[6450-01-P]

DEPARTMENT OF ENERGY

10 CFR Part 431

[Docket Number EERE-2012-BT-STD-0029]

RIN 1904-AC82

Energy Conservation Program: Energy Conservation Standards for Packaged Terminal Air Conditioners and Packaged Terminal Heat Pumps

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

ACTION: Notice of proposed rulemaking (NOPR) 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 packaged terminal air conditioners (PTACs) and packaged terminal heat pumps (PTHPs). EPCA also requires the U.S. Department of Energy (DOE) to determine whether more-stringent, amended standards would be technologically feasible and economically justified, and would save a significant amount of energy. In this document, DOE proposes amended energy conservation standards for PTACs and PTHPs. The document also announces a public meeting to receive comment on these proposed standards and associated analyses and results.

DATES: DOE will hold a public meeting on Wednesday, October 29, 2014, from 9 a.m. to 4 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.

DOE will accept comments, data, and information regarding this notice of proposed rulemaking (NOPR) before and after the public meeting, but no later than [**INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER**]. See section VII, "Public Participation" for details.

ADDRESSES: The public meeting will be held at the U.S. Department of Energy, Forrestal Building, Room 8E-089, 1000 Independence Avenue, SW., Washington, DC 20585. To attend, please notify Ms. Brenda Edwards at (202) 586–2945. For more information, refer to the Public Participation section near the end of this document.

Any comments submitted must identify the NOPR for Energy Conservation Standards for packaged terminal air conditioners (PTACs) and packaged terminal heat pumps (PTHPs), and provide docket number EERE-2012–BT–STD–0029 and/or regulatory information number (RIN) number 1904-AC82. Comments may be submitted using any of the following methods:

1. Federal eRulemaking Portal: www.regulations.gov. Follow the instructions for submitting comments.
2. E-mail: pkgTerminalAC-HP2012STD0029@ee.doe.gov. Include the docket number and/or RIN in the subject line of the message.
3. Mail: Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Program, Mailstop EE-5B, 1000 Independence Avenue, SW., Washington, DC, 20585-0121. If possible, please submit all items on a CD. It is not necessary to include printed copies.
4. Hand Delivery/Courier: Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Program, 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 e-mail to Chad_S_Whiteman@omb.eop.gov.

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

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

A link to the docket web page can be found at: http://www.regulations.gov/#!docketDetail;D=EERE-2012-BT-STD-0029. This web page contains a link to the docket for this document on the 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. See section VII for further information on how to submit comments through www.regulations.gov.

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. Ronald Majette, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Program, EE-5B, 1000 Independence Avenue, SW., Washington, DC, 20585-0121. Telephone: (202) 586-7935. E-mail: PTACs@ee.doe.gov.

Ms. Jennifer Tiedeman, U.S. Department of Energy, Office of the General Counsel, GC-71, 1000 Independence Avenue, SW., Washington, DC 20585-0121. Telephone: (202) 287-6111. E mail: Jennifer.Tiedeman@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. 6291-6309, as codified), added by Public Law 95-619, Title IV, section 441(a), established the Energy Conservation Program for Certain Industrial Equipment.[2] This equipment includes packaged terminal air conditioners (PTACs) and packaged terminal heat pumps (PTHPs), the subjects of this document.

Pursuant to EPCA, DOE may prescribe a standard more stringent than the level in American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)/Illuminating Engineering Society of North America (IESNA) Standard 90.1, after ASHRAE amends the energy conservation standards found in ASHRAE/IESNA Standard 90.1, if DOE can demonstrate "by clear and convincing evidence," that such a more stringent standard "would result in significant additional conservation of energy and is technologically feasible and economically justified." (42 U.S.C. 6313(a)(6)(A)(II)) In accordance with these criteria, DOE proposes to amend the energy conservation standards for standard-sized PTACs and PTHPs by raising the efficiency levels for this equipment to the levels shown in Table I.1, above the efficiency levels specified by ANSI/ASHRAE/IES Standard 90.1-2013. The proposed standards, which prescribe the minimum allowable energy efficiency ratio (EER) and, for packaged terminal heat pumps, coefficient of performance (COP), are shown in Table I.1.

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

The proposed standards would apply to all covered PTACs and PTHPs manufactured on or after the date four years after publication of the final rule in the Federal Register. (42 U.S.C. 6313(a)(6)(D)) The proposed standards for PTACs and PTHPs represent an improvement in energy efficiency of four to seven percent compared to the efficiency levels specified by ANSI/ASHRAE/IES Standard 90.1-2013, depending on the equipment capacity.

Table I.1. Proposed Energy Conservation Standards for PTACs and PTHPs

Equipment Class			**Proposed Energy Conservation Standards**[*]
Equipment	**Category**	**Cooling Capacity**	
PTAC	Standard Size[**]	<7,000 Btu/h	EER = 12.6
		≥7,000 Btu/h and ≤15,000 Btu/h	EER = 14.9 – (0.324 x Cap[††])
		>15,000 Btu/h	EER = 10.0
PTHP	Standard Size[**]	<7,000 Btu/h	EER = 12.6 COP = 3.5
		≥7,000 Btu/h and ≤15,000 Btu/h	EER = 14.9 – (0.324 x Cap[††]) COP = 4.0 – (0.064 x Cap[††])
		>15,000 Btu/h	EER = 10.0 COP = 3.0

[*] For equipment rated according to the DOE test procedure (ARI Standard 310/380-2004), all energy efficiency ratio (EER) values must be rated at 95ºF outdoor dry-bulb temperature for air-cooled equipment and evaporatively-cooled equipment and at 85ºF entering water temperature for water cooled equipment. All coefficient of performance (COP) values must be rated at 47ºF outdoor dry-bulb temperature for air-cooled equipment, and at 70ºF entering water temperature for water-source heat pumps.
[**] Standard size refers to PTAC or PTHP equipment with wall sleeve dimensions greater than or equal to 16 inches high, or greater than or equal to 42 inches wide.
[†] Non-standard size refers to PTAC or PTHP equipment with wall sleeve dimensions less than 16 inches high and less than 42 inches wide.
[††] Cap means cooling capacity in thousand British thermal units per hour (Btu/h) at 95ºF outdoor dry-bulb temperature.

A. Benefits and Costs to Customers

Table I.2 presents DOE's evaluation of the economic impacts of the proposed standards on customers of PTAC and PTHP equipment, as measured by the average life-cycle cost (LCC) savings and the median payback period. LCC savings refers to the additional dollar amount a customer is expected to save (or expend) over the equipment's lifetime when using equipment with higher efficiency compared to baseline efficiency equipment. For the two PTAC equipment classes the customer is expected to face costs, and for the two PTHP equipment classes the customer is expected to observe savings under the amended standards proposed in this document.

Table I.2. Impacts of Proposed Standards on Customers of PTACs and PTHPs

Cooling Capacity	Average LCC Savings (2013$)	Median Payback Period (years)
< 12,000 Btu/h	$0.40	8.0
≥ 12,000 Btu/h	($2.11)	9.9

* Numbers in parentheses indicate negative savings.
Note: Standard size refers to PTAC or PTHP equipment with wall sleeve dimensions greater than or equal to 16 inches high, or greater than or equal to 42 inches wide.

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 2048). Using a real discount rate of 8.5 percent, DOE estimates that the INPV for manufacturers of PTACs and PTHPs is $58.5 million in 2013$. Under the proposed standards, DOE expects that manufacturers may lose up to 1.3 percent of INPV, which corresponds to approximately $0.7 million.

C. National Benefits[3]

DOE's analyses indicate that the proposed standards would save a significant amount of energy. The lifetime savings for PTACs and PTHPs purchased in the 30-year period that begins in the year of expected compliance with amended standards (2019–2048) amount to 0.06 quadrillion British thermal units (quads). The annual energy savings in 2030 (1.49 thousandths of a quad) are equivalent to 0.08 thousandths of a percent of total U.S. commercial primary energy consumption in 2013.[4]

The cumulative net present value (NPV) of total customer costs and savings of the proposed standards for PTACs and PTHPs ranges from $10.7 million (at a 7-percent discount rate) to $69.0 million (at a 3-percent discount rate). This NPV expresses the estimated total value of future operating-cost savings minus the estimated increase in product costs for equipment purchased in 2019–2048.

In addition, the proposed standards would have significant environmental benefits. The energy savings would result in cumulative emission reductions of 4.3 million metric tons (Mt)[5] of carbon dioxide (CO_2), 16 thousand tons of methane, 9.7 thousand tons of sulfur dioxide (SO_2), and 4.4 thousand tons of nitrogen oxides (NO_X).[6] The cumulative reduction in CO_2 emissions through 2030 amounts to 0.7 Mt.

[3] All monetary values in this section are expressed in 2013 dollars and are discounted to 2013.
[4] Based on U.S. Department of Energy, Energy Information Administration, Annual Energy Outlook 2013.
[5] A metric ton is equivalent to 1.1 short tons. Results for NO_X and Hg are presented in short tons.
[6] 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. The reduction in mercury (Hg) emissions is expected to be very small.

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 a recent Federal interagency process.[7] The derivation of the SCC values is discussed in section IV.L.1. Using discount rates appropriate for each set of SCC values, DOE estimates that the present monetary value of the CO_2 emissions reduction is between $28.1 million and $412.1 million. DOE also estimates that the present monetary value of the NO_X emissions reduction is $2.20 million at a 7-percent discount rate and $5.43 million at a 3-percent discount rate.[8]

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

[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 online at www.whitehouse.gov/sites/default/files/omb/assets/inforeg/technical-update-social-cost-of-carbon-for-regulator-impact-analysis.pdf

[8] DOE is currently investigating valuation of avoided Hg and SO_2 emissions.

Table I.3. Summary of National Economic Benefits and Costs of Proposed Energy Conservation Standards for PTACs and PTHPs*

Category	Present Value million 2013$	Discount Rate
Benefits		
Operating Cost Savings	101.5	7%
	241.9	3%
CO_2 Reduction Monetized Value ($12.0/t case)**	28.1	5%
CO_2 Reduction Monetized Value ($40.5/t case)**	133.0	3%
CO_2 Reduction Monetized Value ($62.4/t case)**	212.3	2.5%
CO_2 Reduction Monetized Value ($119/t case)**	412.1	3%
NO_X Reduction Monetized Value (at $2,684/ton)**	2.20	7%
	5.43	3%
Total Benefits†	236.6	7%
	380.2	3%
Costs		
Incremental Installed Costs	90.8	7%
	172.9	3%
Total Net Benefits		
Including Emissions Reduction Monetized Value†	145.9	7%
	207.3	3%

* This table presents the costs and benefits associated with PTACs and PTHPs shipped in 2019−2048. These results include benefits to customers which accrue after 2048 from the equipment purchased in 2019−2048. The results account for the incremental variable and fixed costs incurred by manufacturers due to amended standards, some of which may be incurred in preparation for the rule.
** The CO_2 values represent global monetized values of the SCC, in 2013$, in 2015 under several scenarios of the updated SCC values. The first three cases use the averages of SCC distributions calculated using 5%, 3%, and 2.5% discount rates, respectively. The fourth case represents the 95th percentile of the SCC distribution calculated using a 3% discount rate. The SCC time series used by DOE incorporates an escalation factor.
† Total Benefits for both the 3% and 7% cases are derived using the series corresponding to average SCC with 3-percent discount rate ($40.5/t case).

The benefits and costs of the proposed standards, for equipment sold in 2019-2048, 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 customer operation of products that meet the proposed standards (consisting primarily of operating cost savings from using less energy, minus increases in equipment purchase and installation costs, which is another way of representing customer NPV), and (2) the annualized monetary value of the benefits of emission reductions, including CO_2 emission reductions.[9]

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. customer 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 PTACs and PTHPs shipped in 2019–2048. 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. These impacts continue well 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 cost of the proposed standards is $8.38 million per year in increased equipment

[9] 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.3. From the present value, DOE then calculated the fixed annual payment over a 30-year period (2019 through 2048) 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.

costs, while the benefits are \$9.4 million per year in reduced equipment operating costs, \$7.2 million in CO_2 reductions, and \$0.20 million in reduced NO_X emissions. In this case, the net benefit amounts to \$8.4 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 standards is \$9.36 million per year in increased equipment costs, while the benefits are \$13.1 million per year in reduced operating costs, \$7.2 million in CO_2 reductions, and \$0.29 million in reduced NO_X emissions. In this case, the net benefit amounts to \$11.2 million per year.

Table I.4. Annualized Benefits and Costs of Proposed Energy Conservation Standards for PTACs and PTHPs

TSL 3	Discount Rate	Primary Estimate*	Low Net Benefits Estimate*	High Net Benefits Estimate*
		million 2013$/year		
Benefits				
Operating Cost Savings	7%	9.4	9.0	9.9
	3%	13.1	12.5	13.9
CO_2 Reduction Monetized Value ($12.0/t case)**	5%	2.0	2.0	2.0
CO_2 Reduction Monetized Value ($40.5/t case)**	3%	7.2	7.2	7.2
CO_2 Reduction Monetized Value ($62.4/t case)**	2.5%	10.7	10.7	10.7
CO_2 Reduction Monetized Value ($119/t case)**	3%	22.3	22.3	22.3
NO_X Reduction Monetized Value (at $2,684/ton)**	7%	0.20	0.20	0.20
	3%	0.29	0.29	0.29
Total Benefits†	7% plus CO_2 range	11.6 to 31.9	11.2 to 31.5	12.1 to 32.4
	7%	16.8	16.4	17.3
	3% plus CO_2 range	15.4 to 35.7	14.8 to 35.0	16.2 to 36.5
	3%	20.6	19.9	21.4
Costs				
Incremental Product Costs	7%	8.38	8.18	10.61
	3%	9.36	9.06	12.29
Net Benefits				
Total†	7% plus CO_2 range	3.2 to 23.5	3.0 to 23.3	1.5 to 21.8
	7%	8.4	8.2	6.7
	3% plus CO_2 range	6.0 to 26.3	5.7 to 26.0	3.9 to 24.2
	3%	11.2	10.9	9.1

* This table presents the annualized costs and benefits associated with PTACs and PTHPs shipped in 2019−2048. These results include benefits to customers which accrue after 2048 from the equipment purchased in 2019−2048. The results account for the incremental variable and fixed costs incurred by manufacturers due to amended standards, 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 Estimate, and High Estimate, respectively. All three estimates use a constant rate for projected product price trends.

** The CO_2 values represent global monetized values of the SCC, in 2013$, in 2015 under several scenarios of the updated SCC values. The first three cases use the averages of SCC distributions calculated using 5%, 3%, and 2.5% discount rates, respectively. The fourth case represents the 95th percentile of the SCC distribution calculated using a 3% discount rate. The SCC time series used by DOE incorporate an escalation factor.
† 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 ($40.5/t case). 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 has tentatively concluded that the proposed standards represent the maximum improvement in energy efficiency that is technologically feasible and economically justified, and would result in a significant conservation of energy. DOE further notes that products achieving these standard levels are already commercially available for at least some, if not most, 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 customer benefits, customer LCC savings, and emission reductions) would outweigh the burdens (loss of INPV for manufacturers and LCC increases for some customers).

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 document and related information collected and analyzed during the course of this rulemaking effort, DOE may adopt energy efficiency levels presented in this document that are either higher or lower than the proposed standards, or some combination of level(s) that incorporate the proposed standards in part.

As noted previously, in this rulemaking DOE is required to, at a minimum, adopt the ASHRAE levels as the Federal standard. (42 U.S.C. (a)(6)(A)(ii)(I)) In order to adopt levels above ASHRAE, DOE must determine that such a standard would result in significant additional conservation of energy and is technologically feasible and economically justified. (42 U.S.C. (a)(6)(A)(ii)(II)) To meet this statutory requirement, in this summary and throughout the NOPR, DOE examined and presents consumer, manufacturer, and economic benefits for the proposed PTAC and PTHP standards as compared to the default automatic adoption of the ASHRAE level, where no models would be available on the market at the current Federal minimum. However, for informational purposes only, in section V.C. DOE also presents summary results for the proposed standards in comparison to a base case including the current Federal minimum standards. This information was not used in the selection of the proposed standard level.

The following section briefly discusses the statutory authority underlying this proposal, as well as some of the relevant historical background related to the establishment of standards for PTACs and PTHPs.

II. Introduction

A. Authority

Title III, Part C[10] 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, section 441(a), established the Energy Conservation Program for

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

Certain Industrial Equipment, which includes the PTAC and PTHP equipment that is the subject of this document. In general, this program addresses the energy efficiency of certain types of commercial and industrial equipment. Relevant provisions of the Act include definitions (42 U.S.C. 6311), energy conservation standards (42 U.S.C. 6313), test procedures (42 U.S.C. 6314), labelling provisions (42 U.S.C. 6315), and the authority to require information and reports from manufacturers (42 U.S.C. 6316).

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

EPCA requires that DOE conduct a rulemaking to consider amended energy conservation standards for a variety of enumerated types of commercial heating, ventilating, and air-conditioning equipment (of which PTACs and PTHPs are a subset) each time ASHRAE Standard 90.1 is updated with respect to such equipment. (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). According to 42

U.S.C. 6313(a)(6)(A), for each type of equipment, EPCA directs that if ASHRAE Standard 90.1 is amended, DOE must publish in the Federal Register an analysis of the energy savings potential of amended energy efficiency standards within 180 days of the amendment of ASHRAE Standard 90.1. (42 U.S.C. 6313(a)(6)(A)(i)) EPCA further directs that DOE must adopt amended standards at the new efficiency level specified in ASHRAE Standard 90.1, unless clear and convincing evidence supports a determination that adoption of a more-stringent level would produce significant additional energy savings and be technologically feasible and economically justified. (42 U.S.C. 6313(a)(6)(A)(ii)) In addition, DOE notes that pursuant to the Energy Independence and Security Act of 2007 (EISA 2007) amendments to EPCA, the agency must periodically review its already-established energy conservation standards for ASHRAE equipment. (42 U.S.C. 6313(a)(6)(C)) In December 2012, this provision was further amended by the American Energy Manufacturing Technical Corrections Act (AEMTCA) to clarify that DOE's periodic review of ASHRAE equipment must occur "[e]very six years." (42 U.S.C. 6313(a)(6)(C)(i))

AEMTCA also modified EPCA to specify that any amendment to the design requirements with respect to the ASHRAE equipment would trigger DOE review of the potential energy savings under U.S.C. 6313(a)(6)(A)(i). Additionally, AEMTCA amended EPCA to require that if DOE proposes an amended standard for ASHRAE equipment at levels more stringent than those in ASHRAE Standard 90.1, DOE, in deciding whether a standard is economically justified, 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 following seven factors:

(1) The economic impact of the standard on manufacturers and consumers of the products subject to the standard;

(2) The savings in operating costs throughout the estimated average life of the product in the type (or class) compared to any increase in the price, initial charges, or maintenance expenses of the products 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 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 considers relevant.

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

Because ASHRAE did not update its efficiency levels for PTACs and PTHPs in ANSI/ASHRAE/IES Standard 90.1-2010, DOE began this rulemaking by 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. 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 stated above.

However, before DOE could finalize this NOPR, ASHRAE acted on October 9, 2013 to adopt ANSI/ASHRAE/IES Standard 90.1-2013, and this revision did contain amended standard levels for PTACs, thereby triggering DOE's statutory obligation under 42 U.S.C. 6313(a)(6)(A) to promulgate an amended uniform national standard at those levels unless DOE determines that there is clear and convincing evidence supporting the adoption of more-stringent energy conservation standards than the ASHRAE levels. Consequently, DOE prepared an analysis of the energy savings potential of amended standards at the ANSI/ASHRAE/IES Standard 90.1-2013 levels (as required by 42 U.S.C. 6313(a)(6)(A)(i)) and updated this NOPR and accompanying analyses to reflect appropriate statutory provisions, timelines, and compliance dates.

EPCA defines a PTHP as "a packaged terminal air conditioner that utilizes reverse cycle refrigeration as its prime heat source and should have supplementary heat source available to builders with the choice of hot water, steam, or electric resistant heat." (42 U.S.C. 6311(10)(B)) Because PTHPs are defined explicitly as a subset of PTACs, the publication of ANSI/ASHRAE/IES Standard 90.1-2013 also triggered DOE to consider whether clear and convincing evidence supports a more-stringent standard than the ASHRAE levels for PTHPs, though the ASHRAE levels for PTHPs were not explicitly revised in 2013.

DOE is proposing amended standards that are more stringent than those set forth in ANSI/ASHRAE/IES Standard 90.1-2013. DOE has tentatively concluded that this rulemaking provides "clear and convincing evidence" that the proposed standards would result in significant conservation of energy and would be technologically feasible and economically justified, as mandated by 42 U.S.C. 6313(a)(6).

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, EPCA, as codified, establishes 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 applicable, water) savings during the first year that the customer will receive as a result of the standard, as calculated under the applicable test procedure.

Additionally, when a type or class of covered equipment such as ASHRAE 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 has followed a similar process in the context of this proposed rulemaking.

DOE has also reviewed this regulation pursuant to Executive Order 13563, issued on January 18, 2011 (76 FR 3281, January 21, 2011). Executive Order 13563 is supplemental to and explicitly reaffirms the principles, structures, and definitions governing regulatory review established in Executive Order 12866, which provides that significant regulatory actions be submitted for review to the Office of Information and Regulatory Affairs (OIRA) in the Office of Management and Budget (OMB). 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, OIRA 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 the 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. Consistent with Executive Order 13563, and the range of impacts analyzed in this rulemaking, the energy efficiency standards proposed herein by DOE achieves maximum net benefits.

B. Background

1. Current Standards

In a final rule published on October 7, 2008 (73 FR 58772), DOE prescribed the current energy conservation standards for all standard size PTAC and PTHP equipment manufactured on or after September 30, 2012, and for all non-standard size PTAC and PTHP equipment manufactured on or after September 30, 2010. (42 U.S.C. 6313(a)(3)) The current energy conservation standards align with ANSI/ASHRAE/IES Standard 90.1-2010. These levels are expressed in EER for the cooling mode and in COP for the heating mode. EER is defined as "the ratio of the produced cooling effect of an air conditioner or heat pump to its net work input, expressed in Btu/watt-hour." 10 CFR 431.92. COP is defined as "the ratio of produced cooling effect of an air conditioner or heat pump (or its produced heating effect, depending on model operation) to its net work input, when both the cooling (or heating) effect and the net work input are expressed in identical units of measurement." 10 CFR 431.92.

The current standards for PTACs and PTHPs are set forth in Table II.1.

Table II.1. Federal Energy Efficiency Standards for PTACs and PTHPs

Equipment Class			Efficiency Level*
Equipment Type	**Sub-Category**	**Cooling Capacity**	
PTAC	Standard Size**	<7,000 Btu/h	EER = 11.7
		≥7,000 Btu/h and ≤15,000 Btu/h	EER = 13.8 – (0.300 x Cap††)
		>15,000 Btu/h	EER = 9.3
	Non-Standard Size†	<7,000 Btu/h	EER = 9.4
		≥7,000 Btu/h and ≤15,000 Btu/h	EER = 10.9 – (0.213 x Cap††)
		>15,000 Btu/h	EER = 7.7
PTHP	Standard Size**	<7,000 Btu/h	EER = 11.9 COP = 3.3
		≥7,000 Btu/h and ≤15,000 Btu/h	EER = 14.0 – (0.300 x Cap††) COP = 3.7 – (0.052 x Cap††)
		>15,000 Btu/h	EER = 9.5 COP = 2.9
	Non-Standard Size†	<7,000 Btu/h	EER = 9.3 COP = 2.7
		≥7,000 Btu/h and ≤15,000 Btu/h	EER = 10.8 – (0.213 x Cap††) COP = 2.9 – (0.026 x Cap††)
		>15,000 Btu/h	EER = 7.6 COP = 2.5

* For equipment rated according to ARI standards, all EER values must be rated at 95ºF outdoor dry-bulb temperature for air-cooled products and evaporatively-cooled products and at 85ºF entering water temperature for water cooled products. All COP values must be rated at 47ºF outdoor dry-bulb temperature for air-cooled products, and at 70ºF entering water temperature for water-source heat pumps.

** Standard size refers to PTAC or PTHP equipment with wall sleeve dimensions greater than or equal to 16 inches high, or greater than or equal to 42 inches wide.

† Non-standard size refers to PTAC or PTHP equipment with wall sleeve dimensions less than 16 inches high and less than 42 inches wide. ASHRAE/IESNA Standard 90.1-1999 also includes a factory labeling requirement for non-standard size PTAC and PTHP equipment as follows: "MANUFACTURED FOR REPLACEMENT APPLICATIONS ONLY; NOT TO BE INSTALLED IN NEW CONSTRUCTION PROJECTS."

†† Cap means cooling capacity in kBtu/h at 95ºF outdoor dry-bulb temperature.

2.

History of Standards Rulemaking for PTACs and PTHPs

On October 29, 1999, ASHRAE adopted ASHRAE/IESNA Standard 90.1–1999, "Energy Standard for Buildings Except Low-Rise Residential Building," which included amended efficiency levels for PTACs and PTHPs. In amending the ASHRAE/IESNA Standard 90.1-1989 levels for PTACs and PTHPs, ASHRAE acknowledged the physical size constraints among the varying sleeve sizes on the market. Specifically, the wall sleeve dimensions of the PTAC and PTHP can limit the attainable energy efficiency of the equipment. Consequently, ASHRAE/IESNA Standard 90.1-1999 used the equipment classes defined by EPCA, which are distinguished by equipment type (i.e., air conditioner or heat pump) and cooling capacity, and further separated these equipment classes by wall sleeve dimensions.[11] Table II.2 shows the efficiency levels in ASHRAE/IESNA Standard 90.1-1999 for PTACs and PTHPs.

[11] Prior to 1999, ASHRAE/IESNA Standard 90.1 provided one efficiency standard for all PTAC and PTHP and did not have different standards by dimension. ASHRAE/IESNA Standard 90.1-1999 increased the standards for all classes and established more stringent standards for "new construction" than for "replacements." DOE energy conservation standards for PTACs and PTHPs did not distinguish between standard and non-standard size units until 2010 (for non-standard size) and 2012 (for standard size).

Table II.2. ASHRAE/IESNA Standard 90.1-1999 Energy Efficiency Levels for PTACs and PTHPs

Equipment Class			ASHRAE/IESNA Standard 90.1-1999 Efficiency Levels[*]
Equipment	**Category**	**Cooling Capacity**	
PTAC	Standard Size[**]	<7,000 Btu/h	EER = 11.0
		≥7,000 Btu/h and ≤15,000 Btu/h	EER = 12.5 – (0.213 x Cap[††])
		>15,000 Btu/h	EER = 9.3
	Non-Standard Size[†]	<7,000 Btu/h	EER = 9.4
		≥7,000 Btu/h and ≤15,000 Btu/h	EER = 10.9 – (0.213 x Cap[††])
		>15,000 Btu/h	EER = 7.7
PTHP	Standard Size[**]	<7,000 Btu/h	EER = 10.8 COP = 3.0
		≥7,000 Btu/h and ≤15,000 Btu/h	EER = 12.3 – (0.213 x Cap[††]) COP = 3.2 – (0.026 x Cap[††])
		>15,000 Btu/h	EER = 9.1 COP = 2.8
	Non-Standard Size[†]	<7,000 Btu/h	EER = 9.3 COP = 2.7
		≥7,000 Btu/h and ≤15,000 Btu/h	EER = 10.8 – (0.213 x Cap[††]) COP = 2.9 – (0.026 x Cap[††])
		>15,000 Btu/h	EER = 7.6 COP = 2.5

* For equipment rated according to ARI standards, all EER values must be rated at 95ºF outdoor dry-bulb temperature for air-cooled products and evaporatively-cooled products and at 85ºF entering water temperature for water cooled products. All COP values must be rated at 47ºF outdoor dry-bulb temperature for air-cooled products, and at 70ºF entering water temperature for water-source heat pumps.
** Standard size refers to PTAC or PTHP equipment with wall sleeve dimensions greater than or equal to 16 inches high, or greater than or equal to 42 inches wide.
[†] Non-standard size refers to PTAC or PTHP equipment with wall sleeve dimensions less than 16 inches high and less than 42 inches wide. ASHRAE/IESNA Standard 90.1-1999 also includes a factory labeling requirement for non-standard size PTAC and PTHP equipment as follows: "MANUFACTURED FOR REPLACEMENT APPLICATIONS ONLY; NOT TO BE INSTALLED IN NEW CONSTRUCTION PROJECTS."
[††] Cap means cooling capacity in kBtu/h at 95ºF outdoor dry-bulb temperature.

Following the publication of ASHRAE/IESNA Standard 90.1-1999, DOE performed a screening analysis that covered 24 of the 34 categories of equipment addressed in ASHRAE/IESNA Standard 90.1-1999, to determine whether more stringent levels would result in significant additional energy conservation of energy and be technologically feasible and economically justified. The report "Screening Analysis for

EPACT-Covered Commercial [Heating, Ventilating and Air-Conditioning] HVAC and Water-Heating Equipment" (commonly referred to as the 2000 Screening Analysis)[12] summarizes this analysis. On January 12, 2001, DOE published a final rule for commercial HVAC and water heating equipment, which concluded that the 2000 Screening Analysis indicated a reasonable possibility of finding "clear and convincing evidence" that more stringent standards for PTACs and PTHPs "would be technologically feasible and economically justified and would result in significant additional conservation of energy." 66 FR 3336, 3349. Under EPCA, these are the criteria for DOE adoption of standards more stringent than those found in ASHRAE/IESNA Standard 90.1. (42 U.S.C. 6313(a)(6)(A)(ii)(II))

In addition, on March 13, 2006, DOE issued a Notice of Availability (NOA), in which DOE revised the energy savings analysis from the 2000 Screening Analysis. 71 FR 12634. DOE stated that, even though the revised analysis reduced the potential energy savings for PTACs and PTHPs that might result from more stringent standards than the efficiency levels specified in ASHRAE/IESNA Standard 90.1-1999, DOE believed that there was a possibility that clear and convincing evidence exists that more stringent standards were warranted. Therefore, DOE stated in the NOA that it was inclined to seek more stringent standard levels than the efficiency levels specified in ASHRAE/IESNA Standard 90.1-1999 for PTACs and PTHPs through a separate rulemaking. 71 FR 12639. On March 7, 2007, DOE issued a final rule stating that DOE had decided to explore more stringent efficiency levels than those in ASHRAE/IESNA

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

Standard 90.1–1999 for PTACs and PTHPs through a separate rulemaking. 72 FR 10038, 10044.

In January 2008, ASHRAE published ANSI/ASHRAE/IESNA Standard 90.1-2007, which reaffirmed the definitions and efficiency levels for PTACs and PTHPs in ASHRAE/IESNA Standard 90.1-1999. On October 7, 2008, DOE published a final rule amending energy conservation standards for PTACs and PTHPs (2008 final rule). 73 FR 58772. This 2008 final rule divided PTACs and PTHPs into two equipment classes – standard size and non-standard size. Prior DOE energy conservation standards for PTACs and PTHPs had not distinguished between standard and non-standard size units. Table II.1 shows the energy conservation standards for PTACs and PTHPs, as amended by the 2008 final rule. Compared to ASHRAE/IESNA Standard 90.1-1999, the standards in the 2008 final rule were identical for non-standard sized PTACs and PTHPs, but had steeper slopes for standard-size PTACs and PTHPs.

In October 2010, ASHRAE published ANSI/ASHRAE/IES Standard 90.1-2010, which reaffirmed the efficiency levels for non-standard size PTACs and PTHPs and increased the efficiency levels for standard size PTACs and PTHPs to match the DOE standards, effective as of October 8, 2012. Hence, DOE did not consider revision of PTAC and PTHP standards at that time.

On February 22, 2013, DOE published a notice of public meeting and availability of the framework document regarding energy conservation standards for PTACs and

PTHPs. 78 FR 12252. The public meeting sought input on DOE's planned analytical approach and identified several issues of particular interest to DOE for this rulemaking proceeding.

DOE received a number of comments from interested parties through the public meeting and written submissions. These commenters are summarized in Table II.3. DOE considered these comments in the preparation of the NOPR. Relevant comments, and DOE's responses, are provided in the appropriate sections of this document.

Table II.3. Interested Parties Providing Comments

Name	Abbreviation	Type*
Air-Conditioning, Heating and Refrigeration Institute	AHRI	IR
Appliance Standards Awareness Project	ASAP	EA
Appliance Standards Awareness Project, American Council for an Energy-Efficient Economy	ASAP, ACEEE (Joint Efficiency Advocates)	EA
Troy Abraham	TA	I
EBM-Papst Inc.	EBM-Papst	CS
General Electric	GE	M
Goodman Manufacturing Company, L.P.	Goodman	M
Ice Air, LLC	Ice Air	M
McQuay International (now Daikin Applied)	McQuay	M
Pacific Gas and Electric Company, Southern California Gas Company, San Diego Gas and Electric, Southern California Edison	PG&E, SCGC, SDG&E, SCE	U
Southern Company Services	SCS	U

*IR: Industry Representative; M: Manufacturer; EA: Efficiency/Environmental Advocate; CS: Component Supplier; I: Individual; U: Utility

Subsequently, on October 9, 2013, ASHRAE published ANSI/ASHRAE/IES Standard 90.1-2013, which reaffirmed the efficiency levels for standard size PTHPs and for nonstandard size PTACs and PTHPs, and which increased the cooling efficiency levels for standard size PTACs to equalize them with the cooling efficiency levels for standard size PTHPs, effective as of January 1, 2015. The issuance of ANSI/ASHRAE/IES 90.1-2013 triggered DOE's statutory obligation under 42 U.S.C. 6313(a)(6)(A) to promulgate an amended uniform national standard at those levels unless DOE determines that there is clear and convincing evidence supporting the adoption of more-stringent energy conservation standards than the ASHRAE levels. Because PTHPs are defined as a subset of PTACs,[13] the publication of ANSI/ASHRAE/IES Standard 90.1-2013 also triggered DOE to consider whether clear and convincing evidence supports a more-stringent standard than the ASHRAE levels for PTHPs, though the ASHRAE levels for PTHPs were not explicitly revised.

[13] EPCA defines a PTHP as "a packaged terminal air conditioner that utilizes reverse cycle refrigeration as its prime heat source and should have supplementary heat source available to builders with the choice of hot water, steam, or electric resistant heat." (42 U.S.C. 6311(10)(B)) Additionally, in its reverse engineering analysis, DOE observed that PTHPs are derivative designs of PTACs such that similar design changes for PTACs and PTHPs (e.g., more efficient compressors, more efficient motors, increased heat exchanger area, and improved air flow) are used to achieve higher efficiency levels.

III. General Discussion

A. Compliance Dates

There are several possible compliance dates for any amended standards for PTACs and PTHPs. These compliance dates vary depending on the triggering mechanism for DOE review (i.e., whether DOE is triggered by a revision to ASHRAE Standard 90.1 or by the "6-year look back" requirement), and the action taken (i.e., whether DOE is adopting ASHRAE Standard 90.1 levels or more-stringent levels). The discussion below explains the potential compliance dates as they pertain to the present rulemaking.

DOE performed the analyses in this rulemaking as if all customers were to purchase new equipment in the year that compliance with amended standards is required. Both PTAC and PTHP equipment fall under the EPCA directive that mandates DOE to publish a final rule amending the standard for this equipment 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 final rule publication date was 2015. EPCA also states that amended standards prescribed under this subsection shall apply to equipment 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) is currently projected to be 2018, and the date under clause (II) is also 2018.

However, ASHRAE adopted a revised ANSI/ASHRAE/IES Standard 90.1-2013, which increases minimum efficiency standards for PTACs and not for PTHPs, before DOE published the NOPR for this rulemaking. This action creates an exception to the aforementioned compliance requirements. The revision of the ANSI/ASHRAE/IES standard requires that the Federal standard for PTAC equipment become effective on or after a date which is two years after the effective date of the applicable minimum energy efficiency requirement in the amended ANSI/ASHRAE/IES standard. (42 U.S.C 6313(a)(6)(D)(i)) The date of issuance of the amended ANSI/ASHRAE/IES standard is currently projected to be January 1, 2015. Therefore, PTAC equipment, only, manufactured on or after January 1, 2017 will be required to meet the amended ANSI/ASHRAE/IES standard. However, if DOE adopts a uniform national standard more stringent than the amended ANSI/ASHRAE/IES Standard 90.1, equipment manufactured on or after a date which is four years after the date of final rule publication in the Federal Register must comply with the amended standard . (42 U.S.C 6313(a)(6)(D)) Therefore, both PTAC and PTHP equipment manufactured on or after January 1, 2019 would be required to meet the more stringent Federal standard.

Based on the above considerations, DOE used 2017 as the compliance year for PTAC equipment with a proposed efficiency level at the ANSI/ASHRAE/IES Standard 90.1-2013 minimum, and 2019 as the compliance year for PTAC and PTHP and equipment with proposed efficiency levels more stringent than that specified in ANSI/ASHRAE/IES Standard 90.1-2013.

For each equipment class for which DOE developed a potential energy savings analysis, Table III.1 exhibits the approximate compliance dates of an amended energy conservation standard.

Table III.1. Approximate Compliance Date of an Amended Energy Conservation Standard for Each Equipment Class

Equipment Class	Approximate Compliance Date for Adopting the Efficiency Levels in ASHRAE Standard 90.1-2013	Approximate Compliance Date for Adopting More Stringent Efficiency Levels than Those in ASHRAE Standard 90.1-2013
PTAC <7,000 Btu/h	01/2017	01/2019
PTAC ≥7,000 to ≤15,000 Btu/h	01/2017	01/2019
PTAC >15,000 Btu/h	01/2017	01/2019
PTHP <7,000 Btu/h	01/2019	01/2019
PTHP ≥7,000 to ≤15,000 Btu/h	01/2019	01/2019
PTHP >15,000 Btu/h	01/2019	01/2019

B. Equipment Classes and Scope of Coverage

When evaluating and establishing energy conservation standards, DOE divides covered equipment into equipment classes by the type of energy used or by capacity or other performance-related features that justifies a different standard. In making a determination whether a performance-related feature justifies a different standard, DOE must consider such factors as the utility to the customer of the feature and other factors DOE determines are appropriate. (42 U.S.C. 6295(q))

Existing energy conservation standards divide PTACs and PTHPs into twelve equipment classes based whether the equipment is an air conditioner or heat pump; the equipment's cooling capacity; and the equipment's wall sleeve dimensions, which fall into two categories:

- Standard size (PTAC or PTHP equipment with wall sleeve dimensions greater than or equal to 16 inches high, or greater than or equal to 42 inches wide)
- Non-standard size (PTAC or PTHP equipment with wall sleeve dimensions less than 16 inches high and less than 42 inches wide)

DOE is not considering amended energy conservation standards for non-standard size PTAC and PTHP equipment in this rulemaking because this equipment class represents a small and declining portion of the market, and due to a lack of adequate information to analyze non-standard size units. The shipments analysis conducted for the 2008 final rule projected that shipments of non-standard size PTACs and PTHPs would decline from approximately 30,000 units in 2012 (6.6% of the entire PTAC and PTHP market) to approximately 16,000 units in 2042 (2.4% of the entire PTAC and PTHP market).[14] McQuay (now Daikin Applied) commented that the installed base for non-standard PTAC and PTHP products is slowly declining as older buildings are demolished. McQuay also commented that non-standard PTAC and PTHP products are being produced by a very limited number of U.S. manufacturers, exclusively for

[14] See DOE's discussion regarding shipment projections for standard and non-standard PTAC and PTHP equipment and the results of shipment projections in the PTAC and PTHP energy conservation standard technical support document at: *http://www1.eere.energy.gov/buildings/appliance_standards/commercial/pdfs/ptac_pthp_tsd/chapter_10.pdf* (Chapter 10, Section 10.5).

replacement applications in older buildings. (McQuay, No. 10 at p. 2)[15] DOE believes McQuay's observations of the market are indicative of a steadily decreasing market share for non-standard-size PTACs and PTHPs, and thus bolsters the justification to eliminate analysis of non-standard-size equipment in the present rulemaking.

An analysis of energy savings for the volume of shipments of non-standard size products show that the national energy savings of non-standard size equipment at a reasonable efficiency level adopted is five-thousandths of one quad of savings. Such level of savings DOE considers negligible.

DOE has not been able to analyze and test non-standard sized PTACs and therefore the Department is proposing to maintain the non-standard size product classes but not subject them to amended minimum energy conservation standards.

Ice Air commented that there should be separate equipment categories for PTACs that use hydronic or gas-fired heat sources. Ice Air also commented that PTACs with hydronic heat or gas heat comprise a significant portion of the market for PTACs installed in high-rise buildings, and asked whether DOE is addressing the efficiency impacts of packaged terminal units with central hydronic systems as compared to units heated by electric heat or heat pumps. Ice Air commented that PTACs that use hydronic

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[15] A notation in the form "McQuay, No. 10 at p. 2" identifies a written comment: (1) Made by McQuay International (now Daikin Applied) ("McQuay"); (2) recorded in document number 10 that is filed in the docket of the PTAC energy conservation standards rulemaking (Docket No. EERE-2012-BT-STD-0029) and available for review at www.regulations.gov; and (3) which appears on page 2 of document number 10.

or gas-fired heat sources should receive a form of efficiency credit. (Ice Air, No. 9 at p. 1)

DOE understands that hydronic heat sources are often more efficient than electric resistance heaters or electric heat pumps, in terms of heat delivered versus primary energy consumed. DOE also understands that hydronic coils impose a pressure drop that may increase fan power consumption and reduce EER. DOE is concerned that this impact may lead manufacturers to eliminate hydronic heating options in PTACs and also lead to sales shifting from hydronic to electric resistance heating, a shift that would lead to increased overall HVAC energy use. Hence, DOE proposes to provide guidance in the future regarding which features (such as hydronic and steam heating systems) may be excluded from products that are tested.

C. Technological Feasibility

1. General

In each 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. DOE then determines which of those means for improving efficiency are technologically feasible. DOE considers technologies incorporated in commercially available products 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, or service; (2) adverse impacts on product utility or availability; and (3) adverse impacts on health or safety. Section IV.B of this document discusses the results of the screening analysis for PTACs and PTHPs, particularly the designs DOE considered, those it screened out, and those that are the basis for the TSLs in this rulemaking. For further details on the screening analysis for this rulemaking, see chapter 4 of the NOPR TSD.

After screening out or otherwise removing from consideration most of the technologies, the following technologies were identified for consideration in the engineering analysis: (1) improved compressor efficiency; (2) improved fan motor efficiency; (3) increased heat exchanger area; and (4) improved air flow and fan blade efficiency. To adopt standards for PTACs and PTHPs that are more stringent than the efficiency levels in ASHRAE Standard 90.1 as amended, DOE must determine, supported by clear and convincing evidence, that such standards are technologically feasible. (42 U.S.C. 6313(a)(6)(A)(ii)(II)) DOE has determined that the efficiency levels considered in this rulemaking are technologically feasible, because DOE has access to test reports showing the highest efficiency level was attainable in a commercially available model.

2. Maximum Technologically Feasible Levels

When DOE proposes to adopt an amended standard for a type or class of covered product, it must determine the maximum improvement in energy efficiency or maximum reduction in energy use that is technologically feasible for such product. (42 U.S.C. 6295(p)(1)) Accordingly, in the engineering analysis, DOE determined the maximum technologically feasible ("max-tech") improvements in energy efficiency for PTACs and PTHPs, using the design parameters for the most efficient products 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.5 of this proposed rule.

D. 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 expected compliance with amended standards (2019−2048).[16] The savings are measured over the entire lifetime of products purchased in the 30-year period.[17] 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

[16] DOE also presents a sensitivity analysis that considers impacts for equipment shipped in a 9-year period.

[17] In the past, DOE presented energy savings results for only the 30-year period that begins in the year of expected compliance. In the calculation of economic impacts, however, DOE considered operating cost savings measured over the entire lifetime of equipment 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.

consumption in the absence of amended mandatory energy conservation standards, and it considers market forces and policies that affect demand for more-efficient equipment.

DOE used its national impact analysis (NIA) spreadsheet model to estimate energy savings from amended standards for the equipment that is the subject of this rulemaking. The NIA spreadsheet model (described in section IV.H of this document) calculates energy savings in site energy, which is the energy directly consumed by equipment at the locations where it is used. For electricity, DOE reports national energy savings in terms of the savings in the energy that is used to generate and transmit the site electricity. To calculate this quantity, DOE derives annual conversion factors from the model used to prepare the Energy Information Administration's (EIA) Annual Energy Outlook (AEO).

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 51282 (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), and thus collectively presents a more complete picture of the impacts of energy efficiency standards. DOE's approach is based on the calculation of an FFC multiplier for each of the energy types used by covered equipment. For more information on FFC energy savings, see section IV.H.

2. Significance of Savings

Among the criteria that govern DOE's adoption of more stringent standards for PTACs and PTHPs than the amended levels in ASHRAE Standard 90.1, clear and convincing evidence must support a determination that the standards would result in ''significant'' energy savings. (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's estimates of the energy savings for each of the TSLs considered for this proposed rule for PTACs and PTHPs (presented in section V.B.3.a) provide evidence that the additional energy savings each would achieve by exceeding the corresponding efficiency levels in ANSI/ASHRAE/IES Standard 90.1–2013 are nontrivial. Therefore, DOE considers these savings to be ''significant'' as required by 42 U.S.C.6313(a)(6)(A)(ii)(II).

E. Economic Justification

1. Specific Criteria

EPCA provides seven factors to be evaluated in determining whether a more stringent standard for PTACs and PTHPs is economically justified. (42 U.S.C. 6313(a)(6)(B)(ii)) The following sections discuss how DOE has addressed each of those seven factors in this rulemaking.

a. Economic Impact on Manufacturers and Customers

In determining the impacts of an amended standard on manufacturers, 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 industry net present value (INPV), which values the industry on the basis of expected future cash flows; cash flows by year; changes in revenue and income; and other measures of impact, as appropriate. Second, DOE analyzes and reports the impacts on different types of manufacturers, including impacts on small manufacturers. Third, DOE considers the impact of amended standards on domestic manufacturer employment and manufacturing capacity, as well as the potential for amended 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 customers, measures of economic impact include the changes in LCC and payback period (PBP) associated with new or amended standards. These measures are discussed further in the following section. For customers 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 customers that may be affected disproportionately by a national standard.

b. Savings in Operating Costs Compared to Increase in Price

EPCA requires DOE to consider the savings in operating costs throughout the estimated average life of the covered equipment 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. 6295(o)(2)(B)(i)(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 equipment. To account for uncertainty and variability in specific inputs, such as equipment lifetime and discount rate, DOE uses a distribution of values, with probabilities attached to each value. For its analysis, DOE assumes that customers will purchase the covered equipment 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 customers 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 analysis is discussed in further detail in section IV.F.

c. Energy Savings

Although significant conservation of energy is a separate statutory requirement for imposing 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. 6295(o)(2)(B)(i)(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 evaluates standards that would not lessen the utility or performance of the considered equipment. (42 U.S.C. 6295(o)(2)(B)(i)(IV)) The standards proposed in this document will not reduce the utility or performance of the equipment under consideration in this rulemaking.

e. Impact of Any Lessening of Competition

EPCA directs DOE to consider any lessening of competition that is likely to result from energy conservation standards. It also directs the Attorney General of the United States (Attorney General) to determine the impact, if any, of any lessening of competition likely to result from a proposed standard and to transmit such determination to the Secretary within 60 days of the publication of a proposed rule, together with an analysis of the nature and extent of the impact. (42 U.S.C. 6313(a)(6)(B)(ii)(V)) DOE will transmit a copy of this proposed rule to the Attorney General with a request that the

Department of Justice (DOJ) provide its determination on this issue. DOE will address the Attorney General's determination in the final rule.

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)(VII)) 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 sectionV.B.6 of this document. DOE also reports estimates of the economic value of emissions reductions resulting from the considered TSLs, in section IV.L of this document.

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. 6295(o)(2)(B)(i)(VII)) No other factors were considered in this proposal.

2. Rebuttable Presumption

As set forth in 42 U.S.C. 6295(o)(2)(B)(iii), EPCA creates a rebuttable presumption that an energy conservation standard is economically justified if the additional cost to the customer 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 customers. 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 customers, manufacturers, the nation, and the environment, as required under 42 U.S.C. 6295(o)(2)(B)(i). 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 V.B.1.c of this proposed rule.

IV. Methodology and Discussion of Related Comments

This section addresses the analyses DOE has performed for this rulemaking with regard to PTACs and PTHPs. A separate subsection addresses each component of the analysis.

A. Market and Technology Assessment

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

1. Definitions of a PTAC and a PTHP

Section 340 of EPCA defines a "packaged terminal air conditioner" as "a wall sleeve and a separate unencased combination of heating and cooling assemblies specified by the builder and intended for mounting through the wall. It includes a prime source of refrigeration, separable outdoor louvers, forced ventilation, and heating availability by builder's choice of hot water, steam, or electricity." (42 U.S.C. 6311(10)(A)) EPCA defines a "packaged terminal heat pump" as "a packaged terminal air conditioner that utilizes reverse cycle refrigeration as its prime heat source and should have supplementary heat source available to builders with the choice of hot water, steam, or electric resistant heat." (42 U.S.C. 6311(10)(B)) DOE codified these definitions in 10 CFR 431.92 in a final rule issued October 21, 2004. 69 FR 61970.

2. Equipment Classes

When evaluating and establishing energy conservation standards, DOE generally divides covered equipment into equipment classes by the type of energy used or by capacity or other performance-related features that affect efficiency. Different energy conservation standards may apply to different equipment classes. (42 U.S.C. 6316(a); 42 U.S.C. 6295(q))

PTACs and PTHPs can be divided into various equipment classes categorized by physical characteristics that affect equipment efficiency. Key characteristics affecting the energy efficiency of the PTAC or PTHP are whether the equipment has reverse cycle heating (i.e., air conditioner or heat pump), the cooling capacity, and the physical dimensions of the unit. The existing Federal energy conservation standards for PTACs and PTHPs correspond to the efficiency levels in ANSI/ASHRAE/IES Standard 90.1-2010, as shown in Tables 4 and 5 of 10 CFR 431.97, dividing PTACs and PTHPs into twelve equipment classes based on these key characteristics. Table IV.1 shows the current equipment class structure.

AHRI and Goodman separately commented that the current equipment classes for PTACs have worked well in the past and do not need to be changed. (Goodman, Framework Public Meeting Transcript, No. 7 at p. 41) (AHRI, Framework Public Meeting Transcript, No. 7 at p. 41)[18] Goodman also commented that the current equipment classes are fair and representative of the market. (Goodman, No. 13 at p. 3) Accordingly, for this rulemaking, DOE is proposing to maintain the same equipment classes, as shown in Table IV.1. As previously described in section III.B, DOE is not considering amending the energy conservation standards of non-standard size PTAC and PTHP equipment in this rulemaking, because this equipment class represents a small and declining portion of the market, and because of a lack of adequate information available to analyze non-standard size units. As described in section III.B, Ice Air commented that there should be separate equipment categories for PTACs that use hydronic or gas-fired heat sources. (Ice Air, No. 9 at p. 1) DOE plans to provide guidance in the future regarding how to address features (such as hydronic or steam heating) which might require special treatment when testing this equipment.

[18] A notation in the form "Goodman, Framework Public Meeting Transcript, No. 7 at p. 41" identifies an oral comment that DOE received during the March 18, 2013, PTAC energy conservation standards framework public meeting, that was recorded in the public meeting transcript in the docket for the PTAC energy conservation standards rulemaking (Docket No. EERE-2012-BT-STD-0029), and is maintained in the Resource Room of the Building Technologies Program. This particular notation refers to a comment (1) made by Goodman during the public meeting; (2) recorded in document number 7, which is the public meeting transcript that is filed in the docket of this energy conservation standards rulemaking; and (3) which appears on page 41 of document number 7.

Table IV.1. Equipment Classes for PTACs and PTHPs

Equipment Class		
Equipment	**Category**	**Cooling Capacity**
PTAC	Standard Size*	< 7,000 Btu/h
		≥ 7,000 Btu/h and ≤ 15,000 Btu/h
		> 15,000 Btu/h
	Non-Standard Size**	< 7,000 Btu/h
		≥ 7,000 Btu/h and ≤ 15,000 Btu/h
		> 15,000 Btu/h
PTHP	Standard Size*	< 7,000 Btu/h
		≥7 ,000 Btu/h and ≤ 15,000 Btu/h
		> 15,000 Btu/h
	Non-Standard Size**	< 7,000 Btu/h
		≥ 7,000 Btu/h and ≤ 15,000 Btu/h
		> 15,000 Btu/h

* Standard size refers to PTAC or PTHP equipment with wall sleeve dimensions having an external wall opening greater than or equal to 16 inches high or greater than or equal to 42 inches wide, and a cross-sectional area greater than or equal to 670 square inches.
** Non-standard size refers to PTAC or PTHP equipment with existing wall sleeve dimensions having an external wall opening of less than 16 inches high or less than 42 inches wide, and a cross-sectional area less than 670 square inches.

3. Market Assessment

This market assessment describes the trade associations, manufacturers in the PTAC/PTHP industry, and the quantities and types of PTAC and PTHP equipment sold and offered for sale. The information DOE gathered serves as resource material throughout the rulemaking. The sections below provide an overview of the PTAC and PTHP market. For more detail on the PTAC and PTHP market, see chapter 3 of the NOPR TSD.

a. Trade Association

The Air-Conditioning, Heating, and Refrigeration Institute (AHRI), formerly referred to as ARI, is the trade association representing PTAC and PTHP manufacturers. ARI and the Gas Appliance Manufacturers Association (GAMA) merged to become AHRI on January 1, 2008.

AHRI develops and publishes technical standards for residential and commercial air-conditioning, heating, and refrigeration equipment using rating criteria and procedures for measuring and certifying equipment performance. The current Federal test procedure for PTACs and PTHPs incorporates by reference an AHRI standard – ANSI/AHRI/CSA 310/380-2004.[19] AHRI has developed a certification program that a number of manufacturers in the PTAC and PTHP industry have used to certify their equipment. Manufacturers certify their own equipment by providing AHRI with test data. Through the AHRI certification program, AHRI evaluates test data, determines if equipment conforms to ANSI/AHRI/CSA 310/380-2004, and verifies that manufacturer-reported ratings are accurate. AHRI also maintains the Directory of Certified Product Performance, which is a database of equipment ratings for all manufacturers who elect to participate in the program. DOE used AHRI's certification data, as summarized by the 2013 AHRI directory of certified PTACs and PTHPs, to examine the population of commercially available units and to screen units for inclusion in the engineering analysis.

AHRI commented that its database is a good source of information, as are the data provided on manufacturers' websites. (AHRI, Framework Public Meeting Transcript, No. 7 at p. 56) McQuay (now Daikin Applied) commented that only five of the 19 interested parties are AHRI members and that non-member catalog and website performance data

[19] DOE has incorporated by reference ANSI/AHRI/CSA Standard 310/380-2004 as the DOE test procedure at 10 CFR 431.97.

are not verified by an independent third party test facility. (McQuay, No. 10 at p. 1) McQuay commented further that DOE should use extreme caution when using non-AHRI member efficiency data. (McQuay, No. 10 at p. 2) DOE notes that the Department used AHRI database and manufacturer-provided data as initial screening criteria, and that an independent third party test facility used test procedure ANSI/AHRI/CSA 310/380-2004 to measure the efficiencies of all units used in the cost assessment analysis.

b. Manufacturers

DOE identified three large manufacturers of standard size PTAC and PTHP that represent more than 80 percent of the standard size market in terms of shipments. These three manufacturers include: General Electric (GE) Company, Amana,[20] and Daikin Applied[21]. Ten other manufacturers represent the remaining 20 percent of the standard size PTAC and PTHP market: Comitale National, Inc.; E-Air, LLC; Electrolux Home Products, Inc.; Friedrich Air Conditioning Company; Gree Electric Appliances of Zhuhai; Haier America; Heat Controller, Inc.; Islandaire; RetroAire; and YMGI Group, LLC.

DOE identified three major manufacturers of non-standard size PTAC and PTHP equipment: Daikin Applied, RetroAire, and Fedders Islandaire, Inc. These three manufacturers share the majority of the non-standard size PTAC and PTHP market. Other manufacturers of non-standard size units include: Air-Con International; Cold Point Corporation; Comitale National, Inc.; E-Air LLC; ECR International; Evergreen LLC; Heat Controller, Inc.; Ice Air LLC; International Refrigeration Products; Prem

[20] Amana is a trademark of Maytag Corporation and is used under license to Goodman Global, Inc.
[21] Daikin Applied (formally McQuay International) is a subsidiary of Daikin Industries, Ltd.

Sales LLC; Simon-Aire, Inc.; and YMGI Group LLC. All of the major manufacturers certify their standard-size equipment with AHRI and are included in the AHRI directory of certified products.

The standard size PTAC and PTHP market differs from the non-standard size PTAC and PTHP industry in that several of the manufacturers of standard size units are domestically owned with manufacturing facilities located outside of the United States. (In contrast, most non-standard size PTAC and PTHP production occurs in the United States.) Currently, there is only one major manufacturer of standard size PTAC and PTHP equipment manufacturing equipment in the United States. Several foreign-owned companies have recently entered the U.S. market for standard-sized PTACs and PTHPs.

Almost all of the manufacturers of non-standard size PTACs and PTHPs are domestically owned with manufacturing facilities located inside of the United States. The non-standard manufacturers tend to specialize in equipment solely for replacement applications. In addition, non-standard size manufacturers produce PTAC and PTHP equipment on a made-to-order basis. Unlike manufacturers of standard size equipment, there has not been an influx of foreign owned companies to sell non-standard size PTAC and PTHP equipment in the United States.

DOE takes into consideration the impact of amended energy conservation standards on small businesses. At this time, DOE has identified several small businesses in the PTAC and PTHP industry that fall under the Small Business Administration

(SBA)'s definition as having 750 employees or fewer. DOE identified at least 12 manufacturers that qualify as small businesses. The PTAC and PTHP small manufacturer subgroup is discussed in chapter 12 of the NOPR TSD and in section V.B.2 of this document.

c. Shipments

DOE reviewed data collected by the U.S. Census Bureau and AHRI to evaluate the annual PTAC and PTHP equipment shipment trends and the value of these shipments. The historical shipments data shown in Table IV.2 provides a picture of the market for PTAC and PTHP equipment. The historical shipments for PTACs and PTHPs are based on data provided by AHRI for the years 2003-2012.

Table IV.2. PTAC and PTHP Industry Estimated Shipment Data, 10-year Totals for 2003-2012, from AHRI (Standard size equipment)

Year	Total Shipments, Standard Size (Thousands of Units)	
	PTAC	PTHP
2003-2012	2,458	2,055

Using information gathered in manufacturer interviews, DOE estimates that about 90 percent of the shipments for PTACs and PTHPs are standard size units, while about 10 percent are non-standard size units.[22] AHRI did not provide a breakdown of shipment data by capacity; however, the cooling capacity with the highest number of models listed in the AHRI Directory of Certified Product Performance is 9,000 Btu/h.

[22] This estimated breakdown of 90% standard-size and 10% non-standard-size units is based on information obtained in manufacturer interviews. This updated estimate differs from the shipment projections from the 2008 PTAC rulemaking quoted in section III.B, which projected that non-standard units would comprise 6.6% of the market in 2014.

4. Technology Assessment

In the technology assessment, DOE uses information about existing and past technology options and prototype designs to help identify technologies that manufacturers could use to improve the efficiency of PTACs and PTHPs. This assessment provides the technical background and structure on which DOE bases its screening and engineering analyses. In surveying PTAC and PTHP technology options, DOE considered a wide assortment of equipment literature, information derived from the teardown analysis, information derived from the stakeholder interviews, and the previous DOE energy conservation standards rulemaking for air-conditioning products and equipment.

Table IV.3 presents the technology options that DOE identified in the Framework Document.[23]

[23] See DOE's discussion of technology options identified in the rulemaking framework document, available at: *http://www.regulations.gov/#!documentDetail;D=EERE-2012-BT-STD-0029-0002* (Section 3.3)

Table IV.3. Framework Document Technology Options

Compressor Improvements • Scroll Compressors • Variable-speed Compressors • Higher Efficiency Compressors
Complex Control Boards (fan motor controllers, digital "energy management" control interfaces, heat pump controllers)
Condenser and evaporator fan and fan motor improvements: • Higher Efficiency Fan Motors • Clutched Fan Motors (allows PTACs with a single motor to reduce power input in recirculation mode by disengaging the condenser fan)
Microchannel Heat Exchangers
Increased Heat Exchanger Area
Hydrophobic Material Treatment of Heat Exchangers (can improve repelling condensed water on evaporator coil)
Re-circuiting Heat Exchanger Coils
Improved Air Flow and Fan Design
Heat Pipes (enhances the evaporator coil dehumidification performance)
Corrosion Protection (helps prevent corrosion of coils and the resulting degradation of performance)
Thermostatic Expansion Valve

The framework document sought comment from interested parties on the technologies listed in Table IV.3, as well as other options that DOE had not listed. Several parties commented on the list of technologies. ASAP inquired whether microgroove heat exchangers are being considered as a potential technology. (ASAP, Framework Public Meeting Transcript, No. 7 at p. 42) DOE interpreted ASAP's comment to reference all heat exchangers with rifled interior tube walls. Goodman commented that DOE should add alternative refrigerants (such as HCFC-32), which could have single-digit improvement in efficiency. (Goodman, No. 13 at p. 3)

AHRI, Goodman, and SCS commented that proprietary designs should not be considered in establishing energy efficiency standards. (AHRI, Framework Public Meeting Transcript, No. 7 at p. 61) (Goodman, No. 13 at p. 5) (SCS, Framework Public

Meeting Transcript, No. 7 at p. 61) As noted in the framework document, DOE will not consider efficiency levels that can only be reached using proprietary designs. 78 FR 12252 (February 22, 2013). Although DOE does consider technologies that are proprietary, it does not consider efficiency levels that can only be reached through the use of proprietary technologies, which could allow a single manufacturer to monopolize the market (any such technologies are eliminated during the engineering analysis). 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.

Table IV.4 lists all of the potential technology options considered, including options listed in the Framework Document and options suggested in stakeholder comments, for improving energy efficiency of PTACs and PTHPs.

Table IV.4. Potential Technology Options for Improving Energy Efficiency of PTACs and PTHPs

Compressor Improvements • Scroll Compressors • Variable-speed Compressors • Higher Efficiency Compressors
Complex Control Boards
Condenser and evaporator fan and fan motor improvements: • Higher Efficiency Fan Motors • Clutched Motor Fans
Microchannel Heat Exchangers
Rifled Interior Heat Exchanger Tube Walls
Increased Heat Exchanger Area
Hydrophobic Material Treatment of Heat Exchangers
Re-circuiting Heat Exchanger Coils
Improved Air Flow and Fan Design
Heat Pipes
Corrosion Protection
Thermostatic Expansion Valve
Alternate Refrigerants (such as HCFC-32)

B. Screening Analysis

After DOE identified the technologies that might improve the energy efficiency of PTACs and PTHPs, DOE conducted a screening analysis. The purpose of the screening analysis is to evaluate the technologies that improve equipment efficiency to determine which technologies to consider further and which to screen out. DOE applied the following four screening criteria to determine which technologies are unsuitable for further consideration in the rulemaking (10 CFR part 430, subpart C, appendix A at 4(a)(4) and 5(b)):

1. Technological feasibility. DOE will consider technologies incorporated in commercial equipment or in working prototypes to be technologically feasible.

2. Practicability to manufacture, install, and service. If mass production and reliable installation and servicing of a technology in commercial equipment could be achieved on the scale necessary to serve the relevant market at the time the standard comes into effect, then DOE will consider that technology practicable to manufacture, install, and service.

3. Adverse impacts on product utility or product availability. If DOE determines a technology would have a significant adverse impact on the utility of the equipment to significant subgroups of customers, or would 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, it will not consider this technology further.

4. Adverse impacts on health or safety. If DOE determines that a technology will have significant adverse impacts on health or safety, it will not consider this technology further. (10 CFR part 430, subpart C, appendix A, 4(a)(4) and 5(b))

Technologies that pass through the screening analysis are referred to as "design options" in the engineering analysis. These four screening criteria do not include the propriety status of design options. As noted previously, DOE will only consider 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.

Details of the screening analysis are in chapter 4 of the NOPR TSD. In view of the above factors, DOE screened out the following design options:

Scroll Compressors

Scroll compressors use two interleaved scrolls (with one scroll fixed and one scroll orbiting without rotating) to compress refrigerant, and may operate at higher efficiencies than the rotary compressors typically used in PTAC and PTHP applications. Goodman commented that presently scroll compressors are only available for equipment with capacity over 1.5 tons refrigeration and the largest model of PTAC or PTHP has capacity of 1.25 tons refrigeration. (Goodman, No. 13 at p. 4)

Though scroll compressors are less common in the capacity range associated with PTAC and PTHP equipment (6,000 to 15,000 Btu/h), several companies manufacture scroll compressors from 9,000 Btu/h and up. However, DOE is not aware of scroll compressor models at these lower capacities that would fit in a PTAC cabinet and that are more efficient than the same capacity of rotary compressor. The rotary compressors found in reverse engineering of PTACs and PTHPs in the 15,000 Btu/h class had efficiency ratings from 9.8 to 10.6 EER. By comparison, scroll compressors of similar capacity are rated from 7.2 EER to 11.0 EER, but most are too tall to fit in a 16" PTAC cabinet.

As a result, DOE does not believe at this time that the use of scroll compressors would improve the efficiency of PTAC and PTHP units, given the size and capacity constraints of these units. For this reason, DOE did not consider scroll compressors further in the NOPR analyses.

Heat pipes

Under humid ambient conditions, using heat pipes to pre-treat the entering air from the conditioned space can improve the evaporator heat exchanger performance. Heat pipes increase the latent cooling capacity (i.e., moisture removal) of an air-conditioner. They do this by transferring heat from the air entering the evaporator to the air leaving the evaporator. This allows the evaporator air exit temperature to be significantly lower. Since the maximum possible moisture content of air increases with increasing temperature, this also means that the reduced-temperature air at the evaporator exit would have lower moisture content. The temperature of the air is then warmed by the post-evaporator portion of the heat pipe. Heat pipes generally shift some of the cooling capacity of the product from reduction of air temperature to reduction of humidity, but do not increase the cooling capacity of an evaporator. They impose additional pressure drop that the indoor fan must overcome, thus they do not improve EER of the equipment. Therefore, DOE screened out heat pipes as a design option for improving the energy efficiency of PTACs and PTHPs.

Alternate refrigerants

Nearly all PTAC and PTHP equipment is designed with R-410A as the refrigerant. The Environmental Protection Agency's (EPA's) Significant New Alternatives Policy (SNAP) Program evaluates and regulates substitutes for the ozone-depleting chemicals (such as air conditioning refrigerants) that are being phased out under the stratospheric ozone protection provisions of the Clean Air Act (CAA) (42

U.S.C. 7401 et seq.). The EPA's SNAP Program currently lists 23 acceptable alternatives for refrigerant used in the Household and Light Commercial Air Conditioning class of equipment (which includes PTAC and PTHP equipment). On July 9, 2014, the EPA issued a notice of proposed rulemaking proposing to list three flammable refrigerants as new acceptable substitutes, subject to use conditions, for refrigerant in the Household and Light Commercial Air Conditioning class of equipment. 79 FR 38811 (July 9, 2014)

Table IV.5 presents the list of potential substitute refrigerants (including refrigerants that are already approved and refrigerants that are proposed for approval) for use in new production in the Household and Light Commercial Air Conditioning class of equipment (which includes PTAC and PTHP equipment). DOE is not aware of any SNAP-approved refrigerants, or any refrigerants that have been proposed for SNAP approval, that are known to enable better efficiency than R-410A for PTAC and PTHP equipment.[24] Hence, DOE did not consider alternate refrigerants for further analysis.

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[24] Additional information regarding EPA's SNAP Program is available online at: http://www.epa.gov/ozone/snap/.

Table IV.5. Potential Substitutes for HCFCs in new Household and Light Commercial Air Conditioning Equipment

Substitutes Approved by EPA SNAP Program
HFC-134a
ISCEON-59, NU-22, R-417A
R-410A
R-410B
R-407C
R-507, R-507A
Ammonia Absorption
Evaporative Cooling
Desiccant Cooling
R-404A
R-125/134a/600a
RS-44
R-421A
R-422D
R-424A
R-125/290/134a/600a
R-422C
R-422B
KDD5, R-438A
R-434A
R-407A
R-437A
R-407F
Substitutes Proposed by EPA SNAP Program in NOPR issued July 9, 2014
HFC-32
Propane (R-290)
R-441A

DOE is aware of initial research with drop-in applications (where an alternate refrigerant replaces the existing refrigerant in a system that is optimized for the existing refrigerant) using R-32 in place of R-410A in a residential ducted split-system application. Initial research shows that, in this application, R-32 had a higher capacity and similar efficiency as R-410A, but its discharge temperatures and pressures were significantly higher.[25] This suggests that R-32 might show efficiency comparable to R-

[25] This research was published in the journal *ASHRAE* Transactions, at:

410A in PTAC and PTHP applications, and the research is inconclusive regarding whether R-32 will reduce energy use and/or by how much.

DOE is not aware of test results from the use of alternate refrigerants in PTAC- or PTHP-specific applications that have been optimized for alternate refrigerants. DOE requests feedback on the efficacy of alternative refrigerants in PTAC and PTHP equipment. This is identified as issue 1 in section VII.E, "Issues on Which DOE Seeks Comment."

Other Technologies Not Considered in the Engineering Analysis

Typically, energy-saving technologies that pass the screening analysis are evaluated in the engineering analysis. However, some technologies are not included in the analysis for other reasons, including: (1) available data suggest that the efficiency benefits of the technology are negligible; (2) data are not available to evaluate the energy efficiency characteristics of the technology; or (3) the test procedure and EER or COP metric would not measure the energy impact of these technologies. Accordingly, DOE eliminated the following technologies from consideration in the engineering analysis based upon these three additional considerations:

(1) Re-circuiting heat exchanger coils;

(2) Rifled interior tube walls;

(3) Microchannel heat exchangers;

(4) Variable speed compressors;

Biswas, Auvi; Barve, Atharva; Cremaschi, Lorenzo (2013). "An Experimental Study of the Performance of New Low Global Warming Potential (LGWP) Refrigerants at Extreme High Temperature Ambient Conditions in Residential AC Ducted Split Systems," *ASHRAE Transactions. 119*(1), special section p1.

(5) Complex control boards;

(6) Corrosion protection;

(7) Hydrophobic material treatment of heat exchangers;

(8) Clutched motor fans; and

(9) Thermostatic expansion valves.

Of these technologies, numbers 1 and 2 are used in baseline products, so no additional energy savings would be expected from their use. Information indicating efficiency improvement potential in PTACs and PTHPs is not available for technology number 3; DOE is not aware of substantiated performance data for PTAC operation with microchannels. Any potential energy savings of technologies 4 through 9 cannot be measured with the established energy use metrics (EER and COP) because those technologies are associated with part-load performance or long-term performance, which is not captured in the EER or COP metrics used for rating PTACs and PTHPs. AHRI commented that PTACs and PTHPs are generally operated at full load most of the time and that it is not common practice in the field to operate the units at part load. (AHRI, Framework Public Meeting Transcript, No. 7 at p. 36). DOE believes that the existing EER (full load) metric accurately reflects equipment efficiency during the year, and the PTAC test procedure revisions in progress at DOE are not expected to incorporate metrics that would account for part-load performance.

Further details of these eliminations are provided below.

Re-circuiting heat exchanger coils

Manufacturers of PTAC and PTHP heat exchangers may improve the heat transfer efficiency across the heat exchanger by rearranging the refrigerant's path through the various tubes inside the heat exchanger. Manufacturers can rearrange the refrigerant path by "re-circuiting" the heat exchanger, either by splitting the refrigerant path into new circuits or re-routing the existing circuits. One objective of re-circuiting is to optimally pair air and refrigerant at every location in the heat exchanger. Goodman commented that PTACs are a very mature industry and that engineers have already optimized the number of circuits for heat transfer. (Goodman, No. 13 at p. 4) DOE agrees with Goodman's comment and has eliminated heat exchanger re-circuiting as a potential avenue for efficiency improvement.

Rifled interior tube walls

Heat exchangers using rifled interior tube walls (also known as "microgrooves") to enhance energy efficiency by improving heat transfer across the heat exchanger. With this technology, the internal face of heat exchanger tubes is rifled with small grooves that increase the interior surface area of the tube and induce turbulence in the refrigerant flow. Goodman commented that microgroove technology is currently being used in baseline products today. (Goodman, Framework Public Meeting Transcript, No. 7 at p. 43) Having observed that microgroove technology was used in the majority of baseline units disassembled in the engineering analysis, DOE agrees with Goodman's comment and has eliminated microgroove technology as a potential avenue for efficiency improvement.

Microchannel heat exchangers

Microchannel heat exchangers in air conditioning applications are heat exchangers in which refrigerant fluid flows in confinements with typical hydraulic diameter of less than one millimeter. Microchannels may improve unit efficiency by improving the efficiency of heat transfer between refrigerant and air across the heat exchanger. Currently, microchannel heat exchangers are in the development stage for applications in PTACs and PTHPs. Goodman commented that microchannel heat exchangers are not proven for consistent, field installed product performance in PTACs and PTHPs. (Goodman, No. 13 at p. 4) ASAP and ACEEE commented that a 2011 scouting report by ENERGY STAR identified microchannel heat exchangers as technology option for improving efficiency. (ASAP and ACEEE, No. 14 at p. 2) DOE notes that the engineering analysis was based on efficiency levels and, because units with microchannels are not commercially available, DOE cannot estimate the increase manufacturing costs associated with whatever efficiency gains such units may offer.

ASAP and ACEEE also commented that Zess, Inc. Industries indicates that it is developing an integrated microchannel refrigeration system for applications in PTAC units as high as 15 EER. (ASAP and ACEEE, No. 14 at p. 2) DOE does not have information regarding these prototype tests that would allow assessment of the efficiency improvements associated with the specific microchannel technology and/or the costs associated with its implementation in a unit that achieves 15 EER.

Complex control boards

Digital energy management control interfaces can reduce annual energy consumption of PTACs or PTHPs by optimizing the operation of the equipment under varying operating conditions. For example, they may allow operation managers in hotels to remotely turn off or change temperature set points of units throughout a building. Goodman commented that it offers controls that turn equipment off when the conditioned room is vacant. (Goodman, Framework Public Meeting Transcript, No. 7 at p. 103) Although this technology can reduce peak energy demand and also reduce overall energy consumption throughout the year, it does not increase the EER under the ARI 310/380-2004 test procedure because of the steady state test conditions.

Ebm-papst commented that some electronic motor speed controllers can cause structure-borne noise, and that a better controller could potentially avoid the need for sound attenuation, which would in turn free up the air path for increased air-side efficiency. (Ebm-papst, No. 8 at p. 1) DOE notes that sound attenuation between the outdoor and indoor sides of the unit is typically put in place to isolate noise originating from the compressor and from airflow across the outdoor heat exchanger. DOE acknowledges that well-designed motor controls can reduce motor noise at low frequencies, but DOE expresses doubt that this noise reduction would decrease the need to insulate against sound transmission from the compressor and outdoor heat exchanger. Goodman commented that complex control boards do not help steady state performance. (Goodman, No. 13 at p. 4) For the reasons noted above, DOE did not consider this technology in the engineering analysis.

Corrosion protection

Corrosion protection materials used in PTACs and PTHPs also protect the equipment and prolong its use when it is exposed to chemically harsh operating conditions. Goodman commented that corrosion protection has a negative impact on steady state operation to some degree, but that corrosion protection may help improve the overall unit performance over several years of operation. (Goodman, No. 13 at p. 4) Although it is beneficial for the unit to be corrosion protected, corrosion protection does not improve the EER as measured by the test procedure. Therefore, DOE did not consider this technology in the engineering analysis.

Hydrophobic material treatment of heat exchangers

Material treatment of heat exchangers (also known as "plasma treatment") allows the condensate that forms on the fins to be repelled and drained faster than on non-treated heat exchangers. Hydrophobic treatments are used to reduce mineral build up and corrosion on heat exchanger fins, to improve long-term performance of the unit. Although enhanced long term performance is beneficial, this treatment is not shown to improve the EER as per the test procedure.

Thermostatic expansion valves

Goodman commented that thermal expansion valves (TXVs) help with seasonal performance but not steady state performance. (Goodman, No. 13 at p. 4) DOE notes that TXVs would not improve the energy efficiency of PTACs or PTHPs, because there is only one condition for which the fixed-orifice expansion device can be optimized. DOE has insufficient information to know whether testing at multiple conditions would make sufficient efficiency improvement to justify the increased test time.

After screening out or otherwise removing from consideration most of the technologies, the technologies that DOE identified for consideration in the engineering analysis are included in Table IV.6. See chapter 3 of the TSD for additional detail on the technology assessment and the technologies analyzed.

Table IV.6. Design Options Retained for Engineering Analysis

Compressor Improvements • Higher Efficiency Compressors[26]
Condenser and evaporator fan and fan motor improvements: • Higher Efficiency Fan Motors
Increased Heat Exchanger Area
Improved Air Flow and Fan Design

These remaining technology options from Table IV.6 are briefly described below.

Higher efficiency compressors

Manufacturers can improve the energy efficiency of PTAC and PTHP units by incorporating more efficient components, such as high efficiency compressors, into their designs. Goodman commented that it is not aware of any compressors currently available or in development by its suppliers that are significantly more efficient than what it is are using now. (Goodman, No. 13 at p. 4) In private interviews, other manufacturers

[26] Currently, all PTAC and PTHP manufacturers incorporate rotary compressors into their equipment designs. DOE is referring to rotary compressors throughout this document unless specifically noted.

indicated that they are already using the most efficient compressor that meets their other design specifications (such as size and noise). DOE observed in reverse engineering analysis that PTAC and PTHP manufacturers use several different compressor models with a wide range of efficiency ratings.

Higher efficiency fan motors

Manufacturers of baseline PTACs and PTHPs use permanent split capacitor (PSC) fan motors due to their modest cost, compact design, and durability. More efficient PSC motor designs applicable to PTACs and PTHPs are an ongoing industry challenge, and there been no substantial gain in efficiency in recent years. PSC manufacturers can improve efficiency by increasing the surface area of rotors, although the overall size of the PSC motor would increase in that case. PTACs and PTHPs have size constraints that do not allow an increase in motor size to a level which would have a significant impact on energy efficiency. DOE believes any further gains in PSC fan motor efficiency will be difficult to achieve, and has thus eliminated improvement of PSC fan motors as a potential avenue for efficiency improvement.

Besides PSC-based fan motors, PTAC and PTHP original equipment manufacturers (OEMs) can choose to implement permanent magnet (PM) motors. Such motors typically offer higher efficiencies than PSC-based fan motors, but these improvements come with increased costs for the motor unit and control hardware. Several manufacturers use DC motors in their higher-efficiency PTAC and PTHP models.

Increased heat exchanger area

Manufacturers of PTACs and PTHPs increase unit efficiency by increasing heat exchanger size, either through elongating the face of the heat exchanger or increasing the number of heat exchanger tube rows. Goodman commented that PTACs (as predominantly a replacement product) are constrained by the dimensions of the equipment that they are replacing. (Goodman, No. 13 at p. 4) Because of these constraints on unit size, there are limits to the efficiency gains that may be had by increasing heat exchanger size. At least one manufacturer has incorporated bent heat exchanger coils to increase the heat exchanger face area while remaining inside the standard size unit constraints.

Improved air flow and fan design

Manufacturers of PTACs and PTHPs currently use several techniques to shape and direct airflow inside PTAC and PTHP units. Ebm-papst commented that DOE should consider "optimization of air path to minimize airflow impedance" as a technology option. Ebm-papst also commented that fine tuning the fan blade design should be considered as a technology option. Ebm-papst further commented that DOE should look into optimization of the fan selection such that the peak fan efficiency is close to the performance demands of the PTAC and enhances the air path in the unit. DOE accepts that manufacturers may improve unit efficiency by selecting appropriate fan and motor combinations. (Ebm-papst, No. 8 at p. 1)

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 cost-benefit calculations for individual customers, 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 has identified three basic methods for developing cost-efficiency curves: (1) the design-option approach, which provides the incremental costs of adding design options to a baseline model that will 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.

In the framework document, DOE proposed using an efficiency-level approach combined with a cost-assessment approach to determine the cost-efficiency relationship, and requested comments on this approach. 78 FR 12252 (February 22, 2013). Goodman commented that the process for DOE to calculate manufacturer costs is adequate, but that the cost analysis from previous rulemakings tended to be on the low side (even for a large manufacturer), and that aggressively low cost estimates could impact small businesses. (Goodman, No. 13 at p. 5) To gather information on the particular and unique costs that small businesses face, DOE interviewed a number of small business manufacturers of PTACs and PTHPs. In these interviews, DOE asked questions regarding the component costs, manufacturing costs, and cost of conversion to manufacturing PTAC and PTHP equipment with higher efficiency. Data collected from these interviews with small businesses were used in the engineering analysis and subsequent cost-benefit calculations.

In the absence of recommended alternative approaches, DOE conducted this engineering analysis for PTACs and PTHPs using a combination of the efficiency level and cost-assessment approaches. More specifically, DOE identified the efficiency levels for the analysis based on the range of rated efficiencies of PTAC and PTHP equipment in the AHRI database. DOE selected PTAC and PTHP equipment that was representative of the market at different efficiency levels, then purchased, tested, and reverse engineered the selected equipment. DOE used the cost-assessment approach to determine the manufacturing production costs for PTAC and PTHP equipment across a range of efficiencies from the baseline to max-tech efficiency levels.

Where feasible, DOE selected models for reverse engineering with low and high efficiencies from a given manufacturer, at both representative cooling capacity levels and for both PTACs and PTHPs. The methodology used to perform reverse engineering analysis and derive the cost-efficiency relationship is described in chapter 5 of the TSD.

2. Equipment Classes Analyzed

DOE developed its engineering analysis for the six equipment classes associated with standard-size PTACs and PTHPs listed in Table IV.1. As discussed in section III.B of this NOPR, DOE did not consider amending energy efficiency standards for non-standard size equipment classes because of their low and declining market share and because of a lack of adequate information to analyze these units.

For PTACs and PTHPs, DOE focused its analysis on high-shipment-volume cooling capacities spanning the range of available equipment. Based on manufacturer interviews,[27] DOE found that the majority of shipments are in the classes with cooling capacity between 7,000 Btu/h to 15,000 Btu/h (see chapter 3 of the TSD for more details on the shipments data). In the framework document, DOE indicated that it would analyze units at the representative capacity of 9,000 Btu/h, and requested comments on this approach. 78 FR 12252 (February 22, 2013). Goodman commented that a 15,000 Btu/h model should be included in the comparison, specifically because 15,000 Btu/h is the largest typical capacity for PTAC and PTHP equipment, and which is space-constrained by its standard dimensions. (Goodman, No. 13 at p. 5) Hence, DOE conducted analysis for two representative cooling capacities: 9,000 Btu/h and 15,000 Btu/h. The 9,000 Btu/h

[27] DOE conducted interviews with high- and low-volume PTAC and PTHP manufacturers, and collected information regarding shipments of PTACs and PTHPs at different cooling capacity levels.

cooling capacity represents the greatest number of models available on the market,[28] while the 15,000 Btu/h cooling capacity represents the greater technical hurdles for efficiency improvement, considering the size constraints of standard-size PTACs and PTHPs.

The selection of two cooling capacities for analysis, at 9,000 Btu/h and 15,000 Btu/h, allowed DOE to investigate the slope of the energy efficiency capacity relationship. For the purposes of conducting the analyses, DOE believes that the results from the two representative cooling capacities can be extrapolated to the entire range of cooling capacities for each equipment class. DOE developed the cost-efficiency curves based on these representative cooling capacities of standard-size units. For the PTAC and PTHP equipment classes with a cooling capacity greater than or equal to 7,000 Btu/h and less than or equal to 15,000 Btu/h, the energy efficiency equation characterizes the relationship between the EER of the equipment and cooling capacity (i.e., EER is a function of the cooling capacity of the equipment) in which EER decreases as capacity increases. For all cooling capacities less than 7,000 Btu/h and all cooling capacities greater than 15,000 Btu/h, the EER is calculated based on the energy efficiency equation for 7,000 Btu/h or 15,000 Btu/h, respectively.

3. Cost Model

DOE developed a manufacturing cost model to estimate the manufacturing production cost (MPC) of PTACs and PTHPs. The cost model is a spreadsheet model

[28] DOE found the cooling capacity of 9,000 Btu/h to have the highest number of models available based on data in the 2013 AHRI Directory and the ACEEE database of equipment.

that converts the materials and components in the bills of materials (BOMs) for PTAC and PTHP equipment 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 estimates on the basis of five-year averages (from 2006 to 2011). The cost of transforming the intermediate materials into finished parts is estimated based on current industry pricing. Further details on the manufacturing cost analysis are provided in chapter 5 of the TSD.

Developing the cost model involved disassembling various PTACs and PTHPs, analyzing the materials and manufacturing processes, and estimating the costs of purchased components. In addition to disassembling various PTACs and PTHPs, manufacturers provided DOE supplemental component cost data for various PTAC and PTHP equipment. DOE reported the MPCs in aggregated form to maintain confidentiality of sensitive component data. DOE obtained input from stakeholders on the MPC estimates and assumptions to confirm accuracy. DOE used the cost model for all of the representative cooling capacities within the PTAC and PTHP equipment classes. Chapter 5 of the TSD provides details and assumptions of the cost model.

4. Baseline Efficiency Level

The engineering analysis estimates the incremental costs for equipment with efficiency levels above the baseline in each equipment class. For the purpose of the engineering analysis, DOE used the engineering baseline EER as the starting point to build the cost efficiency curves. As discussed in section III.A, ANSI/ASHRAE/IES Standard 90.1-2013 was issued in the course of this rulemaking, and this revised Standard 90.1-2013 amended standard levels for PTACs, raising standards by 1.8% above the Federal minimum energy conservation standards for PTACs. DOE is obligated either to adopt those standards developed by ASHRAE or to 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)). For the purposes of calculating energy savings over the ANSI/ASHRAE/IES standard, DOE identified the ANSI/ASHRAE/IES Standard 90.1-2013 as the baseline efficiency level.[29]

The baseline efficiency levels for each equipment class are presented below in Table IV.7.

Table IV.7. Baseline Efficiency Levels

Equipment Type	Equipment Class	Baseline Efficiency Equation	Cooling Capacity	Baseline Efficiency Level
PTAC	Standard Size	EER = 14.0 – (0.300 x Cap†/1000)	9,000 Btu/h	11.3 EER
			15,000 Btu/h	9.5 EER
PTHP	Standard Size	EER = 14.0 – (0.300 x Cap†/1000)	9,000 Btu/h	11.3 EER
			15,000 Btu/h	9.5 EER

† Cap means cooling capacity in Btu/h at 95ºF outdoor dry-bulb temperature.

[29] DOE's estimates of potential energy savings from an amended energy conservation standard are further discussed in section IV.H.

5. Incremental Efficiency Levels

DOE examined performance data of standard size PTACs and PTHPs published in the AHRI Directory of Certified Product Performance (AHRI Directory) and on manufacturers' websites in order to select efficiency levels for consideration in the rulemaking. AHRI commented that its database is a good source of information as well as data from manufacturers' websites. (AHRI, Framework Public Meeting Transcript, No. 7 at p. 56) McQuay commented that website performance data are not verified by an independent third party test facility. (McQuay, No. 10 at p. 1) DOE used website-published data as an initial screening mechanism to select units for reverse engineering; a third party test facility verified the actual performance of the units selected for analysis.

In the framework document, DOE proposed to analyze levels for standard size PTACs that are 4%, 8%, 12%, 16%, and 20% more efficient than the amended PTAC standards that became effective on October 8, 2012. Goodman commented that the proposed increment of 4% for standard size PTACs is too large because PTAC equipment is space-constrained, and Goodman's opinion, 2% or 3% increments would be more reasonable. (Goodman, No. 13 at p. 5) DOE acknowledges Goodman's comment, but believes that an increment of 4% is appropriate to maintain a manageable number of efficiency levels spanning the range of efficiency from the 2012 PTAC standard to the max-tech level of 20% above the 2012 PTAC standard.

After extensive unit testing, DOE revised the maximum technology level from 20% above 2012 PTAC standard stated in the framework document down to 18% above the 2012 PTAC standard.[30] The maximum efficiency level, at 18% above the standards that became effective on October 8, 2012, coincides with the maximum efficiency level observed in the market for standard size PTACs and PTHPs. DOE has independent test data to verify that one PTHP unit demonstrated a cooling efficiency at this "max tech" level. Although the rated efficiencies of PTACs without reverse cycle heating extend only up to the 16% efficiency level, DOE expects that such equipment should be able to attain the same cooling mode efficiencies as PTHPs.

DOE analyzed levels for standard size PTACs that are 1.8%, 4%, 8%, 12%, 16%, and 18% more efficient than the amended PTAC standards that became effective on October 8, 2012. AHRI commented that there is an addendum to ANSI/ASHRAE/IES Standard 90.1-2010 which amends the efficiency standards for standard size PTACs. (AHRI, No. 11 at p. 4) Separately, AHRI commented that the amended efficiency level should be included in DOE's analysis. (AHRI, Framework Public Meeting Transcript, No. 7 at p. 101) Since DOE received these comments, this addendum prescribing new efficiency standards for standard-size PTACs was integrated into ANSI/ASHRAE/IES Standard 90.1-2013. DOE selected the first efficiency level of 1.8% to align with the amended ANSI/ASHRAE/IES Standard 90.1-2013 efficiency level for PTACs. Each of the remaining levels is represented by a percentage increase above the EER value of the PTAC standards that became effective on October 8, 2012.

[30] DOE announced in the framework document for this rulemaking that it planned to consider the maximum efficiency level equal to 20% above the 2012 PTAC standard, because DOE observed a unit rated at that level in the 2013 AHRI Directory of Certified Product Performance. 78 FR 12252. Since issuing the framework document, DOE has acquired and tested many units rated at high efficiency levels. Having completed these observations, DOE believes that a the highest performing standard size PTAC or PTHP unit on the market can achieve an efficiency of 18% above the 2012 PTAC cooling standard.

For the heating efficiency of PTHPs, DOE did not develop a cost-efficiency curve separately to represent the cost of improving COP. Rather, DOE correlated the COP associated with each efficiency level with the efficiency level's EER based on COP and EER ratings from the AHRI database. DOE established a representative curve based on this data to obtain a relationship for COP in terms of EER. DOE used this relationship to select COP values corresponding to each efficiency level. This approach takes into consideration the fact that a PTHP's EER and COP are related and cannot be independently analyzed, while basing the analysis on a representative average relationship between the two efficiency metrics. To determine the typical relationship between EER and COP, DOE examined the entire database of rated equipment and determined a relationship based on the EER and COP ratings of the collective body of certified PTAC and PTHP equipment.

PG&E, SCGC, SDG&E, and SCE commented that DOE should use caution in drawing conclusions based on a relationship between EER and COP ratings, as this may decrease overall efficiency of the unit. Their joint comment states that, depending on the climate zone and operating cycle of a given unit, there may be instances where trading off COP for higher EER results in greater operating efficiency overall. (PG&E, SCGC, SDG&E, SCE, No. 12 at p. 3) DOE did not observe any instances of standard size equipment manufacturers producing different PTHP models for different climate zones. DOE notes that regional standards are not being considered in this rulemaking.

The efficiency levels for each equipment class that DOE considered for the NOPR analyses are presented in Table IV.8. The percentages associated with efficiency levels (ELs) indicate the percentage above the current Federal standard for PTACs.

Table IV.8. Incremental Efficiency Levels for Standard Size PTACs and PTHPs

Equipment Type	Cooling Capacity	Efficiency Levels (Percentages relative to 2012 PTAC ECS)						
		Current Federal PTAC ECS*	**EL1, Baseline, 1.8%****	**EL2, 4%**	**EL3, 8%**	**EL4, 12%**	**EL5, 16%**	**EL6, 18% (MaxTech)**
PTAC	All, EER	13.8 - (0.300 x Cap†)	14.0 - (0.300 x Cap†)	14.4 - (0.312 x Cap†)	14.9 - (0.324 x Cap†)	15.5 - (0.336 x Cap†)	16.0 - (0.348 x Cap†)	16.3 - (0.354 x Cap†)
	9,000 Btu/h	11.1 EER	11.3 EER	11.5 EER	12.0 EER	12.4 EER	12.9 EER	13.1 EER
	15,000 Btu/h	9.3 EER	9.5 EER	9.7 EER	10.0 EER	10.4 EER	10.8 EER	11.0 EER
Equipment Type	**Cooling Capacity**	--	**Baseline, 1.8%****	**EL1, 4%**	**EL2, 8%**	**EL3, 12%**	**EL4, 16%**	**EL5, 18% (MaxTech)**
PTHP	All, EER	--	14.0 - (0.300 x Cap†)	14.4 - (0.312 x Cap†)	14.9 - (0.324 x Cap†)	15.5 - (0.336 x Cap†)	16.0 - (0.348 x Cap†)	16.3 - (0.354 x Cap†)
	All, COP	--	3.7 - (0.052 x Cap†)	3.8 - (0.058 x Cap†)	4.0 - (0.064 x Cap†)	4.1 - (0.068 x Cap†)	4.2 - (0.070 x Cap†)	4.3 - (0.073 x Cap†)
	9,000 Btu/h	--	11.3 EER 3.2 COP	11.5 EER 3.3 COP	12.0 EER 3.4 COP	12.4 EER 3.5 COP	12.9 EER 3.6 COP	13.1 EER 3.6 COP
	15,000 Btu/h	--	9.5 EER 2.9 COP	9.7 EER 2.9 COP	10.0 EER 3.0 COP	10.4 EER 3.1 COP	10.8 EER 3.2 COP	11.0 EER 3.2 COP

* This level represents the current Federal minimum for PTAC equipment.
** This level represents the ANSI/ASHRAE/IES Standard 90.1-2013 minimum for PTAC and PTHP equipment. This level is used as the Baseline for PTAC and PTHP equipment since DOE is required to, at a minimum, adopt the ASHRAE levels as the Federal standard. (42 U.S.C. (a)(6)(A)(ii)(I)). DOE notes that the Baseline level is 1.8% higher than current Federal ECS for PTAC equipment, but is equivalent to current Federal ECS for PTHP equipment. For PTAC equipment, the Baseline level is also termed EL1, and is compared to current Federal ECS in the energy savings analysis in section V.B.3.a.
† Cap means cooling capacity in thousand Btu/h at 95ºF outdoor dry-bulb temperature.

ASAP commented that DOE should evaluate at least one level higher than the current market max efficient unit to arrive a true max-tech unit. (ASAP, Framework

Public Meeting Transcript, No. 7 at p. 56-57) Separately, ASAP and ACEEE stated that DOE must capture the "true max-tech level," which they claim would be higher that what is currently represented by the market. (ASAP and ACEEE, No. 14 at p. 3) DOE acknowledges the comments from ASAP and ACEEE and confirms that this analysis tested the most efficient standard size PTAC and PTHP units available. These units include all of the efficiency-improving design options listed in the screening analysis (increased heat exchanger area, high efficiency compressors, and high efficiency fan motors). DOE does not believe it is feasible to include efficiency levels higher than this, as achieving efficiency levels higher than max tech would depend upon design options that have not been demonstrated in the market for PTACs and PTHPs.

6. Equipment Testing and Reverse Engineering

As discussed above, for the engineering analysis, DOE specifically analyzed representative capacities of 9,000 Btu/h and 15,000 Btu/h to develop incremental cost-efficiency relationships. DOE selected twenty different models representing PTAC and PTHP equipment types at 9,000 Btu/h and 15,000 Btu/h capacities. DOE selected the models as a representative sample of the market at different efficiency levels.
DOE based the selection of units for testing and reverse engineering on the efficiency data available in the AHRI certification database. Details of the key features of the tested units are presented in chapter 5 of the NOPR TSD.

DOE conducted testing on each unit according to the DOE test procedure outlined at 10 CFR 431.96, which incorporates by reference AHRI Standard 310/380-2004 (which itself incorporates ASHRAE Standard 16 and ASHRAE Standard 58). DOE then conducted physical teardowns on each test unit to develop a manufacturing cost model and to evaluate key design features (e.g., improved heat exchangers, compressors, fans/fan motors).

7. Cost-Efficiency Results

The results of the engineering analysis are reported as a set of cost-efficiency data (or "curves") in the form of MPC (in dollars) versus EER, which form the basis for other analyses in the NOPR. DOE created cost-efficiency curves for the two representative cooling capacities within the two standard-size equipment classes of PTACs and PTHPs, as discussed in section IV.C.3, above. DOE developed the incremental cost-efficiency results shown in Table IV.9 for each representative cooling capacity. These cost results are incremented from a baseline efficiency level equivalent to the ANSI/ASHRAE/IES Standard 90.1-2013. Details of the cost-efficiency analysis are presented in chapter 5 of the NOPR TSD.

Table IV.9. Incremental Manufacturing Production Costs (MPC) for Standard Size PTACs and PTHPs

Equipment Type	Cooling Capacity	Efficiency Levels					
		EL1, Baseline*	**EL2**	**EL3**	**EL4**	**EL5**	**EL6**
PTAC	9,000 Btu/h	$0.00	$4.44	$13.08	$22.41	$32.45	$37.73
	15,000 Btu/h	$0.00	$4.26	$15.93	$30.97	$49.38	$59.86
		Baseline*	**EL1**	**EL2**	**EL3**	**EL4**	**EL5**
PTHP	9,000 Btu/h	$0.00	$4.44	$13.08	$22.41	$32.45	$37.73
	15,000 Btu/h	$0.00	$4.26	$15.93	$30.97	$49.38	$59.86

* This level represents the ANSI/ASHRAE/IES Standard 90.1-2013 minimum for PTAC and PTHP equipment. This level is used as the Baseline since DOE is required to, at a minimum, adopt the ASHRAE levels as the Federal standard. (42 U.S.C. (a)(6)(A)(ii)(I)). DOE notes that the Baseline level is 1.8% higher than current Federal ECS for PTAC equipment, but is equivalent to current Federal ECS for PTHP equipment. For PTAC equipment, the Baseline level is also termed EL1.

D. Markups to Determine Equipment Price

The markups analysis develops appropriate markups in the distribution chain to convert the estimates of manufacturer selling price (MSP) derived in the engineering analysis to customer prices. ("Customer" refers to purchasers of the equipment being regulated.) DOE calculates overall baseline and incremental markups based on the equipment markups at each step in the distribution chain. 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.

DOE developed supply chain markups in the form of multipliers that represent increases above MSP and include distribution costs. DOE applied these markups to the MSPs it developed in the engineering analysis, and then added sales taxes to arrive at the equipment prices for baseline and higher efficiency equipment. See chapter 6 of the TSD for additional details on markups.

In the 2008 Final Rule, DOE identified four distribution channels for PTACs and PTHPs, as shown in Table IV.10, to describe how the equipment passes from the manufacturer to the customer. 73 FR 58772. In the new construction market, the manufacturer sells the equipment directly to the customer through a national account. In the replacement market, the manufacturer sells to a wholesaler, who sells to a mechanical contractor, who in turn sells the equipment to the customer or end user. In the third distribution channel, used in both the new construction and replacement markets, the manufacturer sells the equipment to a wholesaler. The wholesaler sells the equipment to a mechanical contractor, who sells it to a general contractor, who in turn sells the equipment to the customer or end user. In the fourth distribution channel, also used in both the new construction and replacement markets, the manufacturer sells the equipment to a wholesaler, who directly sells to the purchaser. DOE used these same distribution channels for the NOPR.

Table IV.10. Distribution Channels for PTAC and PTHP Equipment

	Channel 1	**Channel 2**	**Channel 3**	**Channel 4**
	Manufacturer (through national accounts)	Manufacturer	Manufacturer	Manufacturer
		Wholesaler	Wholesaler	Wholesaler
			Mechanical Contractor	Mechanical Contractor
				General Contractor
	Customer	Customer	Customer	Customer

In the 2008 Final Rule, DOE also estimated percentages of the total sales in the new construction and replacement markets for each of the four distribution channels, as shown in Table IV.11. Commenting on the framework document, Goodman stated that the distribution channels from the 2008 rulemaking are still applicable today. (Goodman, No. 13 at p. 5) Accordingly, DOE used the same shares of the market for the NOPR. However, DOE updated the distribution of equipment to the new construction and replacement markets by using the ratio of projected new construction shipments to total shipments in the compliance year for PTAC equipment. DOE requests comment regarding the selected channels and distribution of shipments through the channels. This is identified as issue 2 in section VII.E, "Issues on Which DOE Seeks Comment."

Table IV.11. Share of Market by Distribution Channel for PTAC and PTHP Equipment

Distribution Channel	New Construction	Replacement
Wholesaler-Customer	30%	15%
Wholesaler-Mech Contractor-Customer	0%	25%
Wholesaler-Mech Contractor-General Contractor-Customer	38%	60%
National Account	32%	0%
Total	100%	100%

For each of the steps in the distribution channels presented above, DOE estimated a baseline markup and an incremental markup. DOE defines a baseline markup as a multiplier that converts the MSP of equipment with baseline efficiency to the customer purchase price for that equipment. An incremental markup is defined as the multiplier to convert the incremental increase in MSP of higher efficiency equipment to the incremental customer purchase price for that equipment. Both baseline and incremental markups are independent of the efficiency levels of the PTACs and PTHPs.

DOE developed the markups for each step of the distribution channels based on available financial data. DOE utilized updated versions of the following data sources: (1) the Heating, Air Conditioning & Refrigeration Distributors International 2012 Profit Report[31] to develop wholesaler markups; (2) the Air Conditioning Contractors of

[31] "2012 Profit Report," Heating Air Conditioning & Refrigeration Distributors International. February 2012. Available online at: www.hardinet.org/Profit-Report

America's (ACCA) 2005 Financial Analysis for the HVACR Contracting Industry[32] and U.S. Census Bureau economic data[33] to develop mechanical contractor markups; and (3) U.S. Census Bureau economic data for the commercial and institutional building construction industry to develop general contractor markups.[34] DOE estimated an average markup for sales through national accounts to be one-half of the markup for the wholesaler-to-customer distribution channel. DOE determined this markup for national accounts on an assumption that the resulting national account equipment price must fall somewhere between the MSP (i.e., a markup of 1.0) and the customer price under a typical chain of distribution (i.e., a markup of wholesaler, mechanical contractor, or general contractor).

The overall markup is the product of all the markups (baseline or incremental markups) for the different steps within a distribution channel. Replacement channels include sales taxes, which were calculated based on State sales tax data reported by the Sales Tax Clearinghouse.

E. Energy Use Analysis

The energy use analysis provides estimates of the annual unit energy consumption (UEC) of PTAC and PTHP equipment at the considered equipment classes and efficiency

[32] "2005 Financial Analysis for the HVACR Contracting Industry," Air Conditioning Contractors of America. 2005.
[33] "Plumbing, Heating, and Air-Conditioning Contractors. Sector 23: 238220. Construction: Industry Series, Preliminary Detailed Statistics for Establishments, 2007," U.S. Census Bureau. 2007.
[34] "2007 Economic Census, Construction Industry Series and Wholesale Trade Subject Series," U.S. Census Bureau. Available online at https://www.census.gov/newsroom/releases/archives/construction_industries/2009-07-27_economic_census.html

levels. The annual UECs are used in subsequent analyses including the LCC, PBP, and National Energy Savings (NES).

Stakeholders commented on the data sources for UEC data. AHRI stated that the methodology used by the ASHRAE 90.1 Committee to estimate energy savings was satisfactory and should be used in this rulemaking. (AHRI, No. 7 at p. 69) Goodman, however, commented that it does not have significant concerns with the energy use analysis performed in the 2008 rulemaking. (Goodman, No. 13 at p. 5) Since the inputs, software, and methodology of the energy use analysis in the 2008 rulemaking was vetted among the stakeholders and there were no comments on the deficiency of the same, DOE used the results of the whole-building simulation performed in the 2008 rulemaking for the source of UEC data. However, DOE wishes to address certain stakeholder concerns, as described below.

AHRI commented that new requirements for minimum air filter effectiveness finalized in 2013 for ASHRAE Standard 62.1 would increase pressure drop and increase fan power. (AHRI, No. 11 at p. 4) Goodman echoed AHRI's concern. (Goodman, No. 13 at p. 6) In response, DOE notes that a simulation- and field-based study found that the extent of the impact on energy consumption due to the change in filter effectiveness at the levels finalized is less than 1%.[35] DOE does not expect such an improvement to impact outputs significantly enough to warrant a change to the value of the filter pressure drop.

[35] Walker, I.S., et al., "System Effects of High Efficiency Filters in Homes," Lawrence Berkeley National Laboratory, LBNL-6144E, 2013.

To estimate the UEC for each equipment class of PTAC and PTHP, DOE began with the cooling UECs for PTACs and the combined cooling and heating UECs for PTHPs utilized in the 2008 standards rulemaking. 73 FR 58772. The cooling and heating UECs for PTHPs were split, assuming equal cooling energy use for PTACs and PTHPs. In addition, DOE adjusted the base-year UECs to account for changes in climate (i.e., heating degree-days and cooling degree-days) between 2008 and 2013, based on a typical meteorological year (TMY) hourly weather data set (referred to as TMY2) and an updated TMY3 data set.

Where identical efficiency levels and cooling capacities were available, DOE used the cooling or heating UEC directly from the previous rulemaking. For additional efficiency levels, DOE scaled the cooling UECs based on interpolations between EERs and scaled the heating UECs based on interpolations between COPs, both at a constant cooling capacity. Likewise, for additional cooling capacities, DOE scaled the UECs based on interpolations between cooling capacities at a constant EER.

For the LCC and PBP analyses, UECs were determined for the representative cooling capacities of 9,000 Btu/h and 15,000 Btu/h for which cost-efficiency curves were provided, as discussed in section IV.C.7. For the NES, UECs were determined for the cooling capacities of 7,000 Btu/h, 9,000 Btu/h, and 15,000 Btu/h for which aggregate shipments were provided by AHRI, as highlighted in section IV.G. National UEC estimates for PTACs and PTHPs for the LCC and PBP analyses, and the NES, are described in detail in chapter 8 of the TSD.

F. Life Cycle Cost and Payback Period Analyses

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

The LCC is the total customer 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 customer discount rates. The PBP is the estimated amount of time (in years) it takes customers 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 standard by the change in annual operating cost (normally lower) that results from the standard.

For any given efficiency level, DOE analyzed these impacts for PTAC and PTHP equipment starting in the compliance years as set for in section V.B.1.a by calculating the change in customers' LCCs likely to result from higher efficiency levels compared with the ASHRAE baseline efficiency levels for the PTAC and PTHP equipment classes discussed in the engineering analysis.

DOE conducted the LCC and PBP analyses for the PTAC and PTHP equipment classes using a spreadsheet model developed in Microsoft Excel. When combined with Crystal Ball (a commercially available software program), the LCC and PBP model generates a Monte Carlo simulation to perform the analyses by incorporating uncertainty and variability considerations in certain of the key parameters as discussed below. Inputs to the LCC and PBP analysis are categorized as: (1) inputs for establishing the total installed cost and (2) inputs for calculating the operating expense. Results of the LCC and PBP analyses were applied to other equipment classes through linear scaling of the results by the cooling capacity of the equipment class.

The following sections contain brief discussions of comments on the inputs and key assumptions of DOE's LCC and PBP analysis and explain how DOE took these comments into consideration. They are also described in detail in chapter 8 of the NOPR TSD.

1. Equipment and Installation Costs

The equipment costs faced by purchasers of PTAC and PTHP equipment are derived from the MSPs estimated in the engineering analysis and the overall markups estimated in the markups analysis.

To develop an equipment price trend for the NOPR, DOE derived an inflation-adjusted index of the producer price index (PPI) for "all other miscellaneous refrigeration and air-conditioning equipment" from 1990-2013.[36] Although the inflation-adjusted index shows a declining trend from 1990 to 2004, data since 2008 have shown a flat-to-slightly rising trend. Given the uncertainty as to which of the trends will prevail in coming years, DOE chose to apply a constant price trend (2013 levels) for each efficiency level in each equipment class for the NOPR.

For installation costs, DOE used a specific cost from RS Means[37] for PTACs and PTHPs and linearly scaled the cost according to the cooling capacities of the equipment classes.

2. Unit Energy Consumption

The calculation of annual per-unit energy consumption at each considered efficiency level and capacity is described in section IV.E.

3. Electricity Prices and Electricity Price Trends

DOE determined electricity prices for PTAC and PTHP users based on tariffs from a representative sample of electric utilities. 69 FR 45481-82. Since air-conditioning loads are strongly peak-coincident, regional marginal prices were developed from the tariff data and then scaled to approximate 2013 prices. This approach calculates energy expenses based on actual commercial building marginal electricity prices that customers

[36] "Producer Price Indexes," Bureau of Labor Statistics (BLS). 2014. Available online at www.bls.gov/ppi/
[37] RS Means Company, Inc. RS Means Mechanical Cost Data 2013. 2013. Kingston, MA

are paying.[38]

The Commercial Buildings Energy Consumption Survey completed in 1992 (CBECS 1992) and in 1995 (CBECS 1995) provides monthly electricity consumption and demand for a large sample of buildings. DOE used these values to help develop usage patterns associated with various building types. Using these monthly values in conjunction with the tariff data, DOE calculated monthly electricity bills for each building. The average price of electricity is defined as the total electricity bill divided by total electricity consumption. From this average price, the marginal price for electricity consumption was determined by applying a 5 percent decrement to the average CBECS consumption data and recalculating the electricity bill. Using building location and the prices derived from the above method, a marginal price was determined for each region of the U.S.

The tariff-based prices were updated to 2013 using the commercial electricity price index published in the AEO (editions 2009 through 2012). An examination of data published by the Edison Electric Institute[39] indicates that the rate of increase of marginal and average prices is not significantly different, so the same factor was used for both pricing estimates. DOE projected future electricity prices using trends in average U.S. commercial electricity price from AEO 2013. [40]

[38] Coughlin, K., C. Bolduc, R. Van Buskirk, G. Rosenquist and J. E. McMahon, "Tariff-based Analysis of Commercial Building Electricity Prices." Lawrence Berkeley National Laboratory. LBNL-55551. 2008.
[39] "EEI Typical Bills and Average Rates Report (bi-annual, 2007-2012)," Edison Electric Institute, Washington, DC.2012.
[40] "Annual Energy Outlook 2013," U.S. Energy Information Administration. May, 2013. Available online at http://www.eia.gov/forecasts/archive/aeo13/index.cfm.

Goodman commented on the need to consider the impact of peak loads on various parts of the analyses. (Goodman, No. 13 at p. 5) DOE is aware that cooling loads are peaking loads, which may be subject to demand charges. DOE's tariff-based electricity prices reflect demand charges.

For further discussion of electricity prices, see chapter 8 of the NOPR TSD.

4. Repair Costs

Repair costs are associated with repairing or replacing components that have failed. The cost of the material and labor in each incident is covered by extended warranties, which are service contracts that can be purchased, and the repair cost can be estimated from annualization of a contract's total price. DOE utilized manufacturer- and vendor-provider extended warranty price data to estimate annual repair costs. DOE assumed that any routine or minor repairs are included in the annualized maintenance costs. Repair costs were linearly scaled by cooling capacity to apply to all equipment classes.

Goodman commented that repair costs are dependent on the specific type of equipment. (Goodman, No. 7 at p. 77) The price data were disaggregated by equipment category, enabling determination of specific repair costs for PTACs and PTHPs.

Goodman also commented that repair costs are typically higher for more efficient products. (Goodman, No. 7 at p. 77) DOE incorporated the cost of a major repair as a means of estimating repair costs by efficiency level. This resulted in repair costs that vary in direct proportion with the price of the equipment, which is a reasonable proxy for efficiency.

5. Maintenance Costs

Maintenance costs are costs associated with general maintenance of the equipment (e.g., checking and maintaining refrigerant charge levels and cleaning heat-exchanger coils). Goodman commented that maintenance costs would depend on the specific type of equipment. (Goodman, No. 7 at p. 77) For PTACs, DOE utilized estimates of annual maintenance cost from the previous rulemaking; the values were adjusted to current material and labor rates. For PTHPs, DOE scaled the adjusted estimate of PTAC maintenance costs with the ratio of PTHP to PTAC annualized maintenance costs from RS Means data.[41] Since maintenance tasks do not change with efficiency level, DOE does not expect maintenance costs to scale with efficiency level. Maintenance costs were linearly scaled by cooling capacity to apply to all equipment classes.

6. Lifetime

Equipment lifetime is the age at which the equipment is retired from service. In the 2008 Final Rule, DOE used a median equipment lifetime of 10 years and a maximum lifetime of 20 years based on a retirement function. 73 FR 58772, 58789 (October 7,

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[41] RS Means Company, Inc. *RSMeans Online.* (Last accessed March 26, 2013.) <http://www.rsmeansonline.com>

2008). In the framework document, DOE stated its intention to use the same median and maximum equipment lifetime in the present rulemaking. AHRI noted in a comment it submitted prior to the publication of the October 7, 2008 Final Rule that the 11-year payback period from the previous rulemaking was longer than the actual life of the equipment, indicating that the value of the lifetime statistics in the present rulemaking too may be greater than the years of actual operation. (AHRI, No. 11 at p. 3) Likewise, Ice Air commented that the lifespan for PTACs and PTHPs with refrigerant-to-air heat transfer technology commonly purchased for commercial use should be 6-7 years based on its conversations with major hotel chains, and the lifespan for hydronic PTACs is 12-20+ years. (Ice Air, No. 9 at p. 1) SCS similarly commented that while equipment may last 20 years, equipment often will be replaced en masse, such as in hotels where a set of equipment is replaced if failures begin to occur often. (SCS, No. 7 at p. 81)

Since DOE accounted for the vintage of each unit in addition to the average age of the stock, the retirement function was updated to allow the vintage of each unit as an input. Thereby, DOE updated the shape and scale factors so that the retirement function can be used to track individual failures for determination of replacement shipments. The details of utilizing the retirement function can be found in chapter 9 of the NOPR TSD.

Additionally, DOE acknowledges that there is some uncertainty regarding the lifetime of PTAC and PTHP equipment, but in the absence of data to substantiate the statements by the stakeholders, it chose to retain the median equipment lifetime of 10 years with a maximum lifetime of 20 years for this NOPR. DOE will consider any data that may be provided in its preparation of the final rule.

7. Discount Rate

The discount rate is the rate at which future expenditures are discounted to estimate their present value. The cost of capital commonly is used to estimate the present value of cash flows to be derived from a typical company project or investment. Most companies use both debt and equity capital to fund investments, so the cost of capital is the weighted-average cost to the firm of equity and debt financing. DOE uses the capital asset pricing model (CAPM) to calculate the equity capital component, and financial data sources to calculate the cost of debt financing.

DOE estimated the cost of capital of companies that purchase PTAC and PTHP equipment. The types of companies that DOE used are large hotel/motel chains, independent hotel/motel, assisted living/health care, and small office. More details regarding DOE's estimates of customer discount rates are provided in chapter 8 of the NOPR TSD.

SCS suggested that in determining discount rates DOE should focus on franchise owners who are purchasing the equipment. (SCS, No. 7 at p. 81) DOE believes that franchise owners would generally fall into the company categories listed above.

8. Base Case Efficiency Distribution

For the LCC analysis, DOE analyzes the considered efficiency levels relative to a base case (i.e., the case without amended energy efficiency standards). This analysis requires an estimate of the distribution of equipment efficiencies in the base case (i.e., what customers would have purchased in the compliance year in the absence of amended standards). DOE refers to this distribution of equipment energy efficiencies as the base case efficiency distribution.

DOE reviewed the AHRI certified products directory[42] for relevant equipment classes to determine the distribution of efficiency levels for commercially-available models within each equipment class analyzed in this NOPR. DOE bundled the efficiency levels into efficiency ranges and determined the percentage of models within each range. To estimate the change between the present and the compliance year, DOE applied a slightly increasing efficiency trend, as explained in section IV.H.

The distribution of efficiencies in the base case for each equipment class can be found in Table IV.12 and Table IV.13 below.

[42] See www.ahridirectory.org/ahriDirectory/pages/home.aspx.

Table IV.12. Base Case Efficiency Market Shares for Packaged Terminal Air Conditioning Equipment (2019)

PTAC < 12,000 Btu/h Cooling Capacity		PTAC ≥ 12,000 Btu/h Cooling Capacity	
EER	Market Share	EER	Market Share
11.1-11.29	0.0%	9.3-9.49	0.0%
11.3-11.49	43.6%	9.5-9.69	25.8%
11.5-11.99	24.3%	9.7-9.99	34.8%
12.0-12.39	29.5%	10.0-10.39	34.7%
12.4-12.89	2.1%	10.4-10.79	2.7%
12.9-13.09	0.5%	10.8-10.99	1.4%
≥13.1	0.0%	≥11.0	0.7%

Table IV.13. Base Case Efficiency Market Shares for Packaged Terminal Heat Pump Equipment (2019)

PTHP < 12,000 Btu/h Cooling Capacity		PTHP ≥ 12,000 Btu/h Cooling Capacity	
EER	Market Share	EER	Market Share
11.3–11.49	48.5%	9.5–9.69	58.2%
11.5–11.99	8.9%	9.7–9.99	0.0%
12.0–12.39	30.2%	10.0–10.39	32.5%
12.4–12.89	12.4%	10.4–10.79	7.9%
12.9–13.09	0.0%	10.8–10.99	1.4%
≥13.1	0.0%	≥11.0	0.0%

9. Payback Period Inputs

The payback period is the amount of time it takes the customer to recover the additional installed cost of more efficient equipment, compared to baseline equipment, through energy cost savings. Payback periods are expressed in years. Payback periods that exceed the life of the equipment mean that the increased total installed cost is not recovered in reduced operating expenses.

The inputs to the PBP calculation are the increase in the total installed cost of the equipment to the customer for each efficiency level and the annual operating cost savings for each efficiency level. The PBP calculation uses the same inputs as the LCC analysis, except that discount rates are not needed.

10. Rebuttable-Presumption Payback Period

EPCA establishes 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 applicable, water) savings during the first year that the customer will receive as a result of the standard, as calculated under the test procedure in place for that standard. (42 U.S.C. 6295(o)(2)(B)(iii) and 42 U.S.C. 6316(a)) For each considered efficiency level, DOE 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, and multiplying that amount by the average energy price forecast for the year in which compliance with the amended standards would be required.

G. Shipments Analysis

DOE uses projections of equipment shipments for PTACs and PTHPs together 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 developed 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. Based off the equipment stock and calibrated model, DOE calculated shipments intended for new construction and replacement applications. The sum of new construction and replacement shipments is the total shipments.

DOE determined the distribution of total shipments among the equipment classes using shipments data by equipment class provided by AHRI for the previous PTAC and PTHP rulemaking. 73 FR 58772.

New construction shipments were calculated using projected new construction floor space of healthcare, lodging, and small office buildings from AEO 2013 and historical PTAC and PTHP saturation in new buildings, which was calculated by dividing historical shipments by historical new construction floor space. Due to unrepresentative market conditions during the financial crisis of 2008-2010, DOE used historical data from its previous analysis to determine the value for the PTAC and PTHP saturation that was used for each year of the analysis period. DOE then projected shipments based on the product of the historical saturation and AEO's projected floor space.

Replacement shipments equal the number of units that fail in a given year. DOE used a retirement function in the form of a Weibull distribution with inputs based on lifetime values from the LCC analysis to estimate the number of units of a given age that fail in each year. When a unit fails, it is removed from the stock and a new unit is replaced in its stead. Replacement shipments account for the largest portion of total shipments.

McQuay commented that non-AHRI PTAC manufacturers are not subject to report their shipment information, and this missing portion of the market should be calculated. (McQuay, No. 10 at p. 1) DOE is not aware of any data that would allow it to account for shipments by non-AHRI PTAC manufacturers. The Department also believes that such shipments represent a small fraction of total shipments. DOE requests comment regarding and data supporting the expected number of shipments that are unreported. This is identified as issue 3 in section VII.E, "Issues on Which DOE Seeks Comment."

Goodman commented that if the annual payback period is not in the low single digits, customers will be more likely to repair equipment rather than replace it with a higher efficiency product. (Goodman, No. 13 at p. 6) DOE recognizes that for any inoperable equipment, there exists a decision to repair or to replace. Given that repair generally would involve a new compressor, which is costly, and could also entail a new coil, DOE believes that equipment replacement would be more financially appealing than a major repair to most decision makers. Thus, for the NOPR DOE used the same shipments projections for the base case (assuming no amended standards) and each standards case.

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

TSD.

H. National Impact Analysis – National Energy Savings and Net Present Value Analyses

The purpose of the NIA is to estimate aggregate impacts of potential energy conservation standards from a national perspective, rather than from the customer perspective represented by the LCC and PBP analysis. Impacts that DOE reports include the national energy savings (NES) from potential standards, the net present value (NPV) of the total commercial customer costs, and the savings that are expected to result from amended 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 customer costs and savings from each TSL.[43] 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 customer benefits for each equipment class over the lifetime of equipment sold from 2019 through 2048.

For the NIA, DOE considered the following equipment classes for which DOE received shipments data:

[43] 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.

- PTAC: <7,000 Btu/h cooling capacity, ≥7000 and ≤15000 Btu/h cooling capacity, and ≥15000 Btu/h cooling capacity; and
- PTHP: <7,000 Btu/h cooling capacity, ≥7000 and ≤15000 Btu/h cooling capacity, and ≥15000 Btu/h cooling capacity.

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. DOE calculated energy savings in each year relative to a base case, defined as DOE adoption of the efficiency levels specified by ANSI/ASHRAE/IES Standard 90.1-2013. DOE also calculated energy savings from adopting efficiency levels specified by ANSI/ASHRAE/IES Standard 90.1-2013 compared to the EPCA base case.

To develop the national NPV of customer benefits from potential energy conservation standards, DOE calculates annual energy expenditures and annual equipment expenditures for the base case and the standards cases. DOE calculated such customer benefits in each year relative to the base case (ANSI/ASHRAE/IES Standard 90.1-2013). DOE calculates annual energy expenditures from annual energy consumption by incorporating forecasted energy prices, using shipment projections and average energy efficiency projections. DOE calculates annual equipment expenditures by multiplying the price per unit times the projected shipments. The aggregate difference each year between energy bill savings and increased equipment expenditures is the net savings or net costs.

Given the uncertainty about future equipment prices, DOE chose to apply a constant price trend (2013 levels) for each efficiency level in each equipment class.

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. To estimate a base-case efficiency trend, DOE started with the base-case efficiency distribution described in section IV.F.8. For the equipment classes that were not covered in the LCC analysis, DOE used the same source (i.e., the AHRI Directory of Certified Product Performance) to estimate the base-case efficiency distribution. Then, DOE applied the trend from 2012 to 2035 that was used in the commercial unitary air conditioner Advance Notice of Proposed Rulemaking (ANOPR), which estimated an increase of approximately 1 EER every 35 years.[44] 69 FR 45460 (July 29, 2004). DOE used this same trend in the standards-case scenarios, when seeking to ascertain the impact of amended standards. DOE, however, assumed for PTACs that a gradual replacement of equipment at the Federal minimum with equipment at the ASHRAE minimum occurs over 10 years after the first year of expected compliance. DOE requests comment regarding and data supporting the selected efficiency trend. This is identified as issue 4 in section VII.E, "Issues on Which DOE Seeks Comment."

The base case efficiency distributions in 2019 for the considered PTAC and PTHP equipment classes can be found in Table IV.14 and Table IV.15.

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[44] See DOE's technical support document underlying DOE's July 29, 2004 ANOPR. (Available at: http://www.regulations.gov/#!documentDetail;D=EERE-2006-STD-0103-0078).

Table IV.14. Base Case Efficiency Market Shares in 2019 for Packaged Terminal Air Conditioning Equipment

PTAC < 7000 Btu/h Cooling Capacity		PTAC ≥ 7000 to ≤ 15000 Btu/h Cooling Capacity		PTAC ≥ 15000 Btu/h Cooling Capacity	
EER	Market Share	EER	Market Share	EER	Market Share
11.7	0%	11.1	0%	9.3	0%
11.9	0%	11.3	38%	9.5	65%
12.2	63%	11.5	29%	9.7	17%
12.6	37%	12.0	29%	10.0	18%
13.1	0%	12.4	3%	10.4	0%
13.6	0%	12.9	1%	10.8	0%
13.8	0%	13.1	0%	11.0	0%

Table IV.15. Base Case Efficiency Market Shares in 2019 for Packaged Terminal Heat Pump Equipment

PTHP < 7000 Btu/h Cooling Capacity		PTHP ≥ 7000 to ≤ 15000 Btu/h Cooling Capacity		PTHP ≥ 15000 Btu/h Cooling Capacity	
EER	Market Share	EER	Market Share	EER	Market Share
11.9	0%	11.3	0%	9.5	0%
12.2	85%	11.5	64%	9.7	74%
12.6	15%	12.0	26%	10.0	26%
13.1	0%	12.4	10%	10.4	0%
13.6	0%	12.9	1%	10.8	0%
13.8	0%	13.1	0%	11.0	0%

To estimate the impact that amended energy conservation standards may have in the first year of compliance, DOE uses a "roll-up" scenario 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. Tables showing the distribution of efficiencies in the base case and the standards cases for each equipment class can be found in chapter 10 of the NOPR TSD.

Using the distribution of efficiencies in the base case and in the standards cases for each equipment class analyzed in the NOPR, DOE calculated market-weighted average efficiency values. The market-weighted average efficiency value represents the average efficiency of the total units shipped at a specified amended standard level. The market-weighted average efficiency values for the base case and the standards cases for each efficiency level analyzed within the equipment classes is provided in chapter 10 of the NOPR TSD.

DOE converted the site electricity consumption and savings to primary energy (power sector energy consumption) using annual conversion factors derived from the AEO 2013 version of the National Energy Modeling System (NEMS). Cumulative energy savings are the sum of the NES for each year in which equipment shipped during 2019 to 2048 continues to operate.

DOE has historically presented NES in terms of primary energy savings. On August 18, 2011, DOE published a final statement of policy in the Federal Register announcing 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. After evaluating the approaches discussed in the August 18, 2011 document, 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). Therefore, DOE used the NEMS model to conduct the FFC analysis. The approach used for this NOPR, and the FFC multipliers that were applied, are described in appendix 10-B of the NOPR TSD.

I. Customer Subgroup Analysis

In analyzing the potential impacts of new or amended standards on commercial customers, DOE evaluates impacts on identifiable groups (i.e., subgroups) of customers that may be disproportionately affected by a national standard. AHRI stated that hotels and motels would be viable candidates for user subgroups. (AHRI, No. 7 at p. 91) For the NOPR, DOE evaluated impacts on a subgroup consisting of independently-operating lodging businesses using the LCC and PBP spreadsheet model. To the extent possible, it utilized inputs appropriate for this subgroup.

The commercial customer subgroup analysis is discussed in detail in chapter 11 of the NOPR TSD.

J. Manufacturer Impact Analysis

1. Overview

DOE performed an MIA to estimate the financial impact of amended energy conservation standards on manufacturers of PTACs and PTHPs, 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 product characteristics, impacts on particular subgroups of firms, and important market and product trends. The complete MIA is outlined in chapter 13 of the NOPR TSD.

DOE conducted the MIA for this rulemaking in three phases. In Phase 1 of the MIA, DOE conducted structured, detailed interviews with a representative cross-section of manufacturers and prepared a profile of the PTAC and PTHP industry. During manufacturer interviews, DOE discussed engineering, manufacturing, procurement, and financial topics to identify key issues or concerns and to inform and validate assumptions used in the GRIM. See section IV.J.2 for a description of the key issues manufacturers raised during the interviews.

DOE used information obtained during these interviews to prepare a profile of the PTAC and PTHP industry, including a manufacturer cost analysis. Drawing on financial analysis performed as part of the 2008 energy conservation standard for PTACs and PTHPs, as well as feedback obtained from manufacturers, DOE derived financial inputs for the GRIM (e.g., sales, general, and administration (SG&A) expenses; research and development (R&D) expenses; and tax rates). DOE also used public sources of information, including company SEC 10-K filings,[45] corporate annual reports, the U.S. Census Bureau's Economic Census,[46] and Hoover's reports,[47] to develop the industry profile.

In Phase 2 of the MIA, DOE prepared an industry cash-flow analysis to quantify the potential impacts of an amended energy conservation standard on manufacturers of PTACs and PTHPs. In general, 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. To quantify these impacts, DOE used the GRIM to perform a cash-flow analysis for the PTAC and PTHP industry using financial values derived during Phase 1.

In Phase 3 of the MIA, DOE evaluated subgroups of manufacturers that may be disproportionately impacted by amended energy conservation standards or that may not be represented accurately 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 two subgroups for separate impact analyses: (1) manufacturers with production assets; and (2) small businesses.

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[45] U.S. Securities and Exchange Commission. *Annual 10-K Reports.* Various Years. <http://www.sec.gov>
[46] "Annual Survey of Manufacturers: General Statistics: Statistics for Industry Groups and Industries." U.S. Census Bureau. 2014. Available at: http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t
[47] Hoovers, Inc. *Company Profiles.* Various Companies. <http://www.hoovers.com>

DOE initially identified 22 companies that sell PTAC and PTHP equipment in the U.S. Most U.S. companies, however, do not own production assets; rather, they import and distribute PTACs and PTHPs manufactured overseas, primarily in China. DOE identified a subgroup of three manufacturers that own production assets. Together, these three manufacturers account for approximately 80 percent of the domestic PTAC and PTHP market. Because manufacturers with production assets will incur different costs to comply with amended energy conservation standards compared to their competitors who do not own production assets, DOE conducted a separate subgroup analysis to evaluate the potential impacts of amended energy conservation standards on manufacturers with production assets. The subgroup analysis of PTAC and PTHP manufacturers with production assets is discussed in chapter 12 of the NOPR TSD and in section VI.B of this document.

For the small businesses subgroup 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 PTAC and PTHP 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 at least 12 manufacturers that qualify as small businesses. The PTAC and PTHP small manufacturer subgroup is discussed in chapter 12 of the NOPR TSD and in section V.B.2 of this document.

2. Government Regulatory Impact Model

DOE uses the GRIM to quantify the changes in cash flow due to amended standards that result in a higher or lower industry value. The GRIM analysis uses a standard, annual cash-flow analysis 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 2048. DOE calculated INPVs by summing the stream of annual discounted cash flows during this period. For PTAC and PTHP manufacturers, DOE used a real discount rate of 8.5 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 more efficient 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 costs (MPCs) 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 with manufacturers during manufacturer interviews.

Shipments Forecasts

The GRIM estimates manufacturer revenues based on total unit shipment forecasts and the distribution of these values by 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 2048 (the end year of the analysis period). See section IV.G. above and chapter 10 of the NOPR TSD for additional details.

Product and Capital Conversion Costs

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 equipment 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 new compliant equipment designs can be fabricated and assembled.

To evaluate the level of capital conversion expenditures manufacturers would likely incur to comply with amended energy conservation standards, DOE used manufacturer interviews to gather data on the anticipated level of capital investment that would be required at each efficiency level. DOE validated manufacturer comments through estimates of capital expenditure requirements derived from the product teardown analysis and engineering analysis described in chapter 5 of the TSD.

DOE assessed the product conversion costs at each considered efficiency level by integrating data from quantitative and qualitative sources. DOE considered market-share-weighted feedback regarding the potential costs of each efficiency level from multiple manufacturers to estimate product conversion costs and validated those numbers against engineering estimates of redesign efforts.

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 new standard. The conversion cost figures used in the GRIM can be found in section V.B.2 of this document. For additional information on the estimated product and capital conversion costs, see chapter 13 of the NOPR TSD.

b. Government Regulatory Impact Model Scenarios

Markup Scenarios

Manufacturer selling prices (MSPs) include direct manufacturing production costs (i.e., labor, materials, and overhead 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 markup 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 PTACs and PTHPs 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 1.27 for all PTAC and PTHP equipment classes.

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 per unit 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 on a per unit basis. Under this scenario, as the costs of production increase under an amended standards case, manufacturers are generally required to reduce their markups to a level that maintains base-case operating profit per unit. The implicit assumption behind this markup scenario is that the industry can only maintain its operating profit in absolute dollars per unit after compliance with the new standard is required. Therefore, operating margin in percentage terms is reduced between the base case and standards case. DOE adjusted 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.

c. Manufacturer Interviews

As part of the MIA, DOE discussed the potential impacts of amended energy conservation standards with manufacturers of PTACs and PTHPs. DOE interviewed manufacturers representing approximately 90 percent of the market by revenue. Information gathered during these interviews enabled DOE to tailor the GRIM to reflect the unique financial characteristics of the industry.

In interviews, DOE asked manufacturers to describe their major concerns regarding this rulemaking. The following section highlights manufacturer concerns that helped to shape DOE's understanding of potential impacts of an amended standard on the industry. Manufacturer interviews are conducted under non-disclosure agreements (NDAs), so DOE does not document these discussions in the same way that it does public comments in the comment summaries and DOE's responses throughout the rest of this document.

d. Size Constraints

Manufacturers expressed concern regarding their ability to maintain the physical dimensions of PTACs and PTHPs while meeting amended energy conservation standards. PTACs and PTHPs are inherently space-constrained equipment. Their value proposition rests in large part on the ability of units to fit into existing wall openings of fixed dimensions: in the case of standard-size equipment impacted by this rulemaking, this means a wall opening of 16"x42." Manufacturers indicated that increasing the efficiency of units given these size constraints poses a significant technical challenge. Specifically, as units become more efficient, they tend to grow in size. Efficiency gains are often achieved by incorporating more efficient system components, including compressors and heat exchangers. Manufacturers noted that as these components become more efficient, they tend to become larger. Yet expanding the size of PTACs and PTHPs to accommodate larger, more efficient components is not an option, as manufacturers must continue to deliver products built to pre-existing dimensions.

Manufacturers also indicated that increasing efficiency without altering product dimensions poses a greater technical challenge for higher-capacity models than for lower-capacity models. For example, redesigning a 15,000 Btu/hour PTAC – the highest capacity offered by many manufacturers – would be more difficult than redesigning a 7,000 Btu/hour model. Some manufacturers stated this could lead them to stop producing their highest-capacity PTAC and PTHP models under an amended standard.

e. Impact on Manufacturer Profitability

Manufacturers also stated that amended energy conservation standards could place downward pressure on profits. Manufacturers noted that consumers typically are unwilling to pay a premium for efficiency and instead purchase PTACs and PTHPs largely on a first-cost basis. Accordingly, manufacturers do not anticipate being able to pass all additional costs of manufacturing more efficient products onto consumers and would expect to see some decline in profitability as a result.

Additionally, manufacturers indicated that higher production and purchase costs could impact profitability by reducing demand for PTACs and PTHPs. Specifically, manufacturers anticipate that higher purchase costs will lead greater numbers of consumers to repair rather than replace existing units. In addition, manufacturers stated higher costs could lead to product switching, as consumers turn to alternative HVAC systems. Presently, the market for PTACs and PTHPs is predominantly a replacement market: approximately 80 percent of sales go toward replacement compared to 20 percent for new construction. Manufacturers indicated that higher costs could drive the new construction market to seek alternatives. The potential for market contraction in this manner could further impact profitability.

f. Impact on Consumer Utility

Manufacturers stated that amended energy conservation standards could make it difficult to meet consumer needs effectively. Three primary concerns arose in this regard: concerns surrounding noise; concerns surrounding humidity control; and concerns surrounding loss of specific product lines.

Noise

Several manufacturers stated that there is a tradeoff between higher efficiency in PTACs and PTHPs and noise levels. Design changes that improve the efficiency of airflow systems (e.g., by increasing fan speed) tend to make units noisier. This is especially true among higher capacity models. Because PTACs and PTHPs are widely used in the lodging sector, where noise is a significant consideration, design changes that result in noisier equipment are not a viable option to increase system efficiency.

Humidity Control

Several manufacturers also indicated that as units become more efficient, they tend to raise concerns surrounding humidity control and mold growth. One manufacturer indicated it has received more customer complaints about humidity levels since 2012, when the 2008 energy conservation standard for PTACs and PTHPs took effect. Another manufacturer noted it has designed a PTAC model with a built-in dehumidification function to better control humidity and prevent mold growth, but this reduces the overall system EER, making it more difficult to comply with amended standards.

Loss of Product Lines

In addition, multiple manufacturers stated that certain models may become unavailable in the face of amended energy conservation standards. Within the standard-size market, the difficulty of redesigning higher capacity models (e.g., 15,000 Btu/hour) while maintaining the existing package size could drive manufacturers to discontinue those models, leaving lower-capacity models (e.g., 12,000 Btu/hour) as the maximum capacity offered.

3. Discussion of Comments

Impact of Other Rulemakings

AHRI commented that manufacturers of PTACs and PTHPs may be impacted by other product rulemakings. (AHRI, Framework Public Meeting at p. 93) In response, DOE has performed an analysis of cumulative regulatory burden (CRB) in section V.B.2 of the NOPR document. The CRB analysis includes only completed regulations that take effect within three years of the effective date of the current final rulemaking. Rulemakings addressed include those for: Residential Boilers (78 FR 675, January 4, 2013), Residential Furnaces (76 FR 37408, June 27, 2011) (76 FR 67037, October 31, 2011), Residential Central Air Conditioners and Heat Pumps (76 FR 37408, June 27, 2011) (76 FR 67037, October 31, 2011), Gas Fired and Electric Storage Water Heaters (75 FR 20112, April 16, 2010), Electric Motors (79 FR 30933, May 29, 2014), Walk-in Coolers and Freezers (79 FR 32049, June 3, 2014), Furnace Fans (79 FR 38129, July 3, 2014), Compressors (79 FR 25377, August 5, 2014), and Commercial and Industrial Fans and Blowers. (78 FR 7306, February 1, 2013).

Alternate Refrigerants

Goodman commented that DOE should look into the impacts of alternate refrigerants on manufacturers as well as users in terms of total energy consumption. (Goodman, Framework Public Meeting at p. 94) Nearly all PTAC and PTHP equipment is designed with R-410A as the refrigerant. DOE is not aware of any regulations or pending regulations that would impact manufacturers' ability to continue using the refrigerant R-410A in PTAC and PTHP equipment.

The U.S. EPA SNAP Program evaluates and regulates substitutes for ozone-depleting chemicals (such as air conditioning refrigerants) that are being phased out under the stratospheric ozone protection provisions of the CAA. On July 9, 2014, the EPA Administrator signed a notice of proposed rulemaking document that changes the listing status for certain substitutes under the SNAP Program.[48] This proposal changes the status of several refrigerants used in automotive air conditioning and in food refrigeration systems. However, the proposal does not include delisting R-410A, nor does it mention that EPA may consider any future delisting of R-410A for use in air conditioning applications.

[48] The NOPR document for SNAP listing status changes has not yet published in the Federal Register. Proposed changes to air conditioning refrigerants status are listed in pp. 132-34 of a pre-publication version of the document, available from the EPA at: http://www.epa.gov/ozone/downloads/SAN_5750_SNAP_Status_Change_Rule_NPRM_signature_version-signed_7-9-2014.pdf

DOE notes that the use of alternate refrigerants by manufacturers of PTACs and PTHPs would not be required as a direct result of this proposed rule. Furthermore, there is no requirement (nor any proposal to adopt requirements) mandating the use of alternate refrigerants at this time. Hence, alternate refrigerants were not considered in this analysis.

Non-Standard Size Equipment

AHRI commented that some manufacturers of non-standard size PTACs and PTHPs would be considered small businesses. (AHRI, Framework Public Meeting at p. 94) DOE has not proposed amended standards for non-standard size PTAC and PTHP equipment in this document. As a result, impacts on manufacturers that exclusively produce non-standard size PTACs and PTHPs are not analyzed. Impacts on small manufacturers that produce standard size PTACs and PTHPs are analyzed in section VI.B, Review Under the Regulatory Flexibility Act.

K. Emissions Analysis

In the emissions analysis, DOE estimated 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 PTAC and PTHP equipment. 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 51282

(August 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.

DOE primarily conducted the emissions analysis using emissions factors for CO_2 and most of the other gases derived from data in EIA's AEO 2013. Combustion emissions of CH_4 and N_2O were estimated using emissions intensity factors published by the Environmental Protection Agency (EPA), GHG Emissions Factors Hub.[49] 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 Fifth Assessment Report of the Intergovernmental Panel on Climate Change,[50] DOE used GWP values of 28 for CH_4 and 265 for N_2O.

EIA prepares the Annual Energy Outlook using the 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

[49] "GHG Emissions Factors Hub," U.S. Environmental Protection Agency. 2014. Available online at http://www.epa.gov/climateleadership/inventory/ghg-emissions.html

[50] [50] IPCC, 2013: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. Chapter 8.

regulations, including recent government actions, for which implementing regulations were available as of December 31, 2012.

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 (D.C.). SO_2 emissions from 28 eastern states and D.C. 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 EPA by the U.S. Court of Appeals for the District of Columbia Circuit but it remained in effect. 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 D.C. Circuit issued a decision to vacate CSAPR.[51] The court ordered EPA to continue administering CAIR. The emissions factors used for this NOPR, which are based on AEO 2013, assume that CAIR remains a binding regulation through 2040.[52]

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

[52] On April 29, 2014, the U.S. Supreme Court reversed the judgment of the D.C. 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 this 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.

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 2016, however, SO_2 emissions will fall as a result of the Mercury and Air Toxics Standards (MATS) for power plants, which were announced by EPA on December 21, 2011. 77 FR 9304 (February 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 2016. Both technologies, which are used to reduce acid gas emissions, also reduce SO_2 emissions. Under the MATS, emissions will be far below the cap established by CAIR, so it is unlikely that excess SO_2 emissions allowances resulting from the lower electricity demand would be needed or used to permit offsetting increases in SO_2

emissions by any regulated EGU. Therefore, DOE believes that efficiency standards will reduce SO_2 emissions in 2016 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 this 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 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 customer 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 (October 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 report from the National Research Council[53] points out that any assessment will suffer from uncertainty, speculation, and lack of information about (1) future emissions of GHGs, (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

[53] National Research Council. Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use. 2009. National Academies Press: Washington, DC.

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 CO_2 emissions. The agency can estimate the benefits from reduced (or costs from increased) emissions in any future year by multiplying the change in emissions in that year by the SCC values appropriate for that year. The net present value of the benefits can then be calculated by multiplying each of these 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 Federal 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 Climate Framework for Uncertainty, Negotiation and Distribution (FUND), Dynamic Integrated Climate Economy (DICE), and Policy Analysis of the Greenhouse Effect (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 (IPCC). 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.

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 IAMs, 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, was included to represent higher than expected impacts from temperature 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,[54] although preference is given to consideration of the global benefits of reducing CO_2 emissions. Table IV.16 presents the values in the 2010 interagency group report,[55] which is reproduced in

[54] It is recognized that this calculation for domestic values is approximate, provisional, and highly speculative. There is no a priori reason why domestic benefits should be a constant fraction of net global damages over time.
[55] "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 online at www.whitehouse.gov/sites/default/files/omb/inforeg/for-agencies/Social-Cost-of-Carbon-for-RIA.pdf.

appendix 14A of the NOPR TSD.

Table IV.16. Annual SCC Values from 2010 Interagency Report, 2010–2050 (in 2007 dollars per metric ton CO2)

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 document were generated using the most recent versions of the three integrated assessment models that have been published in the peer-reviewed literature. Table IV.17 shows the updated sets of SCC estimates from the 2013 interagency update[56] in five-year increments from 2010 to 2050. The full set of annual SCC estimates between 2010 and 2050 is reported in appendix 14B of the NOPR TSD. 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.

[56] 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 online at www.whitehouse.gov/sites/default/files/omb/assets/inforeg/technical-update-social-cost-of-carbon-for-regulator-impact-analysis.pdf

Table IV.17. 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 analytic challenges that are being addressed by the research community, including 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 resulting from this proposed rule, 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, $40.4, $62.2, and $119 per metric ton avoided (values expressed in 2013$). DOE derived values after 2050 using the relevant growth rates for the 2040-2050 period in the interagency update.

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 the 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 $4,889 per ton in 2013$.[57] DOE calculated monetary benefits using a medium value for NO_X

[57] "2006 Report to Congress on the Costs and Benefits of Federal Regulations and Unfunded Mandates on State, Local, and Tribal Entities," U.S. Office of Management and Budget, Office of Information and Regulatory Affairs. 2006.

emissions of $2,683 per short ton (in 2013$), and 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.

M. Utility Impact Analysis

The utility impact analysis estimates several effects on the power generation industry that would result from the adoption of new or 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 uses a variant of NEMS,[58] which is a public domain, multi-sectored, partial equilibrium model of the U.S. energy sector. DOE uses a variant of this model, referred to as NEMS-BT,[59] to account for selected utility impacts of new or amended energy conservation standards. DOE's 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.

[58] 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).
[59] DOE/EIA approves use of the name NEMS to describe only an official version of the model without any modification to code or data. Because this analysis entails some minor code modifications and the model is run under various policy scenarios that are variations on DOE/EIA assumptions, DOE refers to it by the name "NEMS-BT" ("BT" is DOE's Building Technologies Program, under whose aegis this work has been performed).

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 customer 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.[60] There are many reasons for these differences, including wage differences and the fact that the utility sector is more capital-intensive and less labor-

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

intensive than other sectors. Energy conservation standards have the effect of reducing customer utility bills. Because reduced customer 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 PTACs and PTHPs.

For the standard levels considered in this 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).[61] 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-

[61] Scott, M.J., O.V. Livingston, P.J. Balducci, J.M. Roop, and R.W. Schultz. ImSET 3.1: Impact of Sector Energy Technologies. 2009. Pacific Northwest National Laboratory, Richland, WA. Report No. PNNL-18412. <www.pnl.gov/main/publications/external/technical_reports/PNNL-18412.pdf>

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

A. Trial Standard Levels

At the NOPR stage, DOE develops trial standard levels (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.

In this proposed rule, DOE considers six efficiency levels for PTACs and five efficiency levels for PTHPs. DOE groups the efficiency levels into trial standard levels to determine the impact the selected trial standard level has on individual equipment classes. DOE may choose to promulgate equal or unequal efficiency levels, and, in the proposed rule, DOE bases its decision to group efficiency levels based on which is most economically justifiable. In the case of unequal efficiency levels, PTHP efficiency levels set higher than those of PTACs leads not only to additional national energy cost savings but also equipment switching from PTHPs to a less expensive PTAC with electric resistance strip heating, which consumes 190 to 280 percent more energy than PTHPs for the same amount of heating. The national energy cost savings from unequal efficiency levels are negated by the energy costs from more electric resistance strip heating if 2.8 percent or more of total customers switch. Given that PTHPs cost approximately 10 percent more in terms of total installed price compared to PTACs, DOE expects negative energy cost savings from unequal efficiency levels. DOE does not find the grouping of unequal efficiency levels economically justifiable and therefore groups PTAC and PTHP efficiency levels such that they are equalized for the five TSLs it examined.

Table V.1 presents the baseline efficiency level and the efficiency level of each TSL analyzed for standard size PTACs and PTHPs subject to this proposed rule. The baseline efficiency levels correspond to the efficiency levels specified by the energy efficiency equations in ANSI/ASHRAE/IES Standard 90.1-2013 for PTACs and PTHPs. 10 CFR 431.97(c). The TSL 1, 2, 3, 4 efficiency levels represent matched pairs of efficiency levels at 4%, 8%, 12%, and 16% above the current Federal energy conservation standards for PTACs. TSL 5 is the maximum technologically feasible ("max tech") level for each class of equipment as discussed in section IV.C.5.

Table V.1. Standard Size PTACs and PTHPs Baseline Efficiency Levels and TSLs

		Baseline (ANSI/ASHRAE/IES Standard 90.1-2013)*	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5 Max-Tech
PTAC Efficiency Level		**EL1**	**EL2**	**EL3**	**EL4**	**EL5**	**EL6**
PTHP Efficiency Level		**Current Federal ECS**	**EL1**	**EL2**	**EL3**	**EL4**	**EL5**
Equipment Class (cooling capacity)	**Efficiency Metric**						
Standard Size PTAC 9,000 Btu/h	EER	11.3	11.5	12.0	12.4	12.9	13.1
Standard Size PTAC 15,000 Btu/h	EER	9.5	9.7	10.0	10.4	10.8	11.0
Standard Size PTHP 9,000 Btu/h	EER COP	11.3 3.2	11.5 3.3	12.0 3.4	12.4 3.5	12.9 3.6	13.1 3.6
Standard Size PTHP 15,000 Btu/h	EER COP	9.5 2.9	9.7 2.9	10.0 3.0	10.4 3.1	10.8 3.2	11.0 3.2

* This level represents the ANSI/ASHRAE/IES Standard 90.1-2013 minimum for PTAC and PTHP equipment. This level is used as the Baseline since DOE is required to, at a minimum, adopt the ASHRAE

levels as the Federal standard. (42 U.S.C. (a)(6)(A)(ii)(I)). DOE notes that the Baseline level is 1.8% higher than current Federal ECS for PTAC equipment, but is equivalent to current Federal ECS for PTHP equipment. For PTAC equipment, the Baseline level is also termed EL1.

As stated in the engineering analysis (see chapter 5 of the NOPR TSD), current Federal energy conservation standards and the efficiency levels specified by ANSI/ASHRAE/IES Standard 90.1-2013 for PTACs and PTHPs are a function of the equipment's cooling capacity. Both the Federal energy conservation standards and the efficiency standards in ANSI/ASHRAE/IES Standard 90.1-2013 are based on equations to calculate the efficiency levels for PTACs and PTHPs with a cooling capacity greater than or equal to 7,000 Btu/h and less than or equal to 15,000 Btu/h for each equipment class. To derive the standards (i.e., efficiency level as a function of cooling capacity), DOE plotted the representative cooling capacities and the corresponding efficiency levels for each TSL. DOE then calculated the equation of the line passing through the EER values for 9,000 Btu/h and 15,000 Btu/h for standard size PTACs and PTHPs. More details describing how DOE determined the energy efficiency equations for each TSL are found in chapter 9 of the TSD. Table V.2 and Table V.3 identify the energy efficiency equations for each TSL for standard size PTACs and PTHPs.

Table V.2. Energy-Efficiency Equations (EER as a Function of Cooling Capacity) by TSL for Standard Size PTACs

Standard Size** PTACs	Energy Efficiency Equation*
Baseline*** (ANSI/ASHRAE/IES Standard 90.1-2013)	EER = 14.0 - (0.300 x Cap†/1000)
TSL 1	EER = 14.4 - (0.312 x Cap†/1000)
TSL 2	EER = 14.9 - (0.324 x Cap†/1000)
TSL 3	EER = 15.5 - (0.336 x Cap†/1000)
TSL 4	EER = 16.0 - (0.348 x Cap†/1000)
TSL 5 - MaxTech	EER = 16.3 - (0.354 x Cap†/1000)

[*] For equipment rated according to the DOE test procedure, all EER values must be rated at 95ºF outdoor dry-bulb temperature for air-cooled products and evaporatively-cooled products and at 85ºF entering water temperature for water cooled products.

[**] Standard size refers to PTAC or PTHP equipment with wall sleeve dimensions greater than or equal to 16 inches high, or greater than or equal to 42 inches wide.

[***] This level represents the ANSI/ASHRAE/IES Standard 90.1-2013 minimum for PTAC and PTHP equipment. This level is used as the Baseline since DOE is required to, at a minimum, adopt the ASHRAE levels as the Federal standard. (42 U.S.C. (a)(6)(A)(ii)(I)). [†] Cap means cooling capacity in Btu/h at 95ºF outdoor dry-bulb temperature.

Table V.3. Energy-Efficiency Equations (EER as a Function of Cooling Capacity) by TSL for Standard Size PTHPs

Standard Size** PTHPs	Energy Efficiency Equation*
Baseline*** (ANSI/ASHRAE/IES Standard 90.1-2013)	EER = 14.0 - (0.300 x Cap†/1000) COP = 3.7 - (0.052 x Cap†/1000)
TSL 1	EER = 14.4 - (0.312 x Cap†/1000) COP = 3.8 - (0.058 x Cap†/1000)
TSL 2	EER = 14.9 - (0.324 x Cap†/1000) COP = 4.0 - (0.064 x Cap†/1000)
TSL 3	EER = 15.5 - (0.336 x Cap†/1000) COP = 4.1 - (0.068 x Cap†/1000)
TSL 4	EER = 16.0 - (0.348 x Cap†/1000) COP = 4.2 - (0.070 x Cap†/1000)
TSL 5 - MaxTech	EER = 16.3 - (0.354 x Cap†/1000) COP = 4.3 - (0.073 x Cap†/1000)

* For equipment rated according to the DOE test procedure, all EER values must be rated at 95ºF outdoor dry-bulb temperature for air-cooled products and evaporatively-cooled products and at 85ºF entering water temperature for water cooled products. All COP values must be rated at 47ºF outdoor dry-bulb temperature for air-cooled products, and at 70ºF entering water temperature for water-source heat pumps.
** Standard size refers to PTAC or PTHP equipment with wall sleeve dimensions greater than or equal to 16 inches high, or greater than or equal to 42 inches wide.
*** This level represents the ANSI/ASHRAE/IES Standard 90.1-2013 minimum for PTAC and PTHP equipment. This level is used as the Baseline since DOE is required to, at a minimum, adopt the ASHRAE levels as the Federal standard. (42 U.S.C. (a)(6)(A)(ii)(I)).
† Cap means cooling capacity in Btu/h at 95ºF outdoor dry-bulb temperature.

For PTACs and PTHPs with cooling capacity less than 7,000 Btu/h, DOE determined the EERs using a cooling capacity of 7,000 Btu/h in the efficiency-capacity equations. For PTACs and PTHPs with a cooling capacity greater than 15,000 Btu/h cooling capacity, DOE determined the EERs using a cooling capacity of 15,000 Btu/h in the efficiency-capacity equations. This is the same method established in the Energy Policy Act of 1992 and provided in ANSI/ASHRAE/IES Standard 90.1-2013 for calculating the EER and COP of equipment with cooling capacities smaller than 7,000 Btu/h and larger than 15,000 Btu/h. (42 U.S.C. 6313(a)(3)(A))

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 PTACs and PTHPs is economically justified. (42 U.S.C. 6313(a)(6)(B)(ii)) The following sections generally discuss how DOE has addressed each of those factors in this rulemaking.

1. Economic Impacts on Commercial Customers

DOE analyzed the economic impacts on PTAC and PTHP equipment customers by looking at the effects amended standards would have on the LCC and PBP. DOE also examined the impacts of potential standards on customer 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 customers of PTAC and PTHP equipment, DOE conducted LCC and PBP analyses for each TSL. In general, higher-efficiency equipment would affect consumers in two ways: (1) purchase price would increase, and (2) annual operating costs would decrease. Inputs used for calculating the LCC and PBP include total installed costs (i.e., product price plus installation costs), and operating costs (i.e., annual energy savings, energy prices, energy price trends, repair costs, and maintenance costs). The LCC calculation also uses product lifetime and a discount rate. Chapter 8 of the NOPR TSD provides detailed information on the LCC and PBP analyses.

Table V.4 through Table V.7 show the LCC and PBP results for all efficiency levels considered for PTAC and PTHP equipment less than 12,000 Btu/h cooling capacity and greater than and equal to 12,000 Btu/h cooling capacity. In the first of each pair of tables, the simple payback is measured relative to the baseline product. In the second tables, the LCC savings are measured relative to the base-case efficiency distribution in the compliance year (see section IV.F.8 of this document).

Table V.4. Average LCC and PBP Results for Standard Size Equipment <12,000 Btu/h Cooling Capacity (9,000 Btu/h Cooling Capacity)

TSL	Efficiency Level	Average Costs (2013$)				Simple Payback (years)	Average Lifetime (years)
		Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
1	1	$1,491	$194	$1,411	$2,902	6.6	10
2	2	$1,508	$192	$1,395	$2,903	7.3	
3	3	$1,527	$189	$1,379	$2,906	7.8	
4	4	$1,547	$187	$1,363	$2,910	8.2	
5	5	$1,557	$186	$1,356	$2,913	8.3	

Note: The results for each TSL are calculated assuming that all consumers use products with that efficiency level. The PBP is measured relative to the baseline product.

Table V.5. LCC Savings Relative to the Base Case Efficiency Distribution for Standard Size Equipment <12,000 Btu/h Cooling Capacity (9,000 Btu/h Cooling Capacity)

TSL	Efficiency Level	Life-Cycle Cost Savings	
		% of Consumers that Experience Net Cost	Avg. Savings (2013$)*
1	1	20%	$1.23
2	2	37%	$0.40
3	3	62%	($2.31)
4	4	70%	($6.66)
5	5	73%	($9.45)

* Parentheses indicate negative values.
** The calculation includes households with zero LCC savings (no impact).

Table V.6. Average LCC and PBP Results for Standard Size Equipment ≥12,000 Btu/h Cooling Capacity (9,000 Btu/h Cooling Capacity)

TSL	Efficiency Level	Average Costs (2013$)				Simple Payback (years)	Average Lifetime (years)
		Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
1	1	$1,744	$252	$1,832	$3,575	7.8	10
2	2	$1,767	$249	$1,812	$3,579	8.6	
3	3	$1,797	$246	$1,793	$3,590	9.8	
4	4	$1,833	$244	$1,776	$3,609	11.1	
5	5	$1,854	$243	$1,767	$3,621	11.7	

Note: The results for each TSL are calculated assuming that all consumers use products with that efficiency level. The PBP is measured relative to the baseline product.

Table V.7. Savings Relative to the Base Case Efficiency Distribution for Standard Size Equipment ≥12,000 Btu/h Cooling Capacity (15,000 Btu/h Cooling Capacity)

TSL	Efficiency Level	Life-Cycle Cost Savings	
		% of Consumers that Experience Net Cost	Avg. Savings (2013$)*
1	1	23%	$0.01
2	2	42%	($2.11)
3	3	77%	($12.64)
4	4	87%	($31.18)
5	5	91%	($43.49)

* Parentheses indicate negative values.
** The calculation includes households with zero LCC savings (no impact).

For PTACs and PTHPs with a cooling capacity less than 7,000 Btu/h, DOE established the proposed energy conservation standards using a cooling capacity of 7,000 Btu/h in the proposed efficiency-capacity equation. DOE believes the LCC and PBP impacts for equipment in this category will be similar to the impacts of the 9,000 Btu/h units because the MSP and usage characteristics are in a similar range. Similarly, for PTACs and PTHPs with a cooling capacity greater than 15,000 Btu/h, DOE established the proposed energy conservation standards using a cooling capacity of 15,000 Btu/h in the proposed efficiency-capacity equation. DOE believes the impacts for equipment in this category will be similar to units with a cooling capacity of 15,000 Btu/h. More details explaining how DOE developed the proposed energy efficiency equations based on the analysis results for the representative cooling capacities are provided in section V.A of this document.

b. Customer Sub-Group Analysis

Using the LCC spreadsheet model, DOE determined the impact of the TSLs on the small businesses customer subgroup. Table V.8 shows the mean LCC savings from proposed energy conservation standards, and Table V.9 shows the median payback period (in years) for this subgroup. More detailed discussion on the LCC subgroup analysis and results can be found in chapter 12 of the TSD.

Table V.8. Mean Life-Cycle Cost Savings for PTAC and PTHP Equipment Purchased by LCC Sub-Groups (2013$)

Equipment Class (Cooling Capacity)	TSL1	TSL2	TSL3	TSL4	TSL5
Standard Size Equipment (9,000 Btu/h)	$0.81	($0.85)	($4.73)	($10.32)	($13.73)
Standard Size Equipment (15,000 Btu/h)	($0.27)	($3.34)	($15.24)	($35.16)	($48.14)

* Parentheses indicate negative values.
Note: The LCC savings for each TSL are calculated relative to the base case efficiency distribution. The calculation includes households with zero LCC savings (no impact).

Table V.9. Median Payback Period for PTAC and PTHP Equipment Purchased by LCC Sub-Groups (Years)

Equipment Class (Cooling Capacity)	TSL1	TSL2	TSL3	TSL4	TSL5
Standard Size Equipment (9,000 Btu/h)	7.1	8.0	8.9	9.5	9.7
Standard Size Equipment (15,000 Btu/h)	8.4	9.9	12.4	14.7	15.9

Note: The median payback period is calculated only for affected establishments. Establishments with no impact have an undefined payback period, and are therefore not included in calculating the median PBP.

For PTACs and PTHPs with a cooling capacity less than 7,000 Btu/h, DOE believes that the LCC and PBP impacts for equipment in this category will be similar to the impacts of the 9,000 Btu/h units because the MSP and usage characteristics are in a similar range. Similarly, for PTACs and PTHPs with a cooling capacity greater than 15,000 Btu/h, DOE believes the impacts will be similar to units with a cooling capacity of 15,000 Btu/h. See chapter 5 of the TSD for how DOE selected the representative capacities that were analyzed.

c. Rebuttable Presumption Payback

As discussed in section IV.F.10, 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.10 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 evaluate definitively 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 this proposed standards.

Table V.10. Rebuttable-Presumption Payback Period (years) for PTAC or PTHP Equipment

	Trial Standard Level				
	1	**2**	**3**	**4**	**5**
Standard Size Equipment (9,000 Btu/h)	6.6	7.3	7.8	8.2	8.3
Standard Size Equipment (15,000 Btu/h)	7.8	8.6	9.8	11.1	11.7

2. Economic Impacts on Manufacturers

DOE performed a manufacturer impact analysis (MIA) to estimate the impact of amended energy conservation standards on PTAC and PTHP manufacturers. The following section describes the expected impacts on manufacturers at each considered TSL. Chapter 13 of the TSD explains the analysis in further detail.

a. Industry Cash Flow Analysis Results

Table V.11 depicts the estimated financial impacts (represented by changes in industry net present value, or INPV) of amended energy conservation standards on manufacturers of PTACs and PTHPs, as well as the conversion costs that DOE expects manufacturers would incur for all equipment classes at each TSL.

As discussed in section IV.J.2, DOE modeled two different markup scenarios to evaluate the range of cash flow impacts on the PTAC and PTHP industry: (1) the preservation of gross margin percentage markup scenario; and (2) the preservation of per unit operating profit markup scenario.

To assess the less severe end of the range of potential impacts, DOE modeled a preservation of gross margin percentage markup scenario, in which a uniform "gross margin percentage" markup is applied across all potential efficiency levels. In this scenario, DOE assumed that a manufacturer's absolute dollar markup would increase as production costs increase in the standards case.

To assess the more severe end of the range of potential impacts, DOE modeled the preservation of per unit operating profit markup scenario, which reflects manufacturer concerns surrounding their inability to maintain margins as manufacturing production costs increase to meet more stringent efficiency levels. In this scenario, as manufacturers make the necessary investments required to convert their facilities to produce new standards-compliant products and incur higher costs of goods sold, their percentage markup decreases. Operating profit does not change in absolute dollars but decreases as a percentage of revenue.

Each of the modeled scenarios results in a unique set of cash flows and corresponding industry values at each TSL. In the following discussion, the INPV results refer to the difference in industry value between the base case and each standards case that result from the sum of discounted cash flows from the base year 2014 through 2048, the end of the analysis period. To provide perspective on the short-run cash flow impact, DOE includes in the discussion of the results a comparison of free cash flow between the base case and the standards case at each TSL in the year before amended 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 table below presents a range of results reflecting both the preservation of gross margin percentage markup scenario and the preservation of per-unit operating profit markup scenario. As noted, the preservation of operating profit scenario accounts for the more severe impacts presented. Estimated conversion costs and free cash flow in the year prior to the effective date of amended standards do not vary with markup scenario.

Table V.11. Manufacturer Impact Analysis Results for PTACs and PTHPs*

	Units	Base Case	Trial Standard Level				
			1	2	3	4	5
INPV	2013$M	58.5	57.1 to 57.4	57.7 to 58.8	55.4 to 57.5	55.0 to 58.5	51.8 to 55.9
Change in INPV	2013$M	-	(1.4) to (1.1)	(0.7) to 0.3	(3.1) to (0.9)	(3.5) to 0.0	(6.7) to (2.6)
	% Change	-	(2.4) to (1.9)	(1.3) to 0.5	(5.3) to (1.6)	(5.9) to 0.0	(11.4) to (4.4)
Product Conversion Costs	2013$M	-	2.2	4.7	7.2	8.5	13.5
Capital Conversion Costs	2013$M	-	2.3	2.9	7.1	7.1	7.4
Total Conversion Costs	2013$M	-	4.5	7.6	14.3	15.6	20.9
Free Cash Flow	2013$M	3.8	2.2	1.2	(1.5)	(1.8)	(3.4)
	% Change	-	(43.5)	(69.9)	(138.6)	(148.2)	(190.3)

*Parentheses indicate negative values.

TSL 1 represents a 4 percent increase above current federal minimum efficiency standards for PTACs. At TSL 1, DOE estimates the impacts on INPV to range from -$1.4 million to -$1.1 million, or a change of -2.4 percent to -1.9 percent. Industry free cash flow is estimated to decrease by $1.7 million, or a change of 43.5 percent compared to the base-case value of $3.8 million in the year before the compliance date (2018).

DOE estimates that in the year of compliance (2019), 51 percent of all PTAC and PTHP shipments in the base case would already meet or exceed the standard levels at TSL 1. The capital and product conversion costs required to bring the balance of shipments into compliance with amended standards drive the negative INPV results at this level. DOE estimates industry conversion costs of $4.5 million at TSL 1.

TSL 2 represents an 8 percent increase above current federal minimum efficiency standards for PTACs. At TSL 2, DOE estimates impacts on INPV to range from -$0.7 million to $0.3 million, or a change in INPV of -1.3 percent to 0.5 percent. At this level, industry free cash flow is estimated to decrease by $2.7 million, or a change of 69.9 percent compared to the base-case value of $3.8 million in the year before the compliance date (2018).

The INPV impacts at TSL 2 are slightly less severe than those at TSL 1 due to the interplay of conversion costs, manufacturer selling prices, and shipments. DOE estimates that in the year of compliance (2019), 37 percent of all PTAC and PTHP base case shipments would meet efficiency levels at TSL 2 or higher. DOE expects conversion costs required to bring the balance of shipments into compliance would increase to $7.6 million, reflecting the need for additional motor and control changes as well as a more significant R&D and testing burden. However, an anticipated increase in per-unit purchase price at this level combined with steady shipments could dampen the effects of conversion costs on INPV.

TSL 3 represents a 12 percent increase above current federal minimum efficiency standards for PTACs. At TSL 3, DOE estimates impacts on INPV to range from -$3.1 million to -$0.9 million, or a change in INPV of -5.3 percent to -1.6 percent. At this level, industry free cash flow is estimated to decrease by $5.3 million, or a change of 138.6

percent compared to the base-case value of $3.8 million in the year before the compliance date (2018).

DOE estimates that in the year of compliance (2019), only 6 percent of all PTAC and PTHP base case shipments would already meet efficiency levels at TSL 3 or higher. DOE also estimates conversion costs would nearly double relative to conversion costs at TSL 2, increasing to $14.3 million. Anticipated conversion costs at this level include investing in new tooling and redesigning equipment to incorporate additional coils and/or formed coils.

TSL 4 represents a 16 percent increase above current federal minimum efficiency standards for PTACs. At TSL 4, DOE estimates impacts on INPV to range from -$3.5 million to $0.0 million, or a change in INPV of -5.9 percent to 0.0 percent. At this level, industry free cash flow is estimated to decrease by $5.7 million, or a change of 148.2 percent compared to the base-case value of $3.8 million in the year before the compliance date (2018).

DOE estimates that in the year of compliance (2019), less than 1 percent of all PTAC and PTHP base case shipments would already meet efficiency levels at TSL 4 or higher. Conversion costs required to bring nearly 100 percent of equipment into compliance would increase to an estimated $15.6 million. At this level, however, DOE does not anticipate capital conversion costs beyond those required at TSL 3. Rather, equipment conversion costs account for the full increase.

TSL 5 represents the use of max-tech design options for each equipment class. At this level, DOE estimates impacts on INPV to range from -$6.7 million to -$2.6 million, or a change in INPV of -11.4 percent to -4.4 percent. Industry free cash flow is estimated to decrease by $7.3 million, or a change of 190.3 percent compared to the base-case value of $3.8 million in the year before the compliance date (2018).

DOE estimates that in the year of compliance (2019), less than 1 percent of all PTAC and PTHP base case shipments would already meet efficiency levels at TSL 5. At this level, conversion costs required to bring nearly 100 percent of equipment into compliance would increase to an estimated $20.9 million.

At all TSLs, INPV impacts could prove more severe if consumer demand falls in the face of higher per-unit purchase prices.

DOE requests feedback on the expected total conversion costs for the industry at the evaluated TSLs. This is identified as issue 5 in section VII.E, “Issues on Which DOE Seeks Comment.”

b. Direct Impacts on Employment

To quantitatively assess the potential impacts of amended energy conservation standards on direct employment, DOE used the GRIM to estimate the domestic labor expenditures and number of direct employees in the base case and at each TSL from 2014 through 2048. DOE used statistical data from the U.S. Census Bureau's 2011 Annual Survey of Manufacturers,[62] the results of the engineering analysis, and interviews with manufacturers to determine the inputs necessary to calculate industry-wide labor expenditures and domestic direct employment levels. Labor expenditures related to producing the equipment are a function of the labor intensity of producing the equipment, 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 50 percent of PTAC and PTHP 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 Annual Survey of Manufacturers). The production worker estimates in this section only cover workers up to the line-supervisor level who are directly involved in fabricating and assembling a product within an OEM 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.

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[62] "Annual Survey of Manufacturers: General Statistics: Statistics for Industry Groups and Industries," U.S. Census Bureau, 2011. Available at www.census.gov/manufacturing/asm/index.html

To estimate an upper bound to employment change, DOE assumes all domestic manufacturers would choose to continue producing products in the U.S. and would not move production to foreign countries. To estimate a lower bound to employment, DOE estimates the maximum portion of the industry that would choose to leave the industry or relocate production overseas rather than make the necessary conversions at domestic production facilities. A complete description of the assumptions used to generate these upper and lower bounds can be found in chapter 12 of the NOPR TSD.

As noted above, DOE estimates that 50 percent of PTAC and PTHP units sold in the United States are manufactured domestically. In the absence of amended energy conservation standards, DOE estimates that the PTAC and PTHP industry would employ 170 domestic production workers in 2019.

Table V.12 below shows the range of impacts of potential amended energy conservation standards on U.S. production workers of PTACs and PTHPs. The potential changes to direct employment presented suggest that the PTAC and PTHP industry could experience anything from a slight gain in domestic direct employment to a loss of all domestic direct employment.

Table V.12. Potential Changes in the Total Number of Standard Size PTAC and PTHP Production Workers in 2019

	Trial Standard Level*					
	Base Case†	1	2	3	4	5
Potential Changes in Domestic Production Workers in 2019	-	(170) to 4	(170) to 10	(170) to 17	(170) to 22	(170) to 24

* Parentheses indicate negative values.
† Base case assumes 170 domestic production workers in the PTAC and PTHP industry in 2019.

The upper end of the range estimates the maximum increase in the number of production workers in the PTAC and PTHP industry after implementation of an amended energy conservation standard. It assumes manufacturers would continue to produce the same scope of covered equipment within the United States and would require some additional labor to produce more efficient equipment.

The lower end of the range represents the maximum decrease in total number of U.S. production workers that could result from an amended energy conservation standard. Throughout interviews, manufacturers stated their concerns about increasing offshore competition entering the market. If the cost of complying with amended standards significantly erodes the profitability of domestic manufacturers relative to their competitors who manufacture and/or import PTACs and PTHPs from overseas, manufacturers with domestic production could decide to exit the PTAC and PTHP market and/or shift their production facilities offshore. The lower bound of direct employment impacts therefore assumes domestic production of PTACs and PTHPs ceases, as domestic manufacturers either exit the market or shift production overseas in search of reduced manufacturing costs.

This conclusion is independent of any conclusions regarding indirect employment impacts in the broader United States economy, which are documented in chapter 15 of the TSD.

DOE requests comments on the total annual direct employment levels in the industry for PTAC production. This is identified as issue 6 in section VII.E, "Issues on Which DOE Seeks Comment."

c. Impacts on Manufacturing Capacity

According to PTAC and PTHP manufacturers interviewed, amended energy conservation standards will not significantly constrain manufacturing production capacity. Among manufacturers with production assets, some indicated that more stringent energy conservation standards could reduce sales volumes, thereby resulting in excess capacity. Among importers and distributors, amended energy conservation standards would not likely impact capacity. Accordingly, DOE believes manufacturers will be able to maintain production capacity levels sufficient to meet market demand under the proposed levels.

d. Impacts on Subgroups of Manufacturers

As discussed above, using average cost assumptions to develop an industry cash flow estimate is not adequate for assessing differential impacts among subgroups of manufacturers. Small manufacturers, niche players, or manufacturers exhibiting a cost structure that differs largely from the industry average could be affected differently. DOE used the results of the industry characterization to group manufacturers exhibiting similar characteristics. Specifically, DOE identified two subgroups of manufacturers for separate impact analyses: manufacturers with production assets and small business manufacturers.

DOE initially identified 22 companies that sell PTAC and PTHP equipment in the U.S. Among U.S. companies, few own production assets; rather, they import and distribute PTACs and PTHPs manufactured overseas, primarily in China. DOE identified a subgroup of three manufacturers that own production assets. These manufacturers own tooling or production assets either in the U.S. or in foreign countries. Together, these three manufacturers account for approximately 80 percent of the domestic PTAC and PTHP market. Because manufacturers with production assets will incur different conversion costs to comply with amended energy conservation standards compared to their competitors who do not own production assets, DOE conducted a separate analysis to evaluate the impact of an amended standard on the subgroup of manufacturers with production assets.

As with the overall industry analysis, DOE modeled two different markup scenarios to evaluate the range of cash flow impacts on manufacturers with production assets: (1) the preservation of gross margin percentage markup scenario; and (2) the preservation of per unit operating profit markup scenario. See Section IV.J.2 for a complete description of markup scenarios.

Each of the modeled scenarios results in a unique set of cash flows and corresponding INPV values at each TSL. In the following discussion, the INPV results refer to the difference in value of manufacturers with production assets between the base case and standards cases as represented by the sum of discounted cash flows from the base year 2014 through 2048, the end of the analysis period. To provide perspective on the short-run cash flow impact, DOE includes in the discussion of results a comparison of free cash flow between the base case and the standards case at each TSL in the year before amended standards would take effect. This figure provides an understanding of the magnitude of the required conversion costs relative to the cash flow generated by manufacturers with production assets in the base case.

The table below presents a range of results reflecting both the preservation of gross margin percentage markup scenario and the preservation of per unit operating profit markup scenario. As discussed in section IV.J.B, the preservation of operating profit scenario accounts for the more severe impacts presented. Estimated conversion costs and free cash flow in the year prior to the effective date of amended standards do not vary with markup scenario.

Table V.13. Manufacturer Impact Analysis Results for the Subgroup of PTAC and PTHP Manufacturers with Production Assets

	Units	Base Case	Trial Standard Level*				
			1	2	3	4	5
INPV	2013$M	46.8	45.5 to 45.8	45.7 to 46.5	43.0 to 44.7	42.6 to 45.3	39.4 to 42.7
Change in INPV	2013$M	-	(1.3) to (1.0)	(1.1) to (0.3)	(3.8) to (2.1)	(4.2) to (1.5)	(7.3) to (4.1)
	% Change	-	(2.7) to (2.2)	(2.3) to (0.5)	(8.2) to (4.5)	(9.0) to (3.1)	(15.7) to (8.7)
Product Conversion Costs	2013$M	-	1.4	3.9	6.4	7.7	12.7
Capital Conversion Costs	2013$M	-	2.3	2.9	7.1	7.1	7.4
Total Conversion Costs	2013$M	-	3.7	6.8	13.5	14.7	20.1
Free Cash Flow	2013$M	3.1	1.6	0.6	(2.0)	(2.4)	(4.0)
	% Change	-	(46.7)	(79.7)	(165.5)	(177.5)	(230.1)

* Parentheses indicate negative values.

As the results above demonstrate, manufacturers with production assets will experience financial impacts more negative than those facing the industry as a whole, discussed earlier in section V.B.2. These differential impacts derive primarily from the conversion costs manufacturers with production assets will incur in order to comply with an amended standard. In particular, manufacturers with production assets will face capital conversion costs not shared by their competitors who import and distribute PTACs and PTHPs and do not require tooling investments. In interviews, manufacturers with production assets indicated that more stringent standards could require significant investment in new tooling to support new coil designs. In addition, manufacturers with production assets would face product conversion costs in the form of design engineering, product development, testing, certification, marketing, and related costs.

At the standard proposed in this document, DOE estimates the PTAC and PTHP industry as a whole would face $7.6 million in conversion costs; of this, the subgroup of manufacturers with production assets would incur $6.8 million in conversion costs, or 89 percent of the industry total. At this level, manufacturers with production assets would also face an estimated loss in INPV of up to 2.3 percent compared to 1.3 percent for the industry as a whole.

For the small business subgroup 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 PTAC and PTHP 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 at least 12 manufacturers that qualify as small businesses. The PTAC and PTHP small business subgroup analysis is discussed in chapter 12 of the NOPR TSD and in section VI.B of this document.

e. Cumulative Regulatory Burden

While any one regulation may not impose a significant burden on manufacturers, the combined effects of several impending regulations may have serious consequences for some manufacturers, groups of manufacturers, or an entire industry. Assessing the impact of a single regulation may overlook this cumulative regulatory burden. Multiple regulations affecting the same manufacturer can strain profits and can 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 PTAC and PTHP manufacturers that will take effect approximately three years before or after the 2019 compliance date of amended energy conservation standards for standard-sized PTACs and PTHPs. In interviews, manufacturers cited federal regulations on equipment other than PTACs and PTHPs that contribute to their cumulative regulatory burden. The compliance years and expected industry conversion costs of relevant amended energy conservation standards are indicated in the table below:

Table V.14 Compliance Dates and Expected Conversion Expenses of Federal Energy Conservation Standards Affecting PTAC and PTHP Manufacturers

Federal Energy Conservation Standards	Approximate Compliance Date	Estimated Total Industry Conversion Expense
2011 Room Air Conditioners 76 FR 22454 (April 21, 2011); 76 FR 52854 (August 24, 2011)	2014	$171M (2009$)
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	$95.4M (2009$)
Dishwashers***	2018	TBD
Commercial Packaged Air Conditioners and Heat Pumps***	2018	TBD
Commercial Warm-Air Furnaces***	2018	TBD
Furnace Fans 79 FR 38129 (July 3, 2014)	2019	$40.6M (2013$)
Miscellaneous Residential Refrigeration***	2019	TBD
Single Packaged Vertical Units***	2019	TBD
Commercial Water Heaters***	2019	TBD
Commercial Packaged Boilers***	2020	TBD
Residential Water Heaters***	2021	TBD
Clothes Dryers***	2022	TBD
Central Air Conditioners***	2022	TBD
Room Air Conditioners***	2022	TBD

* Conversion expenses for manufacturers of oil-fired furnaces and gas-fired and oil-fired boilers associated with the November 2007 final rule for residential furnaces and boilers are excluded from this figure. 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. EISA 2007 legislated more stringent standards and earlier compliance dates for residential boilers than were required by 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. The conversion costs listed for residential gas-fired and oil-fired boilers in the November 2007 residential furnaces and boilers final rule analysis are not included in this figure.

**Estimated industry conversion expense and approximate compliance date reflect a court-ordered April 24, 2014 remand 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 costs associated with this rule reflect implementation of the amended standards for the remaining furnace product classes (i.e., oil-fired furnaces).

***The final rule for this energy conservation standard has not been published. The compliance date and analysis of conversion costs have not been finalized at this time. (If a value is provided for total industry conversion expense, this value represents an estimate from the NOPR.)

Additionally, manufacturers cited increasing ENERGY STAR[63] standards for room air conditioners and ductless heating and cooling systems as a source of regulatory burden. In response, DOE does not consider ENERGY STAR in its presentation of cumulative regulatory burden, because ENERGY STAR is a voluntary program and is not Federally mandated.

3. National Impact Analysis

a. Amount and Significance of Energy Savings

For each TSL, DOE projected energy savings for PTAC and PTHP equipment purchased in the 30-year period that begins in the year of anticipated compliance with amended standards (2019–2048). 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. DOE also determined energy savings for PTAC equipment with the ANSI/ASHRAE/IES Standard 90.1-2013 minimum efficiency level by comparing with the energy consumption of PTAC equipment meeting the Federal minimum efficiency level. Table V.15 shows the estimated primary energy savings for all the equipment classes of PTACs and PTHPs at each of the TSLs, and Table V.16 presents the estimated full-fuel-cycle energy savings for each TSL. The approach for estimating national energy savings is further described in section IV.H.

[63] ENERGY STAR is a U.S. EPA voluntary program designed to identify and promote energy-efficient products to reduce greenhouse gas emissions. For more information on the ENERGY STAR program, please visit www.energystar.gov.

Table V.15. Cumulative Primary Energy Savings for PTACs and PTHPs (Units Sold from 2019 to 2048)

	ASHRAE Standard 90.1-2013*	Trial Standard Level				
		1	2	3	4	5
	quads					
Standard Size Equipment, 7,000 Btu/h	0.000	0.000	0.003	0.005	0.006	0.006
Standard Size Equipment, 9,000 Btu/h	0.000	0.013	0.050	0.100	0.129	0.132
Standard Size Equipment, 15,000 Btu/h	0.001	0.002	0.005	0.010	0.012	0.013
Total All Classes	0.001	0.015	0.058	0.116	0.148	0.152

* Energy savings determined from comparing PTAC energy consumption at the ANSI/ASHRAE/IES Standard 90.1-2013 efficiency level to that at the Federal minimum efficiency level.

Table V.16 Cumulative Full-Fuel-Cycle Energy Savings for PTACs and PTHPs (Units Sold from 2019 to 2048)

	ASHRAE Standard 90.1-2013*	Trial Standard Level				
		1	2	3	4	5
	quads					
Standard Size Equipment, 7,000 Btu/h	0.000	0.000	0.003	0.005	0.006	0.007
Standard Size Equipment, 9,000 Btu/h	0.000	0.013	0.051	0.102	0.131	0.134
Standard Size Equipment, 15,000 Btu/h	0.001	0.002	0.005	0.010	0.013	0.014
Total All Classes	0.001	0.015	0.059	0.118	0.150	0.155

* Energy savings determined from comparing PTAC energy consumption at the ANSI/ASHRAE/IES Standard 90.1-2013 efficiency level to that at the Federal minimum efficiency level.

The results indicate that each TSL that is more stringent than the corresponding level in ANSI/ASHRAE/IES Standard 90.1-2013 results in additional energy savings. The primary national energy savings from adopting the ANSI/ASHRAE/IES Standard 90.1-2013 minimum for PTACs saves 0.079 thousandths of a quad over the Federal minimum.

OMB Circular A-4[64] 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 also 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.[65] The review timeframe established in EPCA is generally not synchronized with the equipment lifetime, equipment manufacturing cycles, or other factors specific to PTACs and PTHPs. Thus, such results are presented for informational purposes only and are not indicative of any change in DOE's analytical methodology. The NES results based on a 9-year analytical period are presented in Table V.17. The impacts are counted over the lifetime of PTAC and PTHP equipment purchased in 2019–2027.

[64] "Circular A-4: Regulatory Analysis," U.S. Office of Management and Budget, September, 2003. Available at: www.whitehouse.gov/omb/circulars_a004_a-4/

[65] EPCA requires DOE to review its standards at least once every 6 years, and requires, for certain equipment, 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)(i)) 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.

Table V.17. Cumulative Primary Energy Savings for PTAC and PTHP Equipment Trial Standard Levels for Units Sold in 2019–2027

Equipment Class	ASHRAE Standard 90.1-2013*	Trial Standard Level				
		1	2	3	4	5
	quads					
Standard Size Equipment, 7,000 Btu/h	0.000	0.000	0.000	0.002	0.002	0.002
Standard Size Equipment, 9,000 Btu/h	0.000	0.005	0.014	0.028	0.044	0.047
Standard Size Equipment, 15,000 Btu/h	0.000	0.000	0.002	0.004	0.005	0.005
Total All Classes	0.000	0.005	0.017	0.033	0.050	0.055

* Energy savings determined from comparing PTAC energy consumption at the ANSI/ASHRAE/IES Standard 90.1-2013 efficiency level to that at the Federal minimum efficiency level.

b. Net Present Value of Customer Costs and Benefits

DOE estimated the cumulative NPV of the total costs and savings for customers that would result from the TSLs considered for PTAC and PTHP equipment. In accordance with OMB's guidelines on regulatory analysis,[66] 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). 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

[66] "OMB Circular A-4, section E," U.S. Office of Management and Budget, September, 2003. Available online at http://www.whitehouse.gov/omb/circulars_a004_a-4

(i.e., yield on United States Treasury notes), which has averaged about 3 percent for the past 30 years.

Table V.18 shows the customer NPV results for each TSL considered for PTAC and PTHP equipment. In each case, the impacts cover the lifetime of equipment purchased in 2019–2048.

Table V.18 Net Present Value of Customer Benefits for Packaged Terminal Air Conditioning and Heat Pump Equipment Trial Standard Levels for Units Sold in 2019-2048

Product Class	Discount Rate	Trial Standard Level*				
		1	2	3	4	5
		Millions 2013$				
< 7,000 Btu/h	3%	0.7	1.8	2.4	2.2	2.1
7,000 – 15,000 Btu/h		22.3	65.9	113.8	134.6	136.4
> 15,000 Btu/h		1.0	1.2	(2.4)	(6.7)	(7.6)
Total – All Classes		23.9	69.0	113.8	130.2	131.0
< 7,000 Btu/h	7%	0.1	(0.2)	(1.2)	(2.2)	(2.5)
7,000 – 15,000 Btu/h		6.3	12.3	14.5	10.5	9.0
> 15,000 Btu/h		-	(1.5)	(5.4)	(9.5)	(10.4)
Total – All Classes		6.5	10.7	7.9	(1.1)	(3.8)

* Parentheses indicate negative values.
Note: Values of 0.0 represent a non-zero NPV that cannot be displayed due to rounding. Numbers may not sum to total due to rounding.

The NPV results based on the aforementioned nine-year analytical period are presented in Table V.19. The impacts are counted over the lifetime of equipment purchased in 2019–2027. 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.19 Net Present Value of Customer Benefits for Packaged Terminal Air Conditioning and Heating Equipment Trial Standard Levels for Units Sold in 2019-2027

Product Class	Discount Rate	Trial Standard Level*				
		1	2	3	4	5
		Millions 2013$				
< 7,000 Btu/h	3%	0.2	0.7	0.6	0.4	0.3
7,000 – 15,000 Btu/h		10.5	24.2	39.0	49.9	51.8
> 15,000 Btu/h		0.5	1.2	0.2	(2.6)	(3.5)
Total – All Classes		11.2	26.0	39.8	47.8	48.6
< 7,000 Btu/h	7%	0.1	-	(0.7)	(1.4)	(1.6)
7,000 – 15,000 Btu/h		4.3	6.7	6.8	3.5	2.0
> 15,000 Btu/h		-	(0.4)	(2.1)	(5.1)	(6.0)
Total – All Classes		4.4	6.2	4.0	(2.9)	(5.6)

* Parentheses indicate negative values.
Note: Values of 0.0 represent a non-zero NPV that cannot be displayed due to rounding. Numbers may not sum to total due to rounding.

c. Indirect Impacts on Employment

DOE expects amended energy conservation standards for PTAC and PTHP equipment to reduce energy costs for equipment owners, and the resulting net savings to be 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, where these uncertainties are reduced.

The results suggest that the proposed standards are likely to have 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.

4. Impact on Utility or Performance of Equipment

In performing the engineering analysis, DOE considered efficiency levels that may be achieved using design options that would not lessen the utility or performance of the individual classes of equipment. (42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(2)(B)(i)(IV)) As presented in section III.C of this document, DOE concluded that the efficiency levels proposed for standard size equipment in this document are technologically feasible and would not reduce the utility or performance of PTACs and PTHPs. PTAC and PTHP manufacturers currently offer equipment that meet or exceed the proposed standard levels.

5. Impact of Any Lessening of Competition

DOE considers any lessening of competition that is likely to result from 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 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 will provide the Department of Justice (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 or costs of energy production. Reduced electricity demand due to energy conservation standards is also likely to reduce the cost of maintaining the reliability of the electricity system, particularly during peak-load periods. As a measure of this reduced demand, chapter 15 of the TSD presents the estimated reduction in generating capacity for the TSLs that DOE considered in this rulemaking.

The expected energy savings from amended PTAC and PTHP standards could also produce environmental benefits in the form of reduced emissions of air pollutants and greenhouse gases associated with electricity production. Table V.20 provides DOE's estimate of cumulative emissions reductions projected to result from the TSLs considered in this rulemaking. DOE reports annual emissions reductions for each TSL in chapter 13 of the NOPR TSD.

Table V.20. Summary of Emissions Reductions for PTAC and PTHP (units sold from 2019 to 2048)

	Trial Standard Level				
	1	2	3	4	5
Power Sector Emissions					
CO_2 (million metric tons)	1.06	4.15	8.23	10.52	10.81
SO_2 (thousand tons)	2.46	9.70	19.22	24.07	24.60
NO_X (thousand tons)	0.48	1.90	3.76	4.63	4.69
Hg (tons)	0.00	0.01	0.02	0.03	0.03
N_2O (thousand tons)	0.02	0.07	0.14	0.17	0.17
CH_4 (thousand tons)	0.10	0.39	0.77	0.98	1.01
Upstream Emissions					
CO_2 (million metric tons)	0.05	0.18	0.36	0.47	0.48
SO_2 (thousand tons)	0.01	0.04	0.08	0.10	0.10
NO_X (thousand tons)	0.65	2.53	5.02	6.43	6.62
Hg (tons)	0.00	0.00	0.00	0.00	0.00
N_2O (thousand tons)	0.00	0.00	0.00	0.00	0.00
CH_4 (thousand tons)	3.92	15.36	30.51	39.10	40.22
Total FFC Emissions					
CO_2 (million metric tons)	1.10	4.33	8.60	10.98	11.29
SO_2 (thousand tons)	2.47	9.74	19.30	24.17	24.70
NO_X (thousand tons)	1.12	4.42	8.78	11.06	11.31
Hg (tons)	0.00	0.01	0.02	0.03	0.03
N_2O (thousand tons)	0.02	0.07	0.14	0.18	0.18
N_2O (thousand tons CO_2eq)*	5.43	21.37	42.19	52.32	53.53
CH_4 (thousand tons)	4.02	15.75	31.28	40.08	41.22
CH_4 (million tons CO_2eq)*	100.53	393.72	782.02	1001.97	1030.54

* CO_2eq is the quantity of CO_2 that would have the same global warming potential (GWP) as the subject emission.

As part of the analysis for this 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. As discussed in section IV.L.1, DOE used the most recent values for the SCC developed by an interagency process. The four sets of SCC values 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). These values correspond to the value of emission reductions in 2015; the values for later years are higher due to increasing damages as the projected magnitude of climate change increases.

Table V.21 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.21. Estimates of Global Present Value of CO_2 Emissions Reduction under Packaged Terminal Air Conditioning and Heat Pump Equipment Trial Standard Levels

TSL	Social Cost of Carbon Case*			
	5% discount rate, average*	3% discount rate, average*	2.5% discount rate, average*	3% discount rate, 95th percentile*
	million 2013$			
Power Sector Emissions				
1	6.90	32.60	52.04	101.01
2	26.86	127.30	203.32	394.56
3	53.64	253.57	404.84	786.02
4	70.70	329.56	524.84	1021.08
5	73.17	339.99	541.12	1053.04
Upstream Emissions				
1	0.31	1.45	2.31	4.49
2	1.20	5.66	9.03	17.53
3	2.39	11.27	17.98	34.93
4	3.16	14.70	23.40	45.54
5	3.28	15.18	24.15	47.01
Total FFC Emissions				
1	7.21	34.05	54.35	105.50
2	28.06	132.95	212.35	412.08
3	56.03	264.84	422.82	820.95
4	73.86	344.26	548.24	1066.62
5	76.45	355.18	565.28	1100.06

* For each of the four cases, the corresponding SCC value for emissions in 2015 is $12.0, $40.5, $62.4, and $119 per metric ton (2013$).

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 PTACs and PTHPs. The dollar-per-ton values that DOE used are discussed in section IV.L.1. Table V.22 presents the cumulative present values for each TSL calculated using seven-percent and three-percent discount rates.

Table V.22. Estimates of Present Value of NO_X Emissions Reduction under Packaged Terminal Air Conditioning and Heat Pump Equipment Trial Standard Levels

TSL	3% discount rate	7% discount rate
	million 2013$	
Power Sector Emissions		
1	0.56	0.21
2	2.20	0.81
3	4.39	1.62
4	5.57	2.13
5	5.67	2.18
Upstream Emissions		
1	0.83	0.36
2	3.23	1.39
3	6.46	2.80
4	8.59	3.89
5	8.92	4.09
Total FFC Emissions		
1	1.39	0.57
2	5.43	2.20
3	10.85	4.42
4	14.16	6.02
5	14.59	6.27

7. Summary of National Economic Impacts

The NPV of the monetized benefits associated with emissions reductions can be viewed as a complement to the NPV of the customer savings calculated for each TSL considered in this rulemaking. Table V.23. 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 customer 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.23. Net Present Value of Customer Savings Combined with Present Value of Monetized Benefits from CO_2 and NO_X Emissions Reductions

TSL	Customer 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
	million 2013\$			
1	32.5	59.4	79.7	130.8
2	102.5	207.3	286.7	486.5
3	180.6	389.4	547.4	945.5
4	218.2	488.6	692.6	1211.0
5	222.1	500.8	710.9	1245.7
TSL	Customer NPV at 7% 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
	million 2013\$			
1	14.3	41.1	61.4	112.6
2	41.0	145.9	225.2	425.0
3	68.3	277.1	435.1	833.3
4	78.7	349.1	553.1	1071.5
5	78.9	357.6	567.7	1102.5

* These label values represent the global SCC in 2015, in 2013$.

Although adding the value of customer 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. customer 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 2019–2048. 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.

8. Other Factors

The Secretary of Energy, in determining whether a standard is economically justified, may consider any other factors that he/she deems to be relevant. (42 U.S.C. 6316 (a); 42 U.S.C. 6295(o)(2)(B)(i)(VI)) No other factors were considered in this analysis.

C. Proposed Standard

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

In selecting the proposed energy conservation standards for PTACs and PTHPs for consideration in this notice of proposed rulemaking, DOE started by examining the maximum technologically feasible levels, and determined whether those levels were economically justified. Upon finding the maximum technologically feasible levels not to be justified, DOE analyzed the next lower TSL to determine whether that level was economically justified. DOE repeated this procedure until it reached the highest efficiency level that is technologically feasible, economically justified and saves a significant amount of energy.

To aid the reader as DOE discusses 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 identifiable subgroups of customers that may be disproportionately affected by a national standard (see section V.B.1.b), and impacts on employment. DOE discusses the impacts on employment in PTAC and PTHP manufacturing in section V.B.2, and discusses the indirect employment impacts in section V.B.3.c.

1. Benefits and Burdens of Trial Standard Levels Considered for Packaged Terminal Air Conditioners and Packaged Terminal Heat Pumps

Table V.24 and Table V.25 summarize the quantitative impacts estimated for each

TSL for packaged terminal air conditioners and packaged terminal heat pumps.

Table V.24. Summary of Analytical Results for Packaged Terminal Air Conditioning and Heat Pump Equipment: National Impacts

Category	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
National FFC Energy Savings quads					
	0.015	0.059	0.118	0.150	0.155
NPV of Customer Benefits* 2013$ million**					
3% discount rate	23.9	69.0	113.8	130.2	131.0
7% discount rate	6.5	10.7	7.9	(1.1)	(3.8)
Cumulative Emissions Reduction (Total FFC Emissions)					
CO_2 million metric tons	1.10	4.33	8.60	10.98	11.29
SO_2 thousand tons	2.47	9.74	19.30	24.17	24.70
NO_X thousand tons	1.12	4.42	8.78	11.06	11.31
Hg tons	0.00	0.01	0.02	0.03	0.03
N_2O thousand tons	0.02	0.07	0.14	0.18	0.18
N_2O thousand tons CO_2eq*	5.43	21.37	42.19	52.32	53.53
CH_4 thousand tons	4.02	15.75	31.28	40.08	41.22
CH_4 thousand tons CO_2eq*	100.53	393.72	782.02	1001.97	1030.54
Value of Emissions Reduction (Total FFC Emissions)					
CO_2 2013$ million**	7.2 to 105.5	28.1 to 412.1	56.0 to 820.9	73.9 to 1066.6	76.4 to 1100.1
NO_X – 3% discount rate 2013$ million	1.39	5.43	10.85	14.16	14.59
NO_X – 7% discount rate 2013$ million	0.57	2.20	4.42	6.02	6.27

* CO_2eq is the quantity of CO_2 that would have the same global warming potential (GWP) as the subject emission.
** Range of the economic value of CO_2 reductions is based on estimates of the global benefit of reduced CO_2 emissions.
*** Parentheses indicate negative values.

Table V.25. Summary of Analytical Results for Packaged Terminal Air Conditioning and Heat Pump Equipment: Manufacturer and Customer Impacts

Category	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
Industry Impacts* **					
Change in Industry NPV (2013$M)	(1.4) to (1.1)	(0.7) to 0.3	(3.1) to (0.9)	(3.5) to 0.0	(6.7) to (2.6)
Industry NPV (% Change)	(2.4) to (1.9)	(1.3) to 0.5	(5.3) to (1.6)	(5.9) to 0.0	(11.4) to (4.4)
Customer Mean LCC Savings* ** 2013$					
Standard Size Equipment, 9,000 Btu/h	1.23	0.40	(2.31)	(6.66)	(9.45)
Standard Size Equipment, 15,000 Btu/h	0.01	(2.11)	(12.64)	(31.18)	(43.48)
Weighted Average*	1.14	0.21	(3.05)	(8.41)	(11.89)
Customer Median PBP years					
Standard Size Equipment, 9,000 Btu/h	7.1	8.0	8.9	9.5	9.8
Standard Size Equipment, 15,000 Btu/h	8.4	9.9	12.4	14.8	15.9
Weighted Average*	7.2	8.2	9.2	9.9	10.2
Standard Size Equipment 9,000 Btu/h**					
Customers with Net Cost %	20%	37%	63%	71%	73%
Customers with No Impact %	54%	37%	7%	0%	0%
Customers with Net Benefit %	26%	27%	31%	29%	27%
Standard Size Equipment 15,000 Btu/h**					
Customers with Net Cost %	23%	42%	77%	87%	91%
Customers with No Impact %	61%	41%	7%	2%	1%
Customers with Net Benefit %	17%	17%	16%	10%	9%
Weighted Average**					
Customers with Net Cost %	20%	37%	63%	72%	74%
Customers with No Impact %	54%	37%	7%	0%	0%
Customers with Net Benefit %	26%	26%	30%	28%	26%

* Weighted by shares of each equipment class in total projected shipments in 2019.
** Rounding may cause some items to not total 100 percent.
*** Parentheses indicate negative values.

First, DOE considered TSL 5, the most efficient level (max tech), which would save an estimated total of 0.155 quads of energy, an amount DOE considers significant. TSL 5 has an estimated NPV of customer cost of $3.8 million using a 7 percent discount rate, and an estimated NPV of customer savings of $131.0 million using a 3 percent discount rate.

The cumulative emissions reductions at TSL 5 are 11.29 million metric tons of CO_2, 11.31 thousand tons of NO_X, 24.70 thousand tons of SO_2, 41.22 thousand tons of CH_4, and 0.03 tons of Hg. The estimated monetary value of the CO_2 emissions reductions at TSL 5 ranges from $76.4 million to $1,100.1 million.

At TSL 5, DOE projects that the average PTAC customer or PTHP customer will experience an increase in LCC. Purchasers are projected to lose on average $11.89 over the life of the equipment. DOE estimates LCC increases for 74 percent of customers that purchase a standard size PTAC or PTHP. The median payback period for a standard size PTAC or PTHP at TSL 5 is projected to be longer than the mean lifetime of the equipment.

At TSL 5, the projected change in INPV ranges from a decrease of $6.7 million to a decrease of $2.6 million. If the more severe range of impacts is reached, TSL 5 could result in a net loss of up to 11.4 percent of INPV for manufacturers. Currently, there is only one equipment line being manufactured at TSL 5 efficiency levels, and the equipment is a PTHP. DOE believes that PTAC and PTHP manufacturers will be able to design and produce equipment at TSL 5, based on the existence of a unit that achieves TSL 5 levels without the use of proprietary technologies.

In view of the foregoing, DOE concludes that, at TSL 5 for PTACs and PTHPs, the benefits of energy savings and emissions reductions would be outweighed by the potential multi-million dollar negative net economic cost to the Nation, the economic burden on customers, and the large capital conversion costs that could result in a reduction in INPV for manufacturers. Consequently, DOE has concluded that TSL 5 is not economically justified.

Next, DOE considered TSL 4, which would save an estimated total of 0.150 quads of energy, an amount DOE considers significant. TSL 4 has an estimated NPV of customer cost of $1.1 million using a 7 percent discount rate, and an estimated NPV of customer savings of $130.2 million using a 3 percent discount rate.

The cumulative emissions reductions at TSL 4 are 10.98 million metric tons of CO_2, 11.06 thousand tons of NO_X, 24.17 thousand tons of SO_2, 40.08 thousand tons of CH_4, and 0.03 tons of Hg. The estimated monetary value of the CO_2 emissions reductions at TSL 4 ranges from $73.9 million to $1066.6 million.

At TSL 4, DOE projects that the average PTAC customer or PTHP customer will experience an increase in LCC. Purchasers are projected to lose on average $8.41 over the life of the equipment. DOE estimates LCC increases for 72 percent of customers that purchase a standard size PTAC or PTHP. The median payback period for a standard size PTAC or PTHP at TSL 4 is projected to be shorter than the mean lifetime of the equipment.

At TSL 4, the projected change in INPV ranges from a decrease of $3.5 million to a decrease of \$0.0 million. If the lower bound of the range of impacts is reached, TSL 4 could result in a net loss of up to 5.9 percent of INPV for manufacturers.

After carefully considering the analysis and weighing the benefits and burdens of TSL 4, the Secretary has tentatively concluded that at TSL 4, the benefits of energy savings and emissions reductions would be outweighed by the potential multi-million dollar negative net economic cost to the Nation, the economic burden on customers, and the large capital conversion costs that could result in a reduction in INPV for manufacturers.

Next, DOE considered TSL 3, which would save an estimated total of 0.118 quads of energy, an amount DOE considers significant. TSL 3 has an estimated NPV of customer savings of \$7.9 million using a 7 percent discount rate, and \$113.8 million using a 3 percent discount rate.

The cumulative emissions reductions at TSL 3 are 8.60 million metric tons of CO_2, 8.78 thousand tons of NO_X, 19.30 thousand tons of SO_2, 31.28 thousand tons of CH_4, 0.02 tons of Hg. The estimated monetary value of the CO_2 emissions reductions at TSL 3 ranges from \$56.0 million to \$820.9 million.

At TSL 3, DOE projects that the average PTAC customer or PTHP customer will experience an increase in LCC. Purchasers are projected to lose on average \$3.05 over the life of the product. DOE estimates LCC increases for 63 percent of customers that purchase a standard size PTAC or PTHP. The median payback period for a standard size PTAC or PTHP at TSL 3 is projected to be shorter than the mean lifetime of the equipment.

At TSL 3, the projected change in INPV ranges from a decrease of $3.1 million to a decrease of $0.9 million. If the lower bound of the range of impacts is reached, TSL 3 could result in a net loss of up to 5.3 percent of INPV for manufacturers.

After carefully considering the analysis and weighing the benefits and burdens of TSL 3, the Secretary has tentatively concluded that at TSL 3, the benefits of energy savings, emissions reductions, and net economic savings to the Nation would be outweighed by the potential economic burden on the majority of customers of PTAC and PTHP equipment and the capital conversion costs that could result in a reduction in INPV for manufacturers.

Next, DOE considered TSL 2, which would save an estimated total of 0.059 quads of energy, an amount DOE considers significant. TSL 2 has an estimated NPV of customer savings of $10.7 million using a 7 percent discount rate, and $69.0 million using a 3 percent discount rate.

The cumulative emissions reductions at TSL 2 are 4.33 million metric tons of CO_2, 4.42 thousand tons of NO_X, 9.74 thousand tons of SO_2, 15.75 thousand tons of CH_4, and 0.01 tons of Hg. The estimated monetary value of the CO_2 emissions reductions at TSL 2 ranges from $28.1 million to $412.1 million.

At TSL 2, DOE projects that the average PTAC or PTHP customer will experience an decrease in LCC. Purchasers are projected to save on average $0.21 over the life of the equipment. DOE estimates LCC increases for 37 percent of customers that purchase a standard size PTAC or PTHP. The median payback period for a standard size PTAC or PTHP at TSL 2 is projected to be shorter than the mean lifetime of the equipment.

At TSL 2, the projected change in INPV ranges from a decrease of $0.7 million to an increase of $0.3 million. If the lower bound of the range of impacts is reached, TSL 3 could result in a net loss of up to 1.3 percent of INPV for manufacturers.

After carefully considering the analysis and weighing the benefits and burdens of TSL 2, the Secretary has tentatively concluded that at TSL 2, the benefits of energy savings, emissions reductions, net economic benefits to the Nation and the potential economic savings to customers of PTAC and PTHP equipment outweigh the potential economic burden on customers and the capital conversion costs that could result in a reduction in INPV for manufacturers. Accordingly, the Secretary concludes that TSL 2 saves a significant amount of energy and is technologically feasible and economically justified. Therefore, DOE proposes to adopt the energy conservation standards for PTACs and PTHPs at TSL 2.

Although DOE proposed this level based on examining energy savings and economic justification as compared to adoption of the ANSI/ASHRAE/IES Standard 90.1-2013 level (i.e., the ASHRAE Standard 90.1-2013 baseline) as required by statute (42 U.S.C. 6313(a)(6)(A)(ii)), DOE presents in Table V.26 to Table V.31, for informational purposes only, the benefits and burdens on the customer, the manufacturer, and the Nation in comparison to a base case including the current Federal standards. The results compared to the ASHRAE Standard 90.1-2013 baseline are also included for comparison.

Table V.26. Average LCC and PBP Results for PTACs and PTHPs at the Proposed Trial Standard Level for Units Sold in 2019-2048 Compared to the Current Federal Standards

	Equipment Class	Average Life-Cycle Costs (2013$)				Simple Payback (years) †	Average Lifetime (years)
		Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
ASHRAE Baseline	<12,000 Btu/h	$1,508	$192	$1,395	$2,903	7.3	10
	≥12,000 Btu/h	$1,767	$249	$1,812	$3,579	8.6	
	Total -- All Classes	**$1,527**	**$196**	**$1,425**	**$2,952**	**7.4**	
Current Federal Standards	<12,000 Btu/h	$1,506	$192	$1,395	$2,901	7.2	
	≥12,000 Btu/h	$1,764	$249	$1,812	$3,576	8.1	
	Total -- All Classes	**$1,525**	**$196**	**$1,425**	**$2,950**	**7.3**	

Note: The results for each TSL are calculated assuming that all consumers use products with that efficiency level. The PBP is measured relative to the baseline product.

Table V.27. LCC Savings Relative to the Base Case Efficiency Distribution for PTACs and PTHPs at the Proposed Trial Standard Level for Units Sold in 2019-2048 Compared to the Current Federal Standards

	Equipment Class	Life-Cycle Cost Savings	
		% of Consumers that Experience Net Cost	Avg. Savings (2013$)*
ASHRAE Baseline	<12,000 Btu/h	37%	$0.40
	≥12,000 Btu/h	42%	($2.11)
	Total -- All Classes	**37%**	**$0.21**
Current Federal Standards	<12,000 Btu/h	36%	$0.47
	≥12,000 Btu/h	41%	($2.02)
	Total -- All Classes	**36%**	**$0.29**

* Parentheses indicate negative values.
** The calculation includes households with zero LCC savings (no impact).

Table V.28. Manufacturer Impact Analysis Results for PTACs and PTHPs at the Proposed Trial Standard Level for Units Sold in 2019-2048 Compared to the Current Federal Standards

	ASHRAE Standard 90.1-2013 Baseline	**Current Federal Standards**
Base Case INPV (2013$ millions)	58.47	58.46
Standards Case INPV (2013$ millions)	57.73 to 58.76	57.68 to 58.75
Change in INPV (% Change)	(1.26) to 0.49	(1.34) to 0.50

* Numbers in parentheses indicate negative savings.

Table V.29. Cumulative National Primary and Full-Fuel-Cycle Energy Savings and Net Present Value of Customer Benefit for PTACs and PTHPs at the Proposed Trial Standard Level for Units Sold in 2019-2048 Compared to Current Federal Standards*

	National Primary Energy Savings (quads)		**National FFC Energy Savings (quads)**		**NPV at 3% (million 2013$)**		**NPV at 7% (million 2013$)**	
	ASHRAE Standard 90.1-2013 Baseline	Current Federal Standards	ASHRAE Standard 90.1-2013 Baseline	Current Federal Standards	ASHRAE Standard 90.1-2013 Baseline	Current Federal Standards	ASHRAE Standard 90.1-2013 Baseline	Current Federal Standards
Standard Size Equipment, 7,000 Btu/h	0.003	0.003	0.003	0.003	1.8	1.8	(0.2)	(0.2)
Standard Size Equipment, 9,000 Btu/h	0.05	0.05	0.051	0.051	65.9	65.8	12.3	12.3
Standard Size Equipment, 15,000 Btu/h	0.005	0.006	0.005	0.006	1.2	1.1	(1.5)	(1.7)
Total -- All Classes	**0.058**	**0.059**	**0.059**	**0.060**	**69.0**	**68.8**	**10.7**	**10.5**

* Parentheses indicate negative values.
Note: Components may not sum to total due to rounding.

Table V.30. Cumulative Emissions Reduction, Global Present Value of CO_2 Emissions Reduction, and Present Value of NO_x Emissions Reduction for PTACs and PTHPs at the Proposed Trial Standard Level Compared to the Current Federal Standards

	Power Sector and Site Emissions		**Upstream Emissions**		**Total Emissions**	
	ASHRAE Standard 90.1-2013 Baseline	Current Federal Standards	ASHRAE Standard 90.1-2013 Baseline	Current Federal Standards	ASHRAE Standard 90.1-2013 Baseline	Current Federal Standards
Cumulative Emissions Reductions						
CO_2 (million metric tons)	4.15	4.17	0.18	0.18	4.33	4.35
SO_2 (thousand tons)	9.70	9.76	0.04	0.04	9.74	9.80
NO_X (thousand tons)	1.90	1.91	2.53	2.54	4.42	4.45
Hg (tons)	0.01	0.01	0.00	0.00	0.01	0.01
N_2O (thousand tons)	0.07	0.07	0.00	0.00	0.07	0.07
CH_4 (thousand tons)	0.39	0.39	15.36	15.45	15.75	15.84
Global Present Value of CO_2 Emissions Reduction, SCC Scenario* (million 2013$)						
5% discount rate, average	26.86	27.02	1.20	1.20	28.06	28.23
3% discount rate, average	127.30	128.04	5.66	5.69	132.95	133.73
2.5% discount rate, average	203.32	204.51	9.03	9.08	212.35	213.59
3% discount rate, 95th percentile	394.56	396.87	17.53	17.63	412.08	414.50
Present Value of NO_x Emissions Reduction (million 2013$)						
3% discount rate	2.20	2.22	3.23	3.25	5.43	5.46
7% discount rate	0.81	0.81	1.39	1.40	2.20	2.22

* For each of the four cases, the corresponding SCC value for emissions in 2015 is $12.0, $40.5, $62.4 and $119 per metric ton (2013$).

** Values of "0.00" represent rounded non-zero emissions reductions.

Table V.31. PTACs and PTHPs at the Proposed TSL: Net Present Value of Consumer Savings Combined with Net Present Value of Monetized Benefits from CO_2 and NO_X Emissions Reductions Compared to the Current Federal Standards

	SCC Value of \$12.0/metric ton CO_2* and Medium Value for NO_X**		SCC Value of \$40.5/metric ton CO_2* and Medium Value for NO_X**		SCC Value of \$62.4/metric ton CO_2* and Medium Value for NO_X**		SCC Value of \$119/metric ton CO_2* and Medium Value for NO_X**	
	ASHRAE Standard 90.1-2013 Baseline	Current Federal Standards	ASHRAE Standard 90.1-2013 Baseline	Current Federal Standards	ASHRAE Standard 90.1-2013 Baseline	Current Federal Standards	ASHRAE Standard 90.1-2013 Baseline	Current Federal Standards
	million 2013$							
Consumer NPV at 3% Discount Rate added with each SCC and NO_x value	102.5	102.5	207.3	208.0	286.7	287.8	486.5	488.7
Consumer NPV at 7% Discount Rate added with each SCC and NO_x value	41.0	40.9	145.9	146.4	225.2	226.3	425.0	427.2

* These label values represent the global SCC in 2015, in 2013$. The present values have been calculated with scenario-consistent discount rates.
** Medium Value corresponds to \$2,684 per ton of NO_X emissions.

Table V.32 shows the proposed energy conservation standards for all equipment classes of PTACs and PTHPs, including all cooling capacities.

Table V.32. Proposed Energy Conservation Standards for PTACs and PTHPs

Equipment Class			Proposed Energy Conservation Standards*
Equipment	Category	Cooling Capacity	
PTAC	Standard Size**	< 7,000 Btu/h	EER = 12.6
		≥ 7,000 Btu/h and ≤ 15,000 Btu/h	EER = 14.9 – (0.324 x Cap††)
		> 15,000 Btu/h	EER = 10.0
PTHP	Standard Size**	< 7,000 Btu/h	EER = 12.6 COP = 3.5
		≥ 7,000 Btu/h and ≤ 15,000 Btu/h	EER = 14.9 – (0.324 x Cap††) COP = 4.0 – (0.064 x Cap††)
		> 15,000 Btu/h	EER = 10.0 COP = 3.0

* For equipment rated according to the DOE test procedure (ARI Standard 310/380-2004), all energy efficiency ratio (EER) values must be rated at 95ºF outdoor dry-bulb temperature for air-cooled equipment and evaporatively-cooled equipment and at 85ºF entering water temperature for water cooled equipment. All coefficient of performance (COP) values must be rated at 47ºF outdoor dry-bulb temperature for air-cooled equipment, and at 70ºF entering water temperature for water-source heat pumps.
** Standard size refers to PTAC or PTHP equipment with wall sleeve dimensions greater than or equal to 16 inches high, or greater than or equal to 42 inches wide.
† Non-standard size refers to PTAC or PTHP equipment with wall sleeve dimensions less than 16 inches high and less than 42 inches wide.
†† Cap means cooling capacity in thousand British thermal units per hour (Btu/h) at 95ºF outdoor dry-bulb temperature.

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

The benefits and costs of the proposed standards, for equipment sold in 2019-2048, 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 customer operation of equipment that meet the proposed standards (consisting primarily of operating cost savings from using less energy, minus increases in equipment purchase and installation costs, which is another way of representing customer NPV), and (2) the annualized monetary value of the benefits of emission reductions, including CO_2 emission reductions.[67]

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. customer monetary savings that occur as a result of market transactions while the value of CO_2 reductions is based on a global value. Second,

[67] 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 (2019 through 2048) 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.

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 PTACs and PTHPs shipped in 2019 –2048. 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. These impacts continue well beyond 2100.

Estimates of annualized benefits and costs of the proposed standards PTACs and PTHPs are shown in Table V.33. 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 cost of the amended standards proposed in this rule is $8.38 million per year in increased equipment costs; while the estimated benefits are $9.4 million per year in reduced equipment operating costs, $7.2 million in CO_2 reductions, and $0.20 million in reduced NO_X emissions. In this case, the net benefit would amount to $8.4 million per year. Using a 3-percent discount rate for all benefits and costs and the average SCC series, the estimated cost of the standards proposed in this rule is $9.36 million per year in increased equipment costs; while the estimated benefits are $13.1 million per year in reduced operating costs, $7.2 million in CO_2 reductions, and $0.29 million in reduced NO_X emissions. In this case, the net benefit would amount to approximately $11.2 million per year.

Table V.33 Annualized Benefits and Costs of Proposed Standards for Packaged Terminal Air Conditioners and Packaged Terminal Heat Pumps

	Discount Rate	Primary Estimate*	Low Net Benefits Estimate*	High Net Benefits Estimate*
		million 2013$/year		
Benefits				
Operating Cost Savings	7%	9.4	9.0	9.9
	3%	13.1	12.5	13.9
CO2 Reduction Monetized Value ($12.0/t case)**	5%	2.0	2.0	2.0
CO2 Reduction Monetized Value ($40.5/t case)**	3%	7.2	7.2	7.2
CO2 Reduction Monetized Value ($62.4/t case)**	2.5%	10.7	10.7	10.7
CO2 Reduction Monetized Value ($119/t case)**	3%	22.3	22.3	22.3
NOX Reduction Monetized Value (at $2,684/ton)**	7%	0.20	0.20	0.20
	3%	0.29	0.29	0.29
Total Benefits†	7% plus CO_2 range	11.6 to 31.9	11.2 to 31.5	12.1 to 32.4
	7%	16.8	16.4	17.3
	3% plus CO_2 range	15.4 to 35.7	14.8 to 35.0	16.2 to 36.5
	3%	20.6	19.9	21.4
Costs				
Incremental Product Costs	7%	8.38	8.18	10.61
	3%	9.36	9.06	12.29
Net Benefits				
Total†	7% plus CO_2 range	3.2 to 23.5	3.0 to 23.3	1.5 to 21.8
	7%	8.4	8.2	6.7
	3% plus CO_2 range	6.0 to 26.3	5.7 to 26.0	3.9 to 24.2
	3%	11.2	10.9	9.1

* This table presents the annualized costs and benefits associated with PTAC and PTHP shipped in 2019–2048. These results include benefits to customers which accrue after 2048 from the equipment purchased in 2019–2048. 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. In addition, incremental equipment costs reflect no change for projected product price trends in the Primary Estimate, an increasing trend for projected product prices in the Low Benefits Estimate, and a decreasing trend for projected product prices in the High Benefits Estimate. The methods used to derive projected price trends are explained in section IV.F.

** The CO_2 values represent global monetized values of the SCC, in 2013$, in 2015 under several scenarios of the updated SCC values. The first three cases use the averages of SCC distributions calculated using 5%, 3%, and 2.5% discount rates, respectively. The fourth case represents the 95th percentile of the SCC distribution calculated using a 3% discount rate. 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.

The annualized values of benefits and burdens of the proposed trial standard level compared to a base case including the Federal baseline are shown in Table V.34.

Table V.34 Annualized Benefits and Costs of Proposed Standards for PTACs and PTHPs at the Proposed Trial Standard Level for Units Sold in 2019-2048 Compared to the Current Federal Standards

	Discount Rate	Primary Estimate*	Low Net Benefits Estimate*	High Net Benefits Estimate*
		million 2013$/year		
Benefits				
Operating Cost Savings	7%	9.4	9.0	9.9
	3%	13.2	12.5	14.0
CO2 Reduction Monetized Value ($12.0/t case)**	5%	2.0	2.0	2.0
CO2 Reduction Monetized Value ($40.5/t case)**	3%	7.2	7.2	7.2
CO2 Reduction Monetized Value ($62.4/t case)**	2.5%	10.7	10.7	10.7
CO2 Reduction Monetized Value ($119/t case)**	3%	22.4	22.4	22.4
NOX Reduction Monetized Value (at $2,684/ton)**	7%	0.20	0.20	0.20
	3%	0.30	0.30	0.30
Total Benefits†	7% plus CO_2 range	11.6 to 32.1	11.3 to 31.7	12.2 to 32.6
	7%	16.9	16.5	17.4
	3% plus CO_2 range	15.5 to 35.9	14.8 to 35.3	16.3 to 36.7
	3%	20.7	20.1	21.5
Costs				
Incremental Product Costs	7%	8.45	8.25	10.71
	3%	9.44	9.14	12.39
Net Benefits				
Total†	7% plus CO_2 range	3.2 to 23.6	3.0 to 23.4	1.5 to 21.9
	7%	8.4	8.2	6.7
	3% plus CO_2 range	6.0 to 26.5	5.7 to 26.1	3.9 to 24.3
	3%	11.3	10.9	9.1

* This table presents the annualized costs and benefits associated with PTAC and PTHP shipped in 2019–2048. These results include benefits to customers which accrue after 2048 from the equipment purchased in 2019–2048. 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. In addition, incremental product costs reflect no change for projected product price trends in the Primary Estimate, an increasing trend for projected equipment prices in the Low Benefits Estimate, and a decreasing trend for projected equipment prices in the High Benefits Estimate. The methods used to derive projected price trends are explained in section IV.F.

** The CO_2 values represent global monetized values of the SCC, in 2013$, in 2015 under several scenarios of the updated SCC values. The first three cases use the averages of SCC distributions calculated using 5%, 3%, and 2.5% discount rates, respectively. The fourth case represents the 95th percentile of the SCC distribution calculated using a 3% discount rate. 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.

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) For certain segments of the companies that purchase PTACs and PTHPs, such as small hotels and residential facilities, there may be a lack of customer information and/or information processing capability about energy efficiency opportunities in the commercial space conditioning market.

(2) There is asymmetric information (one party to a transaction has more and better information than the other) and/or high transactions costs (costs of gathering information).

(3) There are external benefits resulting from improved energy efficiency of PTACs and PTHPs that are not captured by the users of such equipment. These benefits include externalities related to environmental protection and energy security that are not reflected in energy prices, such as reduced emissions of greenhouse gases. DOE attempts to quantify some of the external benefits through use of Social Cost of Carbon values.

In addition, DOE has determined that this regulatory action is not an “economically significant regulatory action” under section 3(f)(1) of Executive Order 12866. Section 6(a)(3)(A) of the Executive Order states that absent a material change in the development of the planned regulatory action, regulatory action not designated as significant will not be subject to review under the aforementioned section unless, within 10 working days of receipt of DOE’s list of planned regulatory actions, the Administrator of OIRA notifies the agency that OIRA has determined that a planned regulation is a significant regulatory action within the meaning of the Executive order. Accordingly, DOE is not submitting this NOPR for review by the Office of Information and Regulatory Affairs (OIRA) in the Office of Management and Budget (OMB).

DOE has also reviewed this regulation pursuant to Executive Order 13563, issued on January 18, 2011. (76 FR 3281, Jan. 21, 2011) EO 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 this 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 website (http://energy.gov/gc/office-general-counsel).

1. Description and Estimated Number of Small Entities Regulated

a. Methodology for Estimating the Number of Small Entities

For manufacturers of PTACs and PTHPs, 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 (September 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/sites/default/files/files/Size_Standards_Table.pdf. PTAC and PTHP manufacturing 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.

DOE reviewed the potential standard levels considered in this NOPR under the provisions of the Regulatory Flexibility Act and the procedures and policies published on February 19, 2003. 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 products covered by this rulemaking. During its market survey, DOE used available public information to identify potential small manufacturers. DOE's research involved industry trade association membership directories (e.g., AHRI), information from previous rulemakings, individual company websites, and market research tools (e.g., Hoover's reports) to create a list of companies that manufacture or sell PTAC and PTHP products covered by this rulemaking. DOE also asked stakeholders and industry representatives if they were aware of any additional small manufacturers during manufacturer interviews and at DOE public meetings. DOE reviewed publicly available data and contacted various companies on its complete list of manufacturers, as necessary, to determine whether they met the SBA's definition of a small business manufacturer. DOE screened out companies that do not offer products impacted by this rulemaking, do not meet the definition of a "small business," or are foreign owned and operated.

DOE initially identified 22 companies that sell PTAC and PTHP equipment that would be affected by this proposal. Of these 22 companies, DOE identified 12 as small businesses.

b. Manufacturer Participation

DOE contacted the identified small businesses to invite them to take part in a manufacturer impact analysis interview. Of the 12 small businesses contacted, DOE was able to reach and discuss potential standards with two. DOE also obtained information about small businesses and potential impacts on small businesses while interviewing large manufacturers.

c. PTAC and PTHP Industry Structure and Nature of Competition

Three major manufacturers supply approximately 80 percent of the market for PTACs and PTHPs. DOE estimates that the remaining 20 percent of the PTAC and PTHP market is served by a combination of small businesses and large businesses that are foreign owned and operated. None of the major manufacturers of PTACs and PTHPs affected by this rulemaking is a domestic small business.

Further, the small businesses identified are not original equipment manufacturers of standard-size PTACs and PTHPs impacted by this rulemaking. Rather, they import, rebrand, and distribute standard-size PTACs and PTHPs manufactured overseas by foreign companies. Some small businesses identified are original equipment manufacturers of non-standard size PTACs and PTHPs. However, energy conservation standards for non-standard equipment are not being amended by this rulemaking. Accordingly, non-standard equipment is not considered in this small business analysis. Rather, this analysis focuses on likely impacts of the proposed rule on small businesses that sell standard-size PTACs and PTHPs.

2. Description and Estimate of Compliance Requirements

As noted, the small businesses identified are not OEMs of standard-size PTACs and PTHPs impacted by this rulemaking. Rather, they import, rebrand, and distribute PTACs and PTHPs manufactured overseas. Accordingly, small businesses would not face capital conversion costs in order to comply with amended standards, as machinery used to produce covered products is owned and operated by OEMs overseas. Small businesses also would not face product conversion costs associated with engineering and redesign of equipment. However, small businesses could experience an increase in equipment purchase price from overseas OEMs if the OEMs incur capital and product conversion costs and pass those onto small business importers. If small businesses are not able to pass all additional costs onto consumers, they could potentially face reduced markups and profits.

Additionally, small businesses would likely face product conversion costs associated with testing and certifying PTACs and PTHPs redesigned to comply with amended standards. Typically, testing and certification costs are proportional to the number of models offered by a company and not to the volume of sales. Because the volume of sales of a small business is often lower than that of a larger manufacturer, a small business's testing and certification costs may be spread over fewer units and lower revenues per model relative to a larger manufacturer. This may result in a disproportionate cost burden on small manufacturers.

Table VI.1 below presents estimated conversion costs as a percentage of annual financial metrics for an average small manufacturer relative to an average large manufacturer.

Table VI.1 Magnitude of Conversion Costs Facing an Average Small Manufacturer versus an Average Large Manufacturer under the Proposed Rule

	Capital Conversion Costs as a Percentage of Annual Capital Expenditures	Product Conversion Costs as a Percentage of Annual R&D Expense	Total Conversion Costs as a Percentage of Annual Revenue	Total Conversion Costs as a Percentage of Annual EBIT
Average Small Manufacturer	0%	61%	2%	56%
Average Large Manufacturer	29%	70%	4%	109%

Because small businesses are not expected to incur capital conversion costs and are expected to face limited product conversion costs in order to comply with the proposed rule, DOE estimates that small businesses will experience lower conversion costs as a percentage of annual revenue and other financial metrics compared to large manufacturers. Nevertheless, DOE recognizes that amended energy conservation standards could potentially impact small businesses disproportionately. In general, larger businesses tend to have larger production and sales volumes over which to spread costs and could have a competitive advantage due to their size and ability to access capital that may not be available to small businesses. Since the proposed standards could cause competitive concerns for small manufacturers, DOE cannot certify that the proposed standards would not have a significant impact on a substantial number of small businesses.

DOE requests comments on the impacts of amended energy conservation standards on small business. This is identified as issue 7 in section VII.E, "Issues on Which DOE Seeks Comment."

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 rule being considered today.

4. Significant Alternatives to the Rule

The discussion above analyzes impacts on small businesses that would result from the TSL DOE is proposing in this document. Though TSLs less stringent than the proposed TSL would be expected to reduce the impacts on small entities, DOE is required by EPCA to establish standards that achieve the maximum improvement in energy efficiency that is technically feasible and economically justified, and result in a significant conservation of energy. Therefore, DOE rejected the lowest TSL.

In addition to the other TSLs being considered, the NOPR TSD includes a regulatory impact analysis in chapter 17. For PTACs and PTHPs, this report discusses the following policy alternatives: (1) no rebate, (2) consumer rebates, (3) consumer tax credits, (4) manufacturer tax credits, (5) voluntary energy efficiency targets, and (6) government bulk purchases. DOE does not intend to consider these alternatives further because they either are not feasible to implement without authority and funding from Congress, or are not expected to result in energy savings as large as those that would be achieved by the proposed energy conservation standards. For PTACs and PTHPs, the energy benefits of alternative policies analyzed range from less than 1 percent to approximately 22 percent of those estimated to result from amended standards.

DOE continues to seek input from businesses that would be affected by this rulemaking and will consider comments received in the development of any final rule.

C. Review Under the Paperwork Reduction Act

Manufacturers of PTACs and PTHPs must certify to DOE that their products comply with any applicable energy conservation standards. In certifying compliance, manufacturers must test their products according to the DOE test procedures for PTACs and PTHPs, including any amendments adopted for those test procedures. DOE has established regulations for the certification and recordkeeping requirements for all covered consumer products and commercial equipment, including PTACs and PTHPs. 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 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.

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 promote simplification and burden reduction. 61 FR 4729 (Feb. 7, 1996). 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 small governments. 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.

This proposed rule is not expected to require expenditures of $100 million or more on the private sector.

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), the proposed rule would establish energy conservation standards for PTACs and PTHPs 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 the 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

DOE has determined, under Executive Order 12630, "Governmental Actions and Interference with Constitutionally Protected Property Rights" 53 FR 8859 (Mar. 18, 1988), that this regulation 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 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 this regulatory action, which proposes energy conservation standards for PTACs and PTHPs, 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. 70 FR 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 document. If you plan to attend the public meeting, please notify Ms. Brenda Edwards at (202) 586-2945 or Brenda.Edwards@ee.doe.gov. Please note that foreign nationals visiting DOE Headquarters are subject to advance security screening procedures. Any foreign national wishing to participate in the meeting should advise DOE as soon as possible by contacting Ms. Edwards to initiate the necessary procedures. Please also note that those wishing to bring laptop computers into the Forrestal Building will be required to obtain a property pass. Visitors should avoid bringing laptop computers, or allow an extra 45 minutes. Persons can attend the public meeting via webinar.

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 website at: http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/45 Participants are responsible for ensuring their systems are compatible with the webinar software.

B. Procedure for Submitting Prepared General Statements For Distribution

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. Such persons may submit requests, along with an advance electronic copy of their statement in PDF (preferred), Microsoft Word or Excel, WordPerfect, or text (ASCII) file format, to the appropriate address shown in the ADDRESSES section at the beginning of this document. The request and advance copy of statements must be received at least one week before the public meeting and may be emailed, hand-delivered, or sent by mail. DOE prefers to receive requests and advance copies via email. Please include a telephone number to enable DOE staff to make follow-up contact, if needed.

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. 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 document. 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 document.

Submitting comments via regulations.gov. The 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 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 regulations.gov cannot be claimed as CBI. Comments received through the website will waive any CBI claims for the information submitted. For information on submitting CBI, see the Confidential Business Information section below.

DOE processes submissions made through 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 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 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. 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. According 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. DOE did not consider alternate refrigerants in the analysis because DOE is not aware of any SNAP-approved refrigerants that are known to have better efficiency than R-410A for PTAC and PTHP equipment. DOE requests feedback on the efficacy of alternative refrigerants in PTAC and PTHP equipment.

2. To estimate the number and type of distribution channels and the distribution of the shipments through the distribution channels, DOE leveraged the information from the 2008 PTAC and PTHP final rule. (73 FR 58772). DOE requests comment regarding the selected channels and distribution of shipments through the channels.

3. Stakeholders mentioned that a number of shipments are not accounted for in the AHRI database because certain manufacturers are non-AHRI manufacturers and are not subject to reporting to the database. DOE requests comment regarding and data supporting the expected number of shipments that are unreported.

4. To estimate a base-case efficiency trend, DOE applied the trend from 2012 to 2035 that was used in the commercial unitary air conditioner Advance Notice of Proposed Rulemaking (ANOPR), which estimated an increase of approximately 1 EER every 35 years. 69 FR 45460 (July 29, 2004). DOE requests comment regarding and data supporting the selected efficiency trend.

5. DOE used information provided by manufacturers to estimate the conversion costs for manufacturers at each TSL. DOE requests feedback on the expected total conversion costs for the industry at the evaluated TSLs.

6. DOE used the GRIM to estimate the domestic labor expenditures and number of direct employees in the base case and at each TSL from 2014 through 2048. DOE requests comments on the total annual direct employment levels in the industry for PTAC and PTHP production.

7. DOE used information provided by manufacturers to analyze the effects of amended energy conservation standards on small businesses. DOE requests comments on impacts facing small businesses as a result of amended standards.

VIII. Approval of the Office of the Secretary

The Secretary of Energy has approved publication of this proposed rule.

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 August 28, 2014.

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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. Amend § 431.97 by revising paragraph (c) to read as follows:

§ 431.97 Energy efficiency standards and their compliance dates.

*   *   *   *   *

(c) Each non-standard size packaged terminal air conditioner (PTAC) and packaged terminal heat pump (PTHP) manufactured on or after October 7, 2010 must meet the applicable minimum energy efficiency standard level(s) set forth in Table 4 of this section. Each standard size PTAC and PTHP manufactured on or after October 8, 2012, and before January 1, 2019 must meet the applicable minimum energy efficiency standard level(s) set forth in Table 4 of this section. Each standard size PTAC and PTHP manufactured on or after January 1, 2019 must meet the applicable minimum energy efficiency standard level(s) set forth in Table 5 of this section.

Table 4 to §431.97—Minimum Efficiency Standards for PTAC and PTHP

Equipment Type	Category	Cooling Capacity	Efficiency Level	Compliance Date: Products manufactured on and after…
PTAC	Standard Size	<7,000 Btu/h	EER = 11.7	October 8, 2012.[2]
		≥7,000 Btu/h and ≤15,000 Btu/h	EER = 13.8 − (0.3 × Cap[1])	October 8, 2012.[2]
		>15,000 Btu/h	EER = 9.3	October 8, 2012.[2]
	Non-Standard Size	<7,000 Btu/h	EER = 9.4	October 7, 2010.
		≥7,000 Btu/h and ≤15,000 Btu/h	EER = 10.9 − (0.213 × Cap[1])	October 7, 2010.
		>15,000 Btu/h	EER = 7.7	October 7, 2010.
PTHP	Standard Size	<7,000 Btu/h	EER = 11.9 COP = 3.3	October 8, 2012.[2]
		≥7,000 Btu/h and ≤15,000 Btu/h	EER = 14.0 − (0.3 × Cap[1]) COP = 3.7 − (0.052 × Cap[1])	October 8, 2012.[2]
		>15,000 Btu/h	EER = 9.5 COP = 2.9	October 8, 2012.[2]
	Non-Standard Size	<7,000 Btu/h	EER = 9.3 COP = 2.7	October 7, 2010.
		≥7,000 Btu/h and ≤15,000 Btu/h	EER = 10.8 − (0.213 × Cap[1]) COP = 2.9 − (0.026 × Cap[1])	October 7, 2010.
		>15,000 Btu/h	EER = 7.6 COP = 2.5	October 7, 2010.

[1]"Cap" means cooling capacity in thousand Btu/h at 95 °F outdoor dry-bulb temperature.
[2] And manufactured before January 1, 2019. See Table 5 of this section for updated efficiency standards that apply to this category of equipment manufactured on and after January 1, 2019.

Table 5 to §431.97—Updated Minimum Efficiency Standards for PTAC and PTHP

Equipment Type	Category	Cooling Capacity	Efficiency Level	Compliance Date: Products manufactured on and after…
PTAC	Standard Size	<7,000 Btu/h	EER = 12.6	January 1, 2019
		≥7,000 Btu/h and ≤15,000 Btu/h	EER = 14.9 – (0.324 x Cap[1])	January 1, 2019
		>15,000 Btu/h	EER = 10.0	January 1, 2019
PTHP	Standard Size	<7,000 Btu/h	EER = 12.6 COP = 3.5	January 1, 2019
		≥7,000 Btu/h and ≤15,000 Btu/h	EER = 14.9 – (0.324 x Cap[1]) COP = 4.0 – (0.064 x Cap[1])	January 1, 2019
		>15,000 Btu/h	EER = 10.0 COP = 3.0	January 1, 2019

[1]"Cap" means cooling capacity in thousand Btu/h at 95 °F outdoor dry-bulb temperature.

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