proposed energy conservation standards for CWAFs.

TABLE V.21—PROPOSED ENERGY CONSERVATION STANDARDS FOR COMMERCIAL WARM AIR FURNACES

Equipment type	Input capacity (Btu/h)	Thermal efficiency
Gas-fired Furnaces	≥225,000	82%
Oil-fired Furnaces	≥225,000	82%

2. Summary of Benefits and Costs (Annualized) of the Proposed Standards

The benefits and costs of the proposed standards can also be expressed in terms of annualized values. The annualized monetary values are the sum of: (1) The annualized national economic value (expressed in 2013$) of the benefits from operation of equipment that meets the proposed standards (consisting primarily of operating cost savings from using less energy, minus increases in equipment purchase costs, which is another way of representing consumer NPV), and (2) the annualized monetary value of the benefits of emission reductions, including CO_2 emission reductions.[78] The value of CO_2

[78] DOE used a two-step calculation process to convert the time-series of costs and benefits into annualized values. First, DOE calculated a present value in 2013, the year used for discounting the NPV of total customer costs and savings, for the time-series of costs and benefits using discount rates of three and seven percent for all costs and benefits except for the value of CO_2 reductions. For the latter, DOE used a range of discount rates. From the present value, DOE then calculated the fixed annual payment over a 30-year period (2018 through 2047) that yields the same present value. The fixed annual payment is the annualized value. Although DOE calculated annualized values, this does not imply that the time-series of cost and

reductions, otherwise known as the Social Cost of Carbon (SCC), is calculated using a range of values per metric ton of CO_2 developed by a recent interagency process.

Although combining the values of operating savings and CO_2 emission reductions provides a useful perspective, two issues should be considered. First, the national operating savings are domestic U.S. consumer monetary savings that occur as a result of market transactions, while the value of CO_2 reductions is based on a global value. Second, the assessments of operating cost savings and CO_2 savings are performed with different methods that use different time frames for analysis. The national operating cost savings is measured for the lifetime of CWAF shipped in 2018 –2047. The SCC values, on the other hand, reflect the present value of some future climate-related impacts resulting from the emission of one metric ton of carbon dioxide in each year. These impacts continue well beyond 2100.

Estimates of annualized benefits and costs of the proposed standards for CWAF are shown in Table V.22. The results under the primary estimate are as follows. Using a 7-percent discount rate for benefits and costs other than CO_2 reduction, for which DOE used a 3-percent discount rate along with the average SCC series that uses a 3-percent discount rate, the estimated cost of the proposed CWAF standards is $3.51 million per year in increased equipment costs, while the estimated benefits are $104 million per year in reduced equipment operating costs, $47 million in CO_2 reductions, and $3.38 million in reduced NO_X emissions. In this case, the net benefit would amount to $151 million per year. Using a 3-percent discount rate for all benefits and costs and the average SCC series, the estimated cost of the proposed CWAF standards is $3.48 million per year in increased equipment costs, while the estimated benefits are $152 million per year in reduced equipment operating costs, $47 million in CO_2 reductions, and $4.57 million in reduced NO_X emissions. In this case, the net benefit would amount to $200 million per year.

TABLE V.22—ANNUALIZED BENEFITS AND COSTS OF PROPOSED STANDARDS (TSL 4) FOR COMMERCIAL WARM AIR FURNACES*

	Discount rate	Million 2013 $/year		
		Primary estimate	Low estimate	High estimate
Benefits				
Operating Cost Savings	7%	104	98	111
	3%	152	143	163
CO_2 Reduction Monetized Value ($12.0/t case)**	5%	13	13	14
CO_2 Reduction Monetized Value ($40.5/t case)**	3%	47	45	48
CO_2 Reduction Monetized Value ($62.4/t case)**	2.5%	69	67	72
CO_2 Reduction Monetized Value ($119/t case)**	3%	145	140	150
NO_X Reduction Monetized Value (at $2,684/ton)**	7%	3.38	3.28	3.49
	3%	4.57	4.41	4.72
Total Benefits†	7% plus CO_2 range	120 to 253	114 to 242	128 to 264
	7%	154	147	163
	3% plus CO_2 range	169 to 302	160 to 287	181 to 318
	3%	203	192	216
Costs				
Incremental Equipment Costs	7%	3.51	3.48	3.67
	3%	3.48	3.41	3.68
Net Benefits/Costs				
Total†	7% plus CO_2 range	117 to 249	111 to 238	124 to 261
	7%	151	143	159
	3% plus CO_2 range	166 to 298	156 to 283	177 to 314
	3%	200	189	212

* This table presents the annualized costs and benefits associated with CWAF shipped in 2018 – 2047. These results include benefits to commercial consumers which accrue after 2048 from the equipment purchased in 2018 – 2047. The results account for the incremental variable and fixed costs incurred by manufacturers due to the standard, some of which may be incurred in preparation for the rule. The Primary, Low Benefits, and High Benefits Estimates utilize projections of energy prices from the *AEO2013* Reference case, Low Economic Growth case, and High Economic Growth case, respectively. Incremental equipment costs account for equipment price trends and include, beyond the reference scenario, a low price decline scenario used in the Low Benefits Estimate and a high price decline scenario used in the High Benefits Estimates.

** The interagency group selected four sets of SCC values for use in regulatory analyses. Three sets of values are based on the average SCC from the three integrated assessment models, at discount rates of 2.5, 3, and 5 percent. The fourth set, which represents the 95th percentile SCC estimate across all three models at a 3-percent discount rate, is included to represent higher-than-expected impacts from temperature change further out in the tails of the SCC distribution. The values in parentheses represent the SCC in 2015. The SCC time series incorporate an escalation factor. The value for NO_X is the average of the low and high values used in DOE's analysis.

† Total benefits for both the 3-percent and 7-percent cases are derived using the series corresponding to average SCC with 3-percent discount rate. In the rows labeled "7% plus CO_2 range" and "3% plus CO_2 range," the operating cost and NO_X benefits are calculated using the labeled discount rate, and those values are added to the full range of CO_2 values.

benefits from which the annualized values were determined is a steady stream of payments.

VI. Procedural Issues and Regulatory Review

A. Review Under Executive Orders 12866 and 13563

Section 1(b)(1) of Executive Order 12866, ''Regulatory Planning and Review,'' 58 FR 51735 (Oct. 4, 1993), requires each agency to identify the problem that it intends to address, including, where applicable, the failures of private markets or public institutions that warrant new agency action, as well as to assess the significance of that problem. The problems that the proposed standards address are as follows:

(1) Insufficient information and the high costs of gathering and analyzing relevant information leads some consumers to miss opportunities to make cost-effective investments in energy efficiency.

(2) In some cases the benefits of more efficient equipment are not realized due to misaligned incentives between purchasers and users. An example of such a case is when the equipment purchase decision is made by a building contractor or building owner who does not pay the energy costs of operating the equipment.

(3) There are external benefits resulting from improved energy efficiency of CWAF that are not captured by the users of such equipment. These benefits include externalities related to public health, environmental protection and national security that are not reflected in energy prices, such as reduced emissions of air pollutants and greenhouse gases that impact human health and global warming.

In addition, DOE has determined that this regulatory action is an ''economically significant regulatory action'' under section 3(f)(1) of Executive Order 12866. Accordingly, section 6(a)(3) of the Executive Order requires that DOE prepare a regulatory impact analysis (RIA) on the rule being proposed and that the Office of Information and Regulatory Affairs (OIRA) in the Office of Management and Budget (OMB) review the rule. DOE presented to OIRA for review the draft rule and other documents prepared for this rulemaking, including the RIA, and has included these documents in the rulemaking record. The assessments prepared pursuant to Executive Order 12866 can be found in the technical support document for this rulemaking.

DOE has also reviewed this proposed regulation pursuant to Executive Order 13563, issued on January 18, 2011. 76 FR 3281 (Jan. 21, 2011). Executive Order 13563 is supplemental to and explicitly reaffirms the principles, structures, and definitions governing regulatory review established in Executive Order 12866. To the extent permitted by law, agencies are required by Executive Order 13563 to: (1) Propose or adopt a regulation only upon a reasoned determination that its benefits justify its costs (recognizing that some benefits and costs are difficult to quantify); (2) tailor regulations to impose the least burden on society, consistent with obtaining regulatory objectives, taking into account, among other things, and to the extent practicable, the costs of cumulative regulations; (3) select, in choosing among alternative regulatory approaches, those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity); (4) to the extent feasible, specify performance objectives, rather than specifying the behavior or manner of compliance that regulated entities must adopt; and (5) identify and assess available alternatives to direct regulation, including providing economic incentives to encourage the desired behavior, such as user fees or marketable permits, or providing information upon which choices can be made by the public.

DOE emphasizes as well that Executive Order 13563 requires agencies to use the best available techniques to quantify anticipated present and future benefits and costs as accurately as possible. In its guidance, the Office of Information and Regulatory Affairs has emphasized that such techniques may include identifying changing future compliance costs that might result from technological innovation or anticipated behavioral changes. For the reasons stated in the preamble, DOE believes that today's NOPR is consistent with these principles, including the requirement that, to the extent permitted by law, benefits justify costs and that net benefits are maximized.

B. 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 (IRFA) 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 rulemaking process. 68 FR 7990. DOE has made its procedures and policies available on the Office of the General Counsel's Web site (*http://energy.gov/gc/office-general-counsel*). DOE has prepared the following IRFA for the products that are the subject of this rulemaking.

For manufacturers of CWAF, the Small Business Administration (SBA) has set a size threshold, which defines those entities classified as ''small businesses'' for the purposes of the statute. DOE used the SBA's small business size standards to determine whether any small entities would be subject to the requirements of the rule. 65 FR 30836, 30848 (May 15, 2000), as amended at 65 FR 53533, 53544 (Sept. 5, 2000) and codified at 13 CFR part 121. The size standards are listed by North American Industry Classification System (NAICS) code and industry description and are available at *http://www.sba.gov/category/navigation-structure/contracting/contracting-officials/small-business-size-standards.* Manufacturing of CWAF is classified under NAICS 333415, ''Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing.'' The SBA sets a threshold of 750 employees or less for an entity to be considered as a small business for this category.

1. Description and Estimated Number of Small Entities Regulated

DOE reviewed the proposed energy conservation standards for CWAF considered in this notice of proposed rulemaking under the provisions of the Regulatory Flexibility Act and the procedures and policies published on February 19, 2003. 68 FR 7990. To better assess the potential impacts of this rulemaking on small entities, DOE conducted a more focused inquiry of the companies that could be small business manufacturers of equipment covered by this rulemaking. DOE conducted a market survey using available public information to identify potential small manufacturers. DOE's research involved industry trade association membership directories (including AHRI [79]), individual company Web sites, and market research tools (*e.g.,* Hoovers reports [80]) to create a list of companies that manufacture or sell the CWAF equipment covered by this rulemaking. DOE also asked industry representatives if they were aware of any other small

[79] Based on listings in the AHRI directory accessed on August 2, 2013 (Available at: *https://www.ahridirectory.org/ahridirectory/pages/home.aspx*).

[80] Hoovers | Company Information | Industry Information | Lists, D&B (2013) (Available at: *http://www.hoovers.com/*) (Last accessed April 3, 2013).

manufacturers during manufacturer interviews. DOE reviewed publicly-available data and contacted companies on its list, as necessary, to determine whether they met the SBA's definition of a small business manufacturer of covered CWAF equipment. DOE screened out companies that do not offer equipment covered by this rulemaking, do not meet the definition of a ''small business,'' or are foreign-owned and operated. DOE was able to identify two manufacturers that meet the SBA's definition of a ''small business'' out of the 13 companies that manufacture products covered by this rulemaking.

Before issuing this NOPR, DOE attempted to contact all the small business manufacturers of CWAF it had identified. None of the small businesses consented to formal interviews. DOE also attempted to obtain information about small business impacts while interviewing large manufacturers.

2. Description and Estimate of Compliance Requirements

DOE identified one small gas-fired CWAF manufacturer and one small oil-fired CWAF manufacturer. The small gas-fired CWAF manufacturer accounts for 17 of the 250 [81] gas-fired CWAF listings in the AHRI Directory, or approximately 7 percent of the listings. This small manufacturer offers product exclusively at 80-percent TE, and at the proposed level of TSL 4, would need to update its equipment offerings to meet a standard of 82-percent TE. However, this position is not unique. There are also some large gas-fired CWAF manufacturers would that would need to update all equipment offerings to meet the proposed standard. From a design perspective, DOE believes that most gas-fired equipment lines on the market today can be upgraded to achieve the proposed standard with increases in heat exchange surface area. However, based on feedback used in the Top-Down conversion costs analysis (see chapter 12 of the NOPR TSD), industry average conversion costs could reach $4.4 million per gas-fired CWAF manufacturer.

TABLE VI.1—AVERAGE CONVERSION COST PER GAS-FIRED CWAF MANUFACTURER*

	Bottom-up model (million $)	Top-down model (million $)
TSL 1	1.0	1.3
TSL 2	1.0	1.3
TSL 3	1.6	4.4
TSL 4	1.6	4.4
TSL 5	7.2	11.3

* Additional information about industry conversion costs and the two estimation models can be found in section IV.J.2.B of this Notice.

Because this is a relatively low sales volume market, and because the industry as a whole generally produces equipment at the baseline, DOE believes the average impacts will be similar for large and small business manufacturers. DOE was unable to identify any publicly available information that would lead to a conclusion that small manufacturers are differentially impacted, and as noted above, requests to conduct interviews with small business manufacturers were declined. Therefore, DOE assumed that small business manufacturers would face similar conversion costs as larger businesses. However, the small gas-fired CWAF manufacturer may need to allocate a greater portion of technical resources or may need to access outside capital to support the transition to the proposed standard.

The small oil-fired CWAF manufacturer accounts for 11 of the 16 oil-fired CWAF listings in the AHRI Directory. The small oil-fired furnace manufacturer produces some of the most efficient products on the market at 82-percent TE. It would be unlikely to be at a technological disadvantage relative to its competitors at the proposed TSL. It is possible the small manufacturer would have a competitive advantage, given its technological lead and experience in the niche market of high-efficiency commercial oil-fired warm air furnaces.

TABLE VI.2—AVERAGE CONVERSION COST PER OIL-FIRED CWAF MANUFACTURER*

	Bottom-up model (million $)	Top-down model (million $)
TSL 1	0.0	0.0
TSL 2	0.2	2.2
TSL 3	0.0	0.0
TSL 4	0.2	2.2
TSL 5	0.9	5.5

* Additional information about industry conversion costs and the two estimation models can be found in section IV.J.2.B of this Notice.

An amended energy conservation standard is likely to necessitate conversion investment by all manufacturers to bring products into compliance. Manufacturers may choose to access outside capital to help fund the upfront, one-time costs to bring products into compliance. Small manufacturers may have greater difficulty securing outside capital [82] and, as a result, may face higher costs of capital than large competitors.

As noted above, none of the small businesses consented to formal interviews, so information regarding the impacts of this proposed standard for small business manufacturers is limited. DOE seeks further information and data regarding the sales volume and annual revenues for small businesses so the agency can be better informed concerning the potential impacts to small business manufacturers of the proposed energy conservation standards, and would consider any such additional information when formulating and selecting TSLs for the final rule.

3. Duplication, Overlap, and Conflict With Other Rules and Regulations

DOE is not aware of any rules or regulations that duplicate, overlap, or conflict with the proposed rule.

4. Significant Alternatives to the Rule

The discussion above analyzes impacts on small businesses that would result from DOE's proposed rule. In addition to the other TSLs being considered, the proposed rulemaking TSD includes a regulatory impact analysis (RIA). For CWAF, the RIA discusses the following policy alternatives: (1) No change in standard; (2) consumer rebates; (3) consumer tax credits; (4) manufacturer tax credits; (5) voluntary energy efficiency targets; and (6) bulk government purchases. While these alternatives may mitigate to some varying extent the economic impacts on small entities compared to the standards, DOE did not consider the alternatives further because they are either not feasible to implement without authority and funding from Congress, or are expected to result in energy savings that are significantly smaller than those that would be expected to result from adoption of the proposed standard levels. In reviewing alternatives that would reduce burden on small business manufacturers, DOE analyzed a case in which the voluntary programs targeted

[81] The AHRI directory lists approximately 1,000 units. Many of these units are from the same model line, share the same chassis, and have the same level of performance, but have different heating capacities or installed product options. DOE consolidated the AHRI listing of CWAF such that all units from the same model line and chassis are listed together as a single unit.

[82] Simon, Ruth, and Angus Loten. ''Small-Business Lending Is Slow to Recover.'' *Wall Street Journal,* August 14, 2014. Accessed August 2014. *http://online.wsj.com/articles/small-business-lending-is-slow-to-recover-1408329562.*

efficiencies corresponding to TSL 4. DOE also examined standards at lower efficiency levels, TSL 3, TSL 2 and TSL 1. (See section V.C of this NOPR for a description of benefits and burdens at each TSL and discussion of DOE's TSL selection process.)

TSL 3 achieves a slightly lower level of energy savings as TSL 4; and it would not significantly reduce burden on small business manufacturers. TSL 3 would reduce the required efficiency of oil-fired CWAF as compared to TSL 4, while leaving the standard for gas-fired CWAF the same. Thus, there would be no reduction of burden for the small business manufacturer of gas-fired CWAF. TSL 3 would marginally reduce the burden for the small business manufacturer of oil-fired CWAF, but as noted previously the majority of the small oil-fired furnace manufacturer's products already meet TSL 4. The small oil-fired manufacturer may have a competitive advantage at TSL 4, given its technological lead and experience in the niche market of high-efficiency commercial oil-fired warm air furnaces. TSL 2 and TSL 1 both achieve savings that would be less than half of that achieved by TSL 4. Voluntary programs at these levels achieve only a fraction of the savings achieved by standards and would provide even lower savings benefits. To achieve substantial reductions in small business impacts would force the standard down to TSL 2 levels, at the expense of substantial energy savings and NPV benefits, which would be inconsistent with DOE's statutory mandate to maximize the improvement in energy efficiency that the Secretary determines is technologically feasible and economically justified. DOE believes that establishing standards at TSL 4 provides the optimum balance between energy savings benefits and impacts on small businesses. DOE notes that it did not consider an alternative compliance date for the entire industry affected by this rulemaking. DOE is constrained by the three-year lead time required by statute (42 U.S.C. 6313(a)(6)(D)). However, certain compliance date alternatives may be available to individual manufacturers, as discussed below. Accordingly, DOE is declining to adopt any of these alternatives and is proposing the standards set forth in this rulemaking. (See chapter 17 of the NOPR TSD for further detail on the policy alternatives DOE considered.) The TSD considers regulatory alternatives that would potentially reduce the burden on the industry as a whole, including small businesses and the agency requests comment on this issue.

Additional compliance flexibilities may be available through other means. For example, individual manufacturers may petition for a waiver of the applicable test procedure. (See 10 CFR 431.401.) Further, EPCA provides that a manufacturer whose annual gross revenue from all of its operations does not exceed $8,000,000 may apply for an exemption from all or part of an energy conservation standard for a period not longer than 24 months after the effective date of a final rule establishing the standard. Additionally, Section 504 of the Department of Energy Organization Act, 42 U.S.C. 7194, provides authority for the Secretary to adjust a rule issued under EPCA in order to prevent ''special hardship, inequity, or unfair distribution of burdens'' that may be imposed on that manufacturer as a result of such rule. Manufacturers should refer to 10 CFR part 430, subpart E, and part 1003 for additional details.

C. Review Under the Paperwork Reduction Act of 1995

Manufacturers of CWAF must certify to DOE that their equipment complies with any applicable energy conservation standards. In certifying compliance, manufacturers must test their equipment according to the applicable DOE test procedures for CWAF, including any amendments adopted for those test procedures on the date that compliance is required. DOE has established regulations for the certification and recordkeeping requirements for all covered consumer products and commercial equipment, including CWAF. 76 FR 12422 (March 7, 2011). The collection-of-information requirement for the certification and recordkeeping is subject to review and approval by OMB under the Paperwork Reduction Act (PRA). This requirement has been approved by OMB under OMB control number 1910–1400. Public reporting burden for the certification is estimated to average 20 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

Notwithstanding any other provision of the law, no person is required to respond to, nor shall any person be subject to a penalty for failure to comply with, a collection of information subject to the requirements of the PRA, unless that collection of information displays a currently valid OMB Control Number.

D. Review Under the National Environmental Policy Act of 1969

Pursuant to the National Environmental Policy Act (NEPA) of 1969, DOE has determined that the proposed rule fits within the category of actions included in Categorical Exclusion (CX) B5.1 and otherwise meets the requirements for application of a CX. See 10 CFR part 1021, App. B, B5.1(b); 1021.410(b) and Appendix B, B(1)–(5). The proposed rule fits within the category of actions under CX B5.1 because it is a rulemaking that establishes energy conservation standards for consumer products or industrial equipment, and for which none of the exceptions identified in CX B5.1(b) apply. Therefore, DOE has made a CX determination for this rulemaking, and DOE does not need to prepare an Environmental Assessment or Environmental Impact Statement for this proposed rule. DOE's CX determination for this proposed rule is available at *http://cxnepa.energy.gov/.*

E. Review Under Executive Order 13132

Executive Order 13132, ''Federalism,'' 64 FR 43255 (Aug. 10, 1999), imposes certain requirements on Federal agencies formulating and implementing policies or regulations that preempt State law or that have Federalism implications. The Executive Order requires agencies 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 tentatively 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 products that are the subject of the proposed rule. States can petition DOE for exemption from such preemption to the extent, and based on criteria, set forth in EPCA. (42 U.S.C. 6297) No further action is required by Executive Order 13132.

F. 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,'' 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; and (3) provide a clear legal standard for affected conduct rather than a general standard; and (4) promote simplification and burden reduction. 61 FR 4729 (Feb. 7, 1996). Regarding 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 section 3(a) and section 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, this proposed rule meets the relevant standards of Executive Order 12988.

G. Review Under the Unfunded Mandates Reform Act of 1995

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA) requires each Federal agency to assess the effects of Federal regulatory actions on State, local, and Tribal governments and the private sector. Pub. L. 104–4, sec. 201 (codified at 2 U.S.C. 1531). For a proposed regulatory action likely to result in a rule that may cause the expenditure 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 that estimates the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a), (b)) The UMRA also 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,'' and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect them. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. 62 FR 12820. DOE's policy statement is also available at *http://energy.gov/gc/office-general-counsel.*

Although today's proposed rule, which proposes amended energy conservation standards for CWAF, does not contain a Federal intergovernmental mandate, it may require annual expenditures of $100 million or more by the private sector. Specifically, the proposed rule would likely result in a final rule that could require expenditures of $100 million or more. Such expenditures may include: (1) investment in research and development and in capital expenditures by CWAF manufacturers in the years between the final rule and the compliance date for the amended standards, and (2) incremental additional expenditures by commercial consumers to purchase higher-efficiency CWAF, starting at the compliance date for the applicable standard.

Section 202 of UMRA authorizes a Federal agency to respond to the content requirements of UMRA in any other statement or analysis that accompanies the proposed rule. 2 U.S.C. 1532(c). The content requirements of section 202(b) of UMRA relevant to a private sector mandate substantially overlap the economic analysis requirements that apply under section 325(o) of EPCA and Executive Order 12866. The **SUPPLEMENTARY INFORMATION** section of the NOPR and the ''Regulatory Impact Analysis'' section of the TSD for this proposed rule respond to those requirements.

Under section 205 of UMRA, the Department is obligated to identify and consider a reasonable number of regulatory alternatives before promulgating a rule for which a written statement under section 202 is required. 2 U.S.C. 1535(a). DOE is required to select from those alternatives the most cost-effective and least burdensome alternative that achieves the objectives of the proposed rule unless DOE publishes an explanation for doing otherwise, or the selection of such an alternative is inconsistent with law. As required by 42 U.S.C. 6313(a), this proposed rule would establish amended energy conservation standards for CWAF that are designed to achieve the maximum improvement in energy efficiency that DOE has determined to be both technologically feasible and economically justified. A full discussion of the alternatives considered by DOE is presented in the ''Regulatory Impact Analysis'' section of the TSD for today's proposed rule.

H. 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 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 not necessary to prepare a Family Policymaking Assessment.

I. 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 proposed rule would not result in any takings that might require compensation under the Fifth Amendment to the U.S. Constitution.

J. 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 Federal agencies to review most disseminations of information to the public under information quality 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 the NOPR under the OMB and DOE guidelines and has concluded that it is consistent with applicable policies in those guidelines.

K. 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 OIRA at 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 promulgates 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.

DOE has tentatively concluded that today's regulatory action, which sets forth proposed energy conservation standards for CWAF, is not a significant energy action because the proposed standards are not likely to have a significant adverse effect on the supply, distribution, or use of energy, nor has it been designated as such by the Administrator at OIRA. Accordingly, DOE has not prepared a Statement of Energy Effects on the proposed rule.

L. 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 (the 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 rulemaking analyses are "influential scientific information," which the Bulletin defines 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." *Id.* at 2667.

In response to OMB's Bulletin, DOE conducted formal in-progress peer reviews of the energy conservation standards development process and analyses and has prepared a Peer Review Report pertaining to the energy conservation standards rulemaking analyses. Generation of this report involved a rigorous, formal, and documented evaluation 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 the following Web site: *www1.eere.energy.gov/buildings/appliance_standards/peer_review.html.*

VII. Public Participation

A. Attendance at the Public Meeting

The time, date, and location of the public meeting are listed in the DATES and **ADDRESSES** sections at the beginning of this notice. If you plan to attend the public meeting, please notify Ms. Brenda Edwards at (202) 586–2945 or *Brenda.Edwards@ee.doe.gov.*

All participants will undergo security processing upon building entry. Any participant with a laptop computer or similar device (*e.g.,* tablets), must undergo additional screening. Note that any foreign national who requests to participate in the public meeting is subject to advance security screening prior to the date of the public meeting, and such persons should contact Ms. Brenda Edwards as soon as possible at (202) 586–2945 to commence the necessary procedures.

Due to the REAL ID Act implemented by the Department of Homeland Security (DHS), there have been recent changes regarding identification (ID) requirements for individuals wishing to enter Federal buildings from specific States and U.S. territories. As a result, driver's licenses from the following States or territory will not be accepted for building entry, and instead, one of the alternate forms of ID listed below will be required.

DHS has determined that regular driver's licenses (and ID cards) from the following jurisdictions are not acceptable for entry into DOE facilities: Alaska, American Samoa, Arizona, Louisiana, Maine, Massachusetts, Minnesota, New York, Oklahoma, and Washington.

Acceptable alternate forms of Photo-ID include: U.S. Passport or Passport Card; an Enhanced Driver's License or Enhanced ID-Card issued by the States of Minnesota, New York or Washington (Enhanced licenses issued by these States are clearly marked Enhanced or Enhanced Driver's License); a military ID or other Federal government-issued Photo-ID card.

In addition, you can attend the public meeting via webinar. Webinar registration information, participant instructions, and information about the capabilities available to webinar participants will be published on DOE's Web site at: *http://www1.eere.energy.gov/buildings/appliance_standards/rulemaking.aspx/ruleid/70.* Participants are responsible for ensuring their systems are compatible with the webinar software.

B. Procedure for Submitting Requests To Speak and Prepared General Statements for Distribution

Any person who has an interest in the topics addressed in this notice, or who is representative of a group or class of persons that has an interest in these issues, may request an opportunity to make an oral presentation at the public meeting. Such persons may hand-deliver requests to speak to the address shown in the **ADDRESSES** section at the beginning of this notice between 9:00 a.m. and 4:00 p.m., Monday through Friday, except Federal holidays. Requests may also be sent by mail or email to: Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Program, Mailstop EE–2J, 1000 Independence Avenue SW., Washington, DC 20585–0121, or *Brenda.Edwards@ee.doe.gov.* Persons who wish to speak should include with their request a computer diskette or CD–ROM in WordPerfect, Microsoft Word, PDF, or text (ASCII) file format that briefly describes the nature of their interest in this rulemaking and the topics they wish to discuss. Such persons should also provide a daytime telephone number where they can be reached.

DOE requests persons scheduled to make an oral presentation to submit an advance copy of their statements at least one week before the public meeting. DOE may permit persons who cannot supply an advance copy of their statement to participate, if those persons have made advance alternative arrangements with the Building Technologies Program. As necessary, requests to give an oral presentation should ask for such alternative arrangements. DOE prefers to receive requests and advance copies via email. Any person who has plans to present a prepared general statement may request that copies of his or her statement be made available at the public meeting.

C. Conduct of the Public Meeting

DOE will designate a DOE official to preside at the public meeting and may also use a professional facilitator to aid discussion. The meeting will not be a judicial or evidentiary-type public hearing, but DOE will conduct it in accordance with 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. There shall not be discussion of proprietary information, costs or prices, market share, or other commercial matters regulated by U.S. anti-trust laws. 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 prepared general statements by participants, and encourage all interested parties to share their views on issues affecting this rulemaking. Each participant will be allowed to make a general statement (within time limits determined by DOE), before the discussion of specific topics. DOE will allow, as time permits, 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.

A transcript of the public meeting will be included in the docket, which can be viewed as described in the *Docket* section at the beginning of this notice and will be accessible on the DOE Web site. In addition, 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 this proposed rule before or after the public meeting, but no later than the date provided in the **DATES** section at the beginning of this proposed rule. Interested parties may submit comments, data, and other information using any of the methods described in the **ADDRESSES** section at the beginning of this notice.

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

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

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

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

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

Include contact information each time you submit comments, data, documents, and other information to DOE. If you submit via mail or hand delivery/courier, please provide all items on a CD, if feasible, in which case it is not necessary to submit printed copies. No facsimiles (faxes) will be accepted.

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

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

Confidential Business Information. Pursuant to 10 CFR 1004.11, any person submitting information that he or she believes to be confidential and exempt by law from public disclosure should submit via email, postal mail, or hand delivery/courier two well-marked copies: one copy of the document marked ''confidential'' including all the information believed to be confidential, and one copy of the document marked ''non-confidential'' with the information believed to be confidential deleted. Submit these documents via email or on a CD, if feasible. DOE will make its own determination about the confidential status of the information and treat it according to its determination.

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

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

E. Issues on Which DOE Seeks Comment

Although DOE welcomes comments on any aspect of this proposal, DOE is particularly interested in receiving comments and views of interested parties concerning the following issues:

1. The use of proprietary designs and patented technologies in CWAF, and whether all manufacturers would be able to achieve the proposed levels through the use of non-proprietary designs. (See section III.B.1 and chapter 3 of the NOPR TSD.)

2. The proposed scope of coverage and equipment classes for this rulemaking. In particular DOE seeks comment on whether there is a need for separate equipment classes for units designed to be installed indoors (*i.e.,* ''non-weatherized'' units) and units designed to be installed outdoors (*i.e.,* ''weatherized'' units) due to the potential need to manage acidic condensate and the potential for condensate freezing after exiting the furnace. (See section IV.A.2 and chapter 3 of the NOPR TSD.)

3. The technologies identified in this rulemaking, as well as the technologies which were primarily considered as the methods for increasing thermal efficiency of commercial warm air furnaces. (See section IV.A.3 and chapters 3 and 4 of the NOPR TSD.)

4. The potential for lessening of product utility for CWAF meeting the proposed standards and whether the proposed standards would likely result in the unavailability in the United States of any covered product type (or class) of performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially the same as those generally available in the United States . (See section II.A and chapter 3 of the NOPR TSD.)

5. The efficiency levels analyzed for gas-fired and oil-fired commercial warm air furnaces. In particular, DOE is interested in the feasibility of the max-tech efficiency levels, as well as the ability of non-condensing technologies to meet the 82 percent thermal efficiency level for gas-fired commercial furnaces. DOE also seeks comment on whether an 82 percent thermal efficiency standard would shift production to condensing technology if manufacturers, for example, would need to design their equipment to a level slightly higher than the DOE standard due to the margin of error associated with the test methodology. In addition, DOE is interested in whether the accuracy of the results from the test method would support measuring thermal efficiencies to the tenth decimal place such that DOE could consider 81.5 percent or some other fraction as a potential standard level as opposed to rounding the standard to the nearest whole number. (See section IV.C.2.b and chapter 5 of the NOPR TSD.)

6. The applicability of the teardown units at 250,000 Btu/h and 400,000 Btu/h input capacities to represent the range of potential input capacities on the market. (See section IV.C.1 and chapter 5 of the NOPR TSD.)

7. The incremental manufacturing costs above the baseline cost at the efficiency levels considered in the engineering analysis, which DOE estimates to be $10 for gas-fired CWAFs and $24 for oil-fired CWAFs at the proposed standard level. (See section IV.C.5 and chapter 5 of the NOPR TSD.)

8. The approach used to estimate the trend for future CWAF consumer prices. (See section IV.F.1 and chapter 8 of the NOPR TSD.)

9. The approach of using CBECS and RECS data for determining the energy consumption of CWAF in residential and commercial buildings. (See section IV.E and chapter 7 of the NOPR TSD.)

10. The analytical methodology to estimate the annual energy use for CWAF. (See section IV.E and chapter 7 of the NOPR TSD.)

11. The approach and data sources used for assessing changes in installation costs for more-efficient CWAF. (See section IV.F.1 and chapter 8 of the NOPR TSD.)

12. The methodology and data sources used for assessing changes in maintenance and repair costs for more-efficient CWAF. (See section IV.F.2.c and chapter 8 of the NOPR TSD.)

13. The approach used to determine the lifetimes for CWAF and whether the lifetimes assumed in the analysis are reflective of CWAF equipment covered by this rule. In addition, the agency is seeking comment on whether the energy efficiency standards would be expected to affect the lifetime of the products covered by the proposed standards. (See section IV.F.2.d and chapter 8 of the NOPR TSD.)

14. The potential for a rebound effect associated with higher efficiency standards for the covered furnaces in both commercial and residential installations. (See section IV.F.2.d and chapter 8 of the NOPR TSD.)

15. The appropriate base case distribution of energy efficiencies for CWAF in 2018 (compliance year of the standard) in the absence of amended energy conservation standards. (See section IV.F.2.d and chapter 8 of the NOPR TSD.)

16. DOE's methodology and data sources used for projecting the future shipments of CWAF in the absence of amended energy conservation standards. Specifically, DOE is interested in the historical data from the past 10 years for CWAF. (See section IV.F.2.d and chapter 9 of the NOPR TSD.)

17. The potential impacts of amended standards on product shipments, including impacts related to equipment switching. (See section IV.F.2.d and chapter 9 of the NOPR TSD.)

18. The methodology used to determine long-term changes in CWAF energy efficiency independent of amending energy conservation standards. (See section IV.H and chapter 10 of the NOPR TSD.)

19. Consumer subgroups that should be considered in this rulemaking. (See section IV.I and chapter 11 of the NOPR TSD.)

20. The approach for conducting the emissions analysis for CWAF. (See section IV.K and chapter 13 of the NOPR TSD.)

21. DOE's approach for estimating monetary benefits associated with emissions reductions, including the SCC values used. (See section IV.L and chapter 14 of the NOPR TSD.)

22. Impacts on small business manufacturers from the proposed standard. In particular, DOE seeks further information and data regarding the sales volume and annual revenues for small businesses so the agency can be better informed concerning the potential impacts to small business manufacturers of the proposed energy conservation standards, and would consider any such additional information when formulating and selecting TSLs for the final rule and whether any feasible compliance flexibilities that the agency may consider. (See section VI.B and chapter 12 of the NOPR TSD.)

VIII. Approval of the Office of the Secretary

The Secretary of Energy has approved publication of this notice of proposed rulemaking.

List of Subjects in 10 CFR Part 431

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

Issued in Washington, DC, on January 16, 2015.

Michael Carr,

Principal Deputy Assistant Secretary, Energy Efficiency and Renewable Energy.

For the reasons set forth in the preamble, DOE proposes to amend part 431 of Chapter II, Subchapter D, of Title 10 of the Code of Federal Regulations, 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. Section 431.77 is revised to read as follows:

§ 431.77 Energy conservation standards and their effective dates.

(a) *Gas-fired Commercial Warm Air Furnaces.* Each gas-fired commercial warm air furnace must meet the following energy efficiency standard levels:

(1) For gas-fired commercial warm air furnaces manufactured on and after January 1, 1994, and before [*date 3 years after publication of the energy conservation standards final rule*], the

thermal efficiency at the maximum rated capacity (rated maximum input) must be not less than 80 percent; and

(2) For gas-fired commercial warm air furnaces manufactured on and after [*date 3 years after publication of the energy conservation standards final rule*], the thermal efficiency at the maximum rated capacity (rated maximum input) must be not less than 82 percent.

(b) *Oil-fired Commercial Warm Air Furnaces.* Each oil-fired commercial warm air furnace must meet the following energy efficiency standard levels:

(1) For oil-fired commercial warm air furnaces manufactured on and after January 1, 1994, and before [*date 3 years after publication of the energy conservation standards final rule*], the thermal efficiency at the maximum rated capacity (rated maximum input) must be not less than 81 percent; and

(2) For oil-fired commercial warm air furnaces manufactured on and after [*date 3 years after publication of the energy conservation standards final rule*], the thermal efficiency at the maximum rated capacity (rated maximum input) must be not less than 82 percent.

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