DEPARTMENT OF ENERGY

10 CFR Parts 429 and 430

[EERE–2021–BT–STD–0020]

RIN 1904–AD49

Energy Conservation Program: Energy Conservation Standards for Consumer Pool Heaters

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

ACTION: Notice of proposed rulemaking and announcement of public meeting.

SUMMARY: The Energy Policy and Conservation Act, as amended (''EPCA''), prescribes energy conservation standards for various consumer products and certain commercial and industrial equipment, including consumer pool heaters. EPCA also requires the U.S. Department of Energy (''DOE'') to periodically determine whether more-stringent, standards would be technologically feasible and economically justified, and would result in significant energy savings. In this notice of proposed rulemaking (''NOPR''), DOE proposes definitions for the different classes of pool heaters, amended energy conservation standards for gas-fired pool heaters, new energy conservation standards for electric pool heaters, and also announces a public meeting to receive comment on these proposed standards and associated analyses and results.

DATES: *Meeting:* DOE will hold a public meeting via webinar on this NOPR on Wednesday, May 4, 2022, from 1 p.m. to 4 p.m. See section VII, ''Public Participation,'' for webinar registration information, participant instructions, and information about the capabilities available to webinar participants.

Comments: Comments regarding the likely competitive impact of the proposed standard should be sent to the Department of Justice contact listed in the **ADDRESSES** section on or before May 16, 2022.

DOE will accept comments, data, and information regarding this NOPR no later than June 14, 2022.

ADDRESSES: Interested persons are encouraged to submit comments using the Federal eRulemaking Portal at *www.regulations.gov.* Follow the instructions for submitting comments. Alternatively, interested persons may submit comments by email to the following address: *PoolHeaters2021STD0020@ee.doe.gov.* Include ''Energy Conservation Standards for Consumer Pool Heaters'' and the docket number EERE–2021–BT–STD–0020 and/or RIN number 1904–AD49 in the subject line of the message. Submit electronic comments in WordPerfect, Microsoft Word, PDF, or ASCII file format, and avoid the use of special characters or any form of encryption.

Although DOE has routinely accepted public comment submissions through a variety of mechanisms, including postal mail and hand delivery/courier, the Department has found it necessary to make temporary modifications to the comment submission process in light of the ongoing Covid–19 pandemic. DOE is currently suspending receipt of public comments via postal mail and hand delivery/courier. If a commenter finds that this change poses an undue hardship, please contact Appliance Standards Program staff at (202) 586–1445 to discuss the need for alternative arrangements. Once the Covid–19 pandemic health emergency is resolved, DOE anticipates resuming all of its regular options for public comment submission, including postal mail and hand delivery/courier.

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

Docket: The docket for this activity, which includes **Federal Register** notices, 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, not all documents listed in the index may be publicly available, such as information that is exempt from public disclosure.

The docket web page can be found at *www.regulations.gov/#!docketDetail;D=EERE-2021-BT-STD-0020.* The docket web page contains instructions on how to access all documents, including public comments, in the docket. See section VII for information on how to submit comments through *www.regulations.gov.*

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 the Office of Energy Efficiency and Renewable Energy following the instructions at *www.regulations.gov.*

EPCA requires the Attorney General to provide DOE a written determination of whether the proposed standard is likely to lessen competition. The U.S. Department of Justice Antitrust Division invites input from market participants and other interested persons with views on the likely competitive impact of the proposed standard. Interested persons may contact the Division at *energy.standards@usdoj.gov* on or before the date specified in the **DATES** section. Please indicate in the ''Subject'' line of your email the title and Docket Number of this proposed rulemaking.

FOR FURTHER INFORMATION CONTACT:

Ms. Julia Hegarty, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Office, EE–5B, 1000 Independence Avenue SW, Washington, DC, 20585–0121. Telephone: (240) 597–6737. Email: *ApplianceStandardsQuestions@ee.doe.gov.*

Ms. Kathryn McIntosh, U.S. Department of Energy, Office of the General Counsel, GC–33, 1000 Independence Avenue SW, Washington, DC, 20585–0121. Telephone: (202) 586–2002. Email: *Kathryn.McIntosh@hq.doe.gov.*

For further information on how to submit a comment, review other public comments and the docket, or participate in the webinar, contact the Appliance and Equipment Standards Program staff at (202) 287–1445 or by email: *ApplianceStandardsQuestions@ee.doe.gov.*

SUPPLEMENTARY INFORMATION:

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I. Synopsis of the Proposed Rule

Title III, Part B [1] of EPCA,[2] established the Energy Conservation Program for Consumer Products Other Than Automobiles. (42 U.S.C. 6291–6309) These products include consumer pool heaters, the subject of this rulemaking. (42 U.S.C. 6292(a)(11))

Pursuant to EPCA, any new or amended energy conservation standard must be designed to achieve the maximum improvement in energy efficiency that DOE determines is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A)) Furthermore, the new or amended standard must result in a significant conservation of energy. (42 U.S.C. 6295(o)(3)(B)) EPCA also provides that not later than 6 years after issuance of any final rule establishing or amending a standard, DOE must publish either a notice of determination that standards for the product do not need to be amended, or a notice of proposed rulemaking including new proposed energy conservation standards (proceeding to a final rule, as appropriate). (42 U.S.C. 6295(m)(1))

In accordance with these and other statutory provisions discussed in this document, DOE proposes amended energy conservation standards for gas-fired pool heaters and new energy conservation standards for electric pool heaters. In addition, the proposed new and amended standards are expressed in terms of the integrated thermal efficiency (TE_I) metric, which replaces the thermal efficiency (TE) metric for gas-fired pool heaters, and are shown in Table I.1. The proposed TE_I standards are expressed as a function of the active mode electrical input power (PE) in British thermal units per hour (Btu/h) for electric pool heaters and the gas input rating (Q_{IN}) in Btu/h for gas-fired pool heaters. These proposed standards, if adopted, would apply to all consumer pool heaters listed in Table I.1 manufactured in, or imported into, the United States starting on the date 5 years after the publication of the final rule for this rulemaking. (42 U.S.C. 6295(m)(4)(A)(ii))

[1] For editorial reasons, upon codification in the U.S. Code, Part B was redesignated Part A.

[2] All references to EPCA in this document refer to the statute as amended through the Energy Act of 2020, Public Law 116–260 (Dec. 27, 2020).

Table I.1 Proposed Energy Conservation Standards for Consumer Pool Heaters

Product Class	Integrated Thermal Efficiency TE_I* *(percent)*
Electric Pool Heater	$\frac{600(PE)}{PE + 1{,}619}$
Gas-Fired Pool Heater	$\frac{84(Q_{IN} + 491)}{Q_{IN} + 2{,}536}$

*PE is the active electrical power for electric pool heaters, in Btu/h, and Q_{IN} is the input capacity for gas-fired pool heaters, in Btu/h, as determined in accordance with the DOE test procedure at title 10 of the Code of Federal Regulations part 430, subpart B, appendix P.

A. Benefits and Costs to Consumers

Table I.2 presents DOE's evaluation of the economic impacts of the proposed standards on consumers of consumer pool heaters, as measured by the average life-cycle cost (''LCC'') savings and the simple payback period (''PBP'').[3] The average LCC savings are positive for electric pool heaters and gas-fired pool heaters, and the PBP is less than the average lifetime of electric pool heaters and gas-fired pool heaters, which is estimated to be 11.2 years (*see* section IV.F.6 of this NOPR).

TABLE I.2—IMPACTS OF PROPOSED ENERGY CONSERVATION STANDARDS ON CONSUMERS OF POOL HEATERS

Product class	Average LCC savings 2020$	Simple payback period years
Electric Pool Heater	1,029	0.7
Gas-fired Pool Heater	43	1.5

DOE's analysis of the impacts of the proposed standards on consumers is described in section IV.F of this document.

B. Impact on Manufacturers

The industry net present value (''INPV'') is the sum of the discounted cash flows to the industry from the reference year through the end of the analysis period (2021–2057). Using a real discount rate of 7.4 percent,[4] DOE estimates that the INPV for manufacturers of consumer pool heaters in the case without new and amended energy conservation standards is $188.7 million in 2020$. Under the proposed standards, the change in INPV is estimated to range from −14.7 percent to −7.7 percent, which is approximately −$27.7 million to −$14.4 million. In order to bring products into compliance with the proposed standards, it is estimated that the consumer pool heater industry would incur conversion costs of approximately $38.8 million.

DOE's analysis of the impacts of the proposed standards on manufacturers is described in section IV.J of this document. The analytic results of the manufacturer impact analysis (''MIA'') are presented in section V.B.2 of this document.

C. National Benefits and Costs[5]

DOE's analyses indicate that the proposed energy conservation standards for consumer pool heaters would save a significant amount of energy. Relative to the case without new or amended standards, the lifetime energy savings for consumer pool heaters purchased in the 30-year period that begins in the anticipated first full year of compliance with the new or amended standards (2028–2057) amount to 0.49 quadrillion British thermal units (''Btu''), or quads.[6] This represents a savings of 5.3 percent relative to the energy use of electric and gas-fired pool heaters in the case without amended standards (referred to as the ''no-new-standards case'').

The cumulative net present value (''NPV'') of total consumer benefits of the proposed standards for consumer pool heaters ranges from $0.95 billion (at a 7-percent discount rate) to $2.39 billion (at a 3-percent discount rate). This NPV expresses the estimated total value of future operating-cost savings minus the estimated increased product and installation costs for consumer pool heaters purchased in 2028–2057.

In addition, the proposed standards for consumer pool heaters are projected to yield significant environmental benefits. DOE estimates that the proposed standards would result in cumulative emission reductions (over the same period as for energy savings) of 19 million metric tons (''Mt'')[7] of carbon dioxide (''CO_2''), 5.5 thousand tons of sulfur dioxide (''SO_2''), 90 thousand tons of nitrogen oxides

[3] The average LCC savings refer to consumers that are affected by a standard and are measured relative to the efficiency distribution in the no-new-standards case, which depicts the market in the compliance year in the absence of new or amended standards (*see* section IV.F.9 of this NOPR). The simple PBP, which is designed to compare specific efficiency levels, is measured relative to the baseline product (*see* section IV.C of this NOPR).

[4] The discount rate was derived from industry financials from publicly traded companies and then modified according to feedback received during manufacturer interviews.

[5] All monetary values in this document are expressed in 2020 dollars.

[6] The quantity refers to full-fuel-cycle (''FFC'') energy savings. FFC energy savings includes the energy consumed in extracting, processing, and transporting primary fuels (*i.e.,* coal, natural gas, petroleum fuels), and, thus, presents a more complete picture of the impacts of energy efficiency standards. For more information on the FFC metric, see section IV.H.1 of this document.

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

(''NO_X''), 161 thousand tons of methane (''CH_4''), 0.15 thousand tons of nitrous oxide (''N_2O''), and 0.03 tons of mercury (''Hg'').[8]

DOE estimates the value of climate benefits from a reduction in greenhouse gases using four different estimates of the social cost of CO_2 (''SC–CO_2''), the social cost of methane (''SC–CH_4''), and the social cost of nitrous oxide (''SC–N_2O''). Together these represent the social cost of greenhouse gases (SC–GHG). DOE used interim SC–GHG values developed by an Interagency Working Group on the Social Cost of Greenhouse Gases (IWG).[9] The derivation of these values is discussed in section IV.L of this document. For presentational purposes, the climate benefits associated with the average SC–GHG at a 3-percent discount rate are estimated to be $0.9 billion. DOE does not have a single central SC–GHG point estimate and it emphasizes the importance and value of considering the benefits calculated using all four SC–GHG estimates.

DOE also estimates health benefits from SO_2 and NO_X emissions reductions.[10] DOE estimates the present value of the health benefits would be $0.1 billion using a 7-percent discount rate, and $0.3 billion using a 3-percent discount rate.[11] DOE is currently only monetizing (for SO_2 and NO_X) $PM_{2.5}$ precursor health benefits and (for NO_X) ozone precursor health benefits but will continue to assess the ability to monetize other effects such as health benefits from reductions in direct $PM_{2.5}$ emissions [12] [13]

Table I.3 summarizes the economic benefits and costs expected to result from the proposed standards for consumer pool heaters. In the table, total benefits for both the 3-percent and 7-percent cases are presented using the average GHG social costs with 3-percent discount rate. DOE does not have a single central SC–GHG point estimate and it emphasizes the importance and value of considering the benefits calculated using all four SC–GHG estimates. The estimated total net benefits using each of the four SC–GHG estimates are presented in section V.B.8. of this document.

TABLE I.3—SUMMARY OF MONETIZED ECONOMIC BENEFITS AND COSTS OF PROPOSED ENERGY CONSERVATION STANDARDS FOR CONSUMER POOL HEATERS

[TSL 5]

	Billion 2020$
3% discount rate	
Consumer Operating Cost Savings	3.2
Climate Benefits *	0.9
Health Benefits **	0.3
Total Benefits †	4.4
Consumer Incremental Product Costs ‡	0.8
Net Benefits	3.6
7% discount rate	
Consumer Operating Cost Savings	1.4
Climate Benefits *	0.9
Health Benefits **	0.1
Total Benefits †	2.4
Consumer Incremental Product costs ‡	0.4
Net Benefits	2.0

Note: This table presents the costs and benefits associated with consumer pool heaters shipped in 2028–2057. These results include benefits to consumers which accrue after 2057 from the products shipped in 2028–2057.

* Climate benefits are calculated using four different estimates of the social cost of carbon (SC–CO2), methane (SC–CH4), and nitrous oxide (SC–N2O) (model average at 2.5 percent, 3 percent, and 5 percent discount rates; 95th percentile at 3 percent discount rate), as shown in Table V.17 through Table V.19. Together these represent the global social cost of greenhouse gases (SC–GHG). For presentational purposes of this table, the climate benefits associated with the average SC–GHG at a 3 percent discount rate are shown, but the Department does not have a single central SC–GHG point estimate. See section. IV.L of this document for more details

** Health benefits are calculated using benefit-per-ton values for NO_X and SO_2. DOE is currently only monetizing $PM_{2.5}$ and (for NO_X) ozone precursor health benefits, but will continue to assess the ability to monetize other effects such as health benefits from reductions in direct $PM_{2.5}$ emissions. The health benefits are presented at real discount rates of 3 and 7 percent. See section IV.L of this document for more details.

[8] DOE calculated emissions reductions relative to the no-new-standards case, which reflects key assumptions in the *Annual Energy Outlook 2021* (''*AEO2021*). *AEO2021* represents current federal and state legislation and final implementation of regulations as of the time of its preparation. See section IV.K for further discussion of *AEO2021* assumptions that effect air pollutant emissions.

[9] See Interagency Working Group on Social Cost of Greenhouse Gases, Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide. Interim Estimates Under Executive Order 13990, Washington, DC, February 2021. Available at: *www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf* (last accessed March 17, 2022).

[10] DOE estimated the monetized value of SO_2 and NO_X emissions reductions associated with site and electricity savings using benefit per ton estimates from the scientific literature. See section IV.L.2 of this document for further discussion.

[11] DOE estimates the economic value of these emissions reductions resulting from the considered TSLs for the purpose of complying with the requirements of Executive Order 12866.

[12] DOE plans to update its methodology to reflect the Environmental Protection Agency's recent updates to benefit-per-ton values in a future impact analysis if DOE issues a final rule and generally for forthcoming rulemakings, but DOE does not have time to fully vet the new methods for this impact analysis.

[13] On March 16, 2022, the Fifth Circuit Court of Appeals (No. 22–30087) granted the federal government's emergency motion for stay pending appeal of the February 11, 2022, preliminary injunction issued in *Louisiana* v. *Biden,* No. 21–cv–1074–JDC–KK (W.D. La.). As a result of the Fifth Circuit's order, the preliminary injunction is no longer in effect, pending resolution of the federal government's appeal of that injunction or a further court order. Among other things, the preliminary injunction enjoined the defendants in that case from ''adopting, employing, treating as binding, or relying upon'' the interim estimates of the social cost of greenhouse gases—which were issued by the Interagency Working Group on the Social Cost of Greenhouse Gases on February 26, 2021—to monetize the benefits of reducing greenhouse gas emissions. In the absence of further intervening court orders, DOE will revert to its approach prior to the injunction and present monetized benefits where appropriate and permissible under law.

† Total and net benefits include consumer, climate, and health benefits. For presentation purposes, total and net benefits for both the 3-percent and 7-percent cases are presented using the average SC–GHG with 3-percent discount rate, but the Department does not have a single central SC–GHG point estimate. DOE emphasizes the importance and value of considering the benefits calculated using all four SC–GHG estimates. See Table V.22 for net benefits using all four SC–GHG estimates. On March 16, 2022, the Fifth Circuit Court of Appeals (No. 22–30087) granted the federal government's emergency motion for stay pending appeal of the February 11, 2022, preliminary injunction issued in *Louisiana* v. *Biden,* No. 21–cv–1074–JDC–KK (W.D. La.). As a result of the Fifth Circuit's order, the preliminary injunction is no longer in effect, pending resolution of the federal government's appeal of that injunction or a further court order. Among other things, the preliminary injunction enjoined the defendants in that case from "adopting, employing, treating as binding, or relying upon" the interim estimates of the social cost of greenhouse gases—which were issued by the Interagency Working Group on the Social Cost of Greenhouse Gases on February 26, 2021—to monetize the benefits of reducing greenhouse gas emissions. In the absence of further intervening court orders, DOE will revert to its approach prior to the injunction and present monetized benefits where appropriate and permissible under law.

‡ Costs include incremental equipment costs as well as installation costs.

The benefits and costs of the proposed standards, for consumer pool heaters sold in 2028–2057, can also be expressed in terms of annualized values. The monetary values for the total annualized net benefits are (1) the reduced consumer operating costs, minus (2) the increase in product purchase prices and installation costs, plus (3) the value of the benefits of GHGs, SO_2 and NO_X emission reductions, all annualized.[14]

The national operating savings are domestic private U.S. consumer monetary savings that occur as a result of purchasing the covered products and are measured for the lifetime of consumer pool heaters shipped in 2028–2057. The climate and health benefits associated with reduced emissions achieved as a result of the proposed standards are also calculated based on the lifetime of consumer pool heaters shipped in 2028–2057.

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 consumer benefits and costs and health benefits from reduced SO_2 and NO_X emissions, and the 3-percent discount rate case for climate benefits from reduced GHG emissions, the estimated cost of the standards proposed in this rule is $49.0 million per year in increased equipment costs, while the estimated annual benefits are $164 million in reduced equipment operating costs, $54.5 million in climate benefits, and $15.6 million in health benefits. In this case, the net benefit would amount to $185 million per year.

Using a 3-percent discount rate for all benefits and costs, the estimated cost of the proposed standards is $49.3 million per year in increased equipment costs, while the estimated annual benefits are $195 million in reduced operating costs, $54.5 million in climate benefits, and $19.6 million in health benefits. In this case, the net benefit would amount to $220 million per year.

TABLE I.4—ANNUALIZED MONETIZED BENEFITS AND COSTS OF PROPOSED ENERGY CONSERVATION STANDARDS FOR CONSUMER POOL HEATERS

[TSL 5]

	Million 2020$/year		
	Primary estimate	Low-net-benefits estimate	High-net-benefits estimate
3% discount rate			
Consumer Operating Cost Savings	194.9	179.0	212.8
Climate Benefits *	54.5	52.4	56.6
Health Benefits **	19.6	18.9	20.4
Total Benefits †	269	250	290
Consumer Incremental Product Costs ‡	49.3	51.4	49.4
Net Benefits	220	199	240
7% discount rate			
Consumer Operating Cost Savings	164.2	152.7	177.7
Climate Benefits *	54.5	52.4	56.6
Health Benefits **	15.6	15.0	16.1
Total Benefits †	234	220	250
Consumer Incremental Product Costs ‡	49.0	50.7	49.2
Net Benefits	185	169	201

Note: This table presents the costs and benefits associated with consumer pool heaters shipped in 2028–2057. These results include benefits to consumers which accrue after 2057 from the products shipped in 2028–2057.

* Climate benefits are calculated using four different estimates of the social cost of carbon (SC–CO2), methane (SC–CH4), and nitrous oxide (SC–N2O) (model average at 2.5 percent, 3 percent, and 5 percent discount rates; 95th percentile at 3 percent discount rate). Together these represent the global social cost of greenhouse gases (SC–GHG). For presentational purposes of this table, the climate benefits associated with the average SC–GHG at a 3 percent discount rate are shown, but the Department does not have a single central SC–GHG point estimate, and it emphasizes the importance and value of considering the benefits calculated using all four SC–GHG estimates. See section. IV.L of this document for more details.

[14] To convert the time-series of costs and benefits into annualized values, DOE calculated a present value in 2028, the year used for discounting the NPV of total consumer costs and savings. For the benefits, DOE calculated a present value associated with each year's shipments in the year in which the shipments occur (*e.g.,* 2030), and then discounted the present value from each year to 2028. The calculation uses discount rates of 3 and 7 percent for all costs and benefits. Using the present value, DOE then calculated the fixed annual payment over a 30-year period, starting in the compliance year, that yields the same present value.

** Health benefits are calculated using benefit-per-ton values for NO_X and SO_2. DOE is currently only monetizing $PM_{2.5}$ and (for NO_X) ozone precursor health benefits, but will continue to assess the ability to monetize other effects such as health benefits from reductions in direct $PM_{2.5}$ emissions. The health benefits are presented at real discount rates of 3 and 7 percent. See section IV.L of this document for more details.

† Total and net benefits include consumer, climate, and health benefits. For presentation purposes, total and net benefits for both the 3-percent and 7-percent cases are presented using the average SC–GHG with 3-percent discount rate, but the Department does not have a single central SC–GHG point estimate. DOE emphasizes the importance and value of considering the benefits calculated using all four SC–GHG estimates. On March 16, 2022, the Fifth Circuit Court of Appeals (No. 22–30087) granted the federal government's emergency motion for stay pending appeal of the February 11, 2022, preliminary injunction issued in *Louisiana* v. *Biden,* No. 21–cv–1074–JDC–KK (W.D. La.). As a result of the Fifth Circuit's order, the preliminary injunction is no longer in effect, pending resolution of the federal government's appeal of that injunction or a further court order. Among other things, the preliminary injunction enjoined the defendants in that case from ''adopting, employing, treating as binding, or relying upon'' the interim estimates of the social cost of greenhouse gases—which were issued by the Interagency Working Group on the Social Cost of Greenhouse Gases on February 26, 2021—to monetize the benefits of reducing greenhouse gas emissions. In the absence of further intervening court orders, DOE will revert to its approach prior to the injunction and present monetized benefits where appropriate and permissible under law.

‡ Costs include incremental equipment costs as well as installation costs.

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

D. Conclusion

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 the significant conservation of energy. DOE further notes that products achieving these standard levels are already commercially available for all product classes covered by this proposal. Based on the analyses described previously, DOE has tentatively concluded that the benefits of the proposed standards to the Nation (energy savings, positive NPV of consumer benefits, consumer LCC savings, and emission reductions) would outweigh the burdens (loss of INPV for manufacturers and LCC increases for some consumers).

DOE also considered more-stringent energy efficiency levels as potential standards 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 received 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.

II. Introduction

The following section briefly discusses the statutory authority underlying this proposed rule, as well as some of the relevant historical background related to the establishment of standards for consumer pool heaters.

A. Authority

EPCA authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment. Title III, Part B of EPCA established the Energy Conservation Program for Consumer Products Other Than Automobiles. These products include consumer pool heaters, the subject of this document. (42 U.S.C. 6292(a)(11)) EPCA prescribed energy conservation standards for these products (42 U.S.C. 6295(e)(2)) and directs DOE to conduct two cycles rulemakings to determine whether to amend these standards. (42 U.S.C. 6295(e)(4)) EPCA further provides that, not later than 6 years after the issuance of any final rule establishing or amending a standard, DOE must publish either a notice of determination that standards for the product do not need to be amended, or a NOPR including new proposed energy conservation standards (proceeding to a final rule, as appropriate). (42 U.S.C. 6295(m)(1))

The energy conservation program for covered products under EPCA consists essentially of four parts: (1) Testing, (2) labeling, (3) the establishment of Federal energy conservation standards, and (4) certification and enforcement procedures. Relevant provisions of EPCA specifically include definitions (42 U.S.C. 6291), test procedures (42 U.S.C. 6293), labeling provisions (42 U.S.C. 6294), energy conservation standards (42 U.S.C. 6295), and the authority to require information and reports from manufacturers (42 U.S.C. 6296).

Federal energy efficiency requirements for covered products established under EPCA generally supersede State laws and regulations concerning energy conservation testing, labeling, and standards. (42 U.S.C. 6297(a)–(c)) DOE may, however, grant waivers of Federal preemption for particular State laws or regulations, in accordance with the procedures and other provisions set forth under EPCA. (*See* 42 U.S.C. 6297(d))

Subject to certain criteria and conditions, DOE is required to develop test procedures to measure the energy efficiency, energy use, or estimated annual operating cost of each covered product. (42 U.S.C. 6295(o)(3)(A) and 42 U.S.C. 6295(r)) Manufacturers of covered products must use the prescribed DOE test procedure as the basis for certifying to DOE that their products comply with the applicable energy conservation standards adopted under EPCA and when making representations to the public regarding the energy use or efficiency of those products. (42 U.S.C. 6293(c) and 42 U.S.C. 6295(s)) Similarly, DOE must use these test procedures to determine whether the products comply with standards adopted pursuant to EPCA. (42 U.S.C. 6295(s)) The DOE test procedures for consumer pool heaters appear at title 10 of the Code of Federal Regulations (''CFR'') part 430, subpart B, appendix P (''appendix P'').

DOE must follow specific statutory criteria for prescribing new or amended standards for covered products, including consumer pool heaters. Any new or amended standard for a covered product must be designed to achieve the maximum improvement in energy efficiency that the Secretary of Energy determines is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A) and 42 U.S.C. 6295(o)(3)(B)) Furthermore, DOE may not adopt any standard that would not result in the significant conservation of energy. (42 U.S.C. 6295(o)(3)(B))

Moreover, DOE may not prescribe a standard: (1) For certain products, including consumer pool heaters, if no test procedure has been established for the product, or (2) if DOE determines by rule that the standard is not technologically feasible or economically justified. (42 U.S.C. 6295(o)(3)(A)–(B)) In deciding whether a proposed standard is economically justified, DOE must determine whether the benefits of the standard exceed its burdens. (42 U.S.C. 6295(o)(2)(B)(i)) DOE must make this determination after receiving comments on the proposed standard, and by considering, to the greatest extent practicable, the following seven statutory 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 covered products in the type (or class) compared to any increase in the price, initial charges, or maintenance expenses for the covered products that are likely to result from the standard;

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

(4) Any lessening of the utility or the performance of the covered products likely to result from the standard;

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

(6) The need for national energy and water conservation; and

(7) Other factors the Secretary of Energy (''Secretary'') considers relevant. (42 U.S.C. 6295(o)(2)(B)(i)(I)–(VII))

Further, EPCA establishes a rebuttable presumption that a standard is economically justified if the Secretary finds that the additional cost to the consumer of purchasing a product complying with an energy conservation standard level will be less than three times the value of the energy savings during the first year that the consumer will receive as a result of the standard, as calculated under the applicable test procedure. (42 U.S.C. 6295(o)(2)(B)(iii))

EPCA 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. 6295(o)(1)) 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 in 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. 6295(o)(4))

Additionally, EPCA specifies requirements when promulgating an energy conservation standard for a covered product that has two or more subcategories. DOE must specify a different standard level for a type or class of product that has 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 such feature justifies a higher or lower standard. (42 U.S.C. 6295(q)(1)) In determining whether a performance-related feature justifies a different standard for a group of products, DOE must consider such factors as the utility to the consumer of the feature and other factors DOE deems appropriate. *Id.* Any rule prescribing such a standard must include an explanation of the basis on which such higher or lower level was established. (42 U.S.C. 6295(q)(2))

Finally, pursuant to the amendments contained in the Energy Independence and Security Act of 2007 (''EISA 2007''), Public Law 110–140, any final rule for new or amended energy conservation standards promulgated after July 1, 2010, is required to address standby mode and off mode energy use. (42 U.S.C. 6295(gg)(3)) Specifically, when DOE adopts a standard for a covered product after that date, it must, if justified by the criteria for adoption of standards under EPCA (42 U.S.C. 6295(o)), incorporate standby mode and off mode energy use into a single standard, or, if that is not feasible, adopt a separate standard for such energy use for that product. (42 U.S.C. 6295(gg)(3)(A)–(B)) DOE's current test procedures for consumer pool heaters, which measures integrated thermal efficiency, addresses standby mode and off mode energy use. In this rulemaking, DOE intends to incorporate such energy use into any new or amended energy conservation standards it adopts in the final rule through use of integrated thermal efficiency as the regulating metric.

B. Background

1. Current Standards

The current energy conservation standard for gas-fired pool heaters is set forth in DOE's regulations at 10 CFR 430.32(k) and is repeated in Table II.1 of this document. The current energy conservation standard for gas-fired pool heaters is in terms of thermal efficiency, which measures only active mode efficiency. Electric pool heaters are a covered product under EPCA, but there is currently no Federal energy conservation standard.

TABLE II.1—FEDERAL ENERGY CONSERVATION STANDARDS FOR CONSUMER POOL HEATERS

Product class	Minimum thermal efficiency (percent)
Gas-Fired Pool Heaters	82

2. History of Standards Rulemakings for Consumer Pool Heaters

On April 16, 2010, DOE published a final rule in which it concluded the first round of rulemaking required under EPCA and established an amended energy conservation standard for consumer pool heaters. 75 FR 20112 (''April 2010 final rule'').[15] In relevant part, the April 2010 final rule amended the statutorily prescribed standards for gas-fired pool heaters with a compliance date of April 16, 2013, on and after which gas-fired pool heaters were required to achieve a thermal efficiency of 82 percent.

On December 17, 2012, DOE published a final rule in the **Federal Register** that established a new efficiency metric for gas-fired pool heaters, ''integrated thermal efficiency.'' 77 FR 74559, 74565 (''December 2012 TP final rule''). The integrated thermal efficiency (TE_I) metric built on the existing thermal efficiency metric for measuring active mode energy efficiency, and also accounts for the energy consumption during standby mode and off mode operation. DOE stated in the December 2012 TP final rule that for purposes of compliance with the energy conservation standard, the test procedure amendments related to standby mode and off mode (*i.e.,* integrated thermal efficiency) are not required until the compliance date of the next standards final rule, which addresses standby and off mode. 77 FR 74559, 74559.

On January 6, 2015, DOE published a final rule pertaining to its test procedures for direct heating equipment (''DHE'') and consumer pool heaters. 80 FR 792 (''January 2015 TP final rule''). In that final rule, DOE established test methods for measuring the integrated thermal efficiency of electric resistance and electric heat pump pool heaters.

To evaluate whether to propose amendments to the energy conservation standard for consumer pool heaters, DOE issued a request for information (''RFI'') in the **Federal Register** on March 26, 2015. 80 FR 15922 (''March

[15] A correction notice was published on April 27, 2010, correcting a reference to the compliance date for the energy conservation standard. 75 FR 21981.

2015 RFI''). Through the March 2015 RFI, DOE requested data and information pertaining to its planned technical and economic analyses for DHE and consumer pool heaters. Among other topics, the March 2015 RFI sought data and information pertaining to electric pool heaters. 80 FR 15922, 15924–15925. Although the March 2015 RFI and the previous energy conservation standards rulemaking (concluding with the April 2010 final rule) included both DHE and consumer pool heaters, DOE has elected to review its energy conservation standards for each of these products separately.[16]

DOE subsequently published a notice of data availability (''NODA'') in the **Federal Register** on October 26, 2015, which announced the availability of its analyses for electric pool heaters. 80 FR 65169 (''October 2015 NODA''). The purpose of the October 2015 NODA was to make publicly available the initial technical and economic analyses conducted for electric pool heaters, and present initial results of those analyses to seek further input from stakeholders. DOE did not propose new or amended standards for consumer pool heaters at that time. The initial technical support document (''TSD'') and accompanying analytical spreadsheets for the October 2015 NODA provided the analyses DOE undertook to examine the potential for establishing energy conservation standards for electric pool heaters and provided preliminary discussions in response to a number of issues raised by comments to the March 2015 RFI. It described the analytical methodology that DOE used and each analysis DOE had performed.

In response to the publication of the March 2015 RFI, DOE received seven comments from interested parties regarding DOE's analytical approach pertaining to both electric and gas-fired pool heaters. The March 2015 RFI comments relating to electric pool heaters were addressed in chapter 2 of the October 2015 NODA TSD. DOE received nine comments in response to the October 2015 NODA. Commenters on the March 2015 RFI and October 2015 NODA are listed in Table II.2 of this document. The comments received in response to October 2015 NODA, as well as those comments received in response to the March 2015 RFI not previously addressed in the October 2015 NODA, are discussed in the appropriate sections of this document.

TABLE II.2—INTERESTED PARTIES PROVIDING WRITTEN COMMENT IN RESPONSE TO THE MARCH 2015 RFI AND/OR OCTOBER 2015 NODA

Name(s)	Commenter type *	Acronym
Association of Pool and Spa Professionals and International Hot Tub Association (Joint Comment).	TA	APSP and IHTA.
Appliance Standard Awareness Project and Natural Resources Defense Council (Joint Comment).	EA	ASAP and NRDC.
Appliance Standard Awareness Project, Natural Resources Defense Council, Alliance to Save Energy, American Council for an Energy-Efficient Economy, and National Consumer Law Center (Joint Comment).	EA	ASAP et al.
Laclede Group	U	Laclede.
National Propane Gas Association	U	NPGA.
Air-Conditioning, Heating and Refrigeration Institute	TA	AHRI.
Edison Electric Institute	U	EEI.
California Investor Owned Utilities	U	CA IOUs.
Adriana Murray	I	Murray.
Jeffery Tawney	I	Tawney.
Raypak, Inc	M	Raypak.
Lochinvar, LLC	M	Lochinvar.
Coates Heater Manufacturing Co., Inc	M	Coates.

* EA: Efficiency/Environmental Advocate; I: Individual; M: Manufacturer; TA: Trade Association; U: Utility or Utility Trade Association.

A parenthetical reference at the end of a comment quotation or paraphrase provides the location of the item in the public record.[17]

C. Deviation From Appendix A

In accordance with section 3(a) of 10 CFR part 430, subpart C, appendix A (''appendix A''), DOE notes that it is deviating from the provision in appendix A regarding the pre-NOPR stages for an energy conservation standards rulemaking. Section 6(d)(2) of appendix A specifies that the length of the public comment period for a NOPR will vary depending upon the circumstances of the particular rulemaking, but will not be less than 75 calendar days. For this NOPR, DOE has opted to instead provide a 60-day comment period. As stated, DOE requested comment in the March 2015 RFI on the technical and economic analyses and provided stakeholders a 30-day comment period. 80 FR 15922. Additionally, DOE provided a 45-day comment period for the October 2015 notice of data availability 80 FR 65169. DOE has relied on many of the same analytical assumptions and approaches as used in the preliminary assessment presented in the notice of data availability and has determined that a 60-day comment period in conjunction with the prior comment periods provides sufficient time for interested parties to review the proposed rule and develop comments.

III. General Discussion

DOE developed this proposal after considering written comments, data, and information from interested parties that represent a variety of interests. The following discussion addresses issues raised by these commenters.

A. Product Classes and Scope of Coverage

When evaluating and establishing energy conservation standards, DOE

[16] The rulemaking docket for DHE can be found at: *www.regulations.gov/#!docketDetail;D=EERE-2016-BT-STD-0007.*

[17] The parenthetical reference provides a reference for information located in the docket of DOE's rulemaking to develop energy conservation standards for pool heaters. (Docket No. EERE–2021–BT–STD–0020, which is maintained at *www.regulations.gov*). The references are arranged as follows: (Commenter name, comment docket ID number, page of that document).

divides covered products into product classes by the type of energy used or by capacity or other performance-related features that justify differing standards. In determining whether a performance-related feature justifies a different standard, DOE must consider such factors as the utility of the feature to the consumer and other factors DOE determines are appropriate. (42 U.S.C. 6295(q)(1))

This NOPR covers consumer ''pool heaters'' defined as an appliance designed for heating nonpotable water contained at atmospheric pressure, including heating water in swimming pools, spas, hot tubs and similar applications. 10 CFR 430.2. The scope of coverage and product classes for this NOPR are discussed in further detail in section IV.A.1 of this NOPR.

B. Test Procedure

EPCA sets forth generally applicable criteria and procedures for DOE's adoption and amendment of test procedures. (42 U.S.C. 6293) Manufacturers of covered products must use these test procedures to certify to DOE that their product complies with energy conservation standards and to quantify the efficiency of their product. DOE's current energy conservation standards for consumer pool heaters are expressed in terms of thermal efficiency. See 10 CFR 430.32(k)(2). As stated in section II.A, DOE's test procedure for consumer pool heaters is found at appendix P.

As discussed in section II of this document, EISA 2007 amended EPCA to require DOE to amend its test procedures for covered consumer products generally to include measurement of standby mode and off mode energy consumption. (42 U.S.C. 6295(gg)(2)(A)) The test procedure applicable to fossil fuel-fired pool heaters, as amended in the December 2012 TP final rule, relies on the TE_I metric, which accounts for energy consumption during active mode operation (sections 2.1.1, 3.1.1, and 4.1.1 of appendix P) and standby mode (sections 2.2, 3.2, and 4.2 of appendix P) and off mode operation (sections 2.3, 3.2, and 4.3 of appendix P), as required by EISA 2007. 77 FR 74559, 74572. *See* also, 77 FR 74559, 74564–74565.

The DOE test procedure for electric resistance and electric heat pump pool heaters incorporates by reference Air-Conditioning, Heating, and Refrigeration Institute (''AHRI'') Standard 1160–2009, ''Performance Rating of Heat Pump Pool Heaters'' (''AHRI 1160'') and American National Standards Institute (''ANSI'')/American Society of Heating, Refrigerating, and Air-Conditioning Engineers (''ASHRAE'') Standard 146–2011, ''Method of Testing and Rating Pool Heaters'' (''ASHRAE 146''). The procedures referenced in AHRI 1160 and ASHRAE 146 are used to determine the active mode energy use for electric resistance (sections 2.1.2, 3.1.2, and 4.1.2 of appendix P) and electric heat pump pool heaters (sections 2.1.3, 3.1.3, and 4.1.3 of appendix P). Standby mode and off mode energy use are also recorded using the same procedures used for fossil-fuel fired pool heaters (sections 2.2, 3.2, and 4.2 and 2.3, 3.2, and 4.3 of appendix P, respectively). The active mode, standby mode, and off mode energy use is then combined into the TE_I metric (section 5 of appendix P).

In this document, DOE is proposing new and amended energy conservation standards for consumer pool heaters. To the extent DOE is also proposing amendments to the test procedure, such proposed amendments are limited to those necessary to accommodate the proposed definitions and the proposed product classes. As discussed further in sections III.F.2 and IV.A.1 of this document, DOE is proposing to amend appendix P to add definitions for active electrical power, input capacity, and output capacity, add a calculation to determine the output capacity for electric pool heaters, and clarify the calculation of input capacity for fossil fuel-fired pool heaters. The proposed amendments to appendix P, if made final, would not impact how the test procedure is conducted in terms of the measurements taken, but rather the additional provisions use existing measurements to calculate the values necessary for comparing product efficiency to the proposed standards.

In response to the March 2015 RFI and October 2015 NODA, DOE received several comments from stakeholders relating to the consumer pool heater test procedure, which DOE will consider further in the next revision of its consumer pool heater test procedure.

C. Technological Feasibility

1. General

In evaluating potential amendments to energy conservation standards, 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. Sections 6(c)(1), (2) of 10 CFR part 430, subpart C, appendix A. 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. Sections 6(b)(3)(i) and 7(b)(1) of appendix A to part 430, subpart C.

After DOE has determined that particular technology options are technologically feasible, it further evaluates each technology option in light of the following additional screening criteria: (1) Practicability to manufacture, install, and service; (2) adverse impacts on product utility or availability; (3) adverse impacts on health or safety, and (4) unique-pathway proprietary technologies. Sections 6(b)(3)(ii)–(v) and 7(b)(2)–(5) of appendix A to part 430 subpart C. Section IV.B of this document discusses the results of the screening analysis for consumer pool heaters, particularly the designs DOE considered, those it screened out, and those that are the basis for the standards considered in this rulemaking. For further details on the screening analysis for this rulemaking, see chapter 4 of the NOPR TSD.

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 consumer pool heaters, using the design parameters for the most efficient products available on the market or in working prototypes. The max-tech levels that DOE determined for this rulemaking are described in section IV.C.1.c of this document and in chapter 5 of the NOPR TSD.

D. Energy Savings

1. Determination of Savings

For each trial standard level (''TSL''), DOE projected energy savings from application of the TSL to consumer pool heaters purchased in the 30-year period that begins in the first full year of compliance with the proposed standards (2028–2057).[18] The savings

[18] Each TSL is composed of specific efficiency levels for each product class. The TSLs considered for this NOPR are described in section V.A of this document. DOE conducted a sensitivity analysis

are measured over the entire lifetime of consumer pool heaters purchased in the previous 30-year period. DOE quantified the energy savings attributable to each TSL as the difference in energy consumption between each standards case and the no-new-standards case. The no-new-standards case represents a projection of energy consumption that reflects how the market for a product would likely evolve in the absence of new or amended energy conservation standards.

DOE used its national impact analysis (''NIA'') spreadsheet model to estimate national energy savings (''NES'') from potential amended or new standards for consumer pool heaters. The NIA spreadsheet model (described in section IV.H of this document) calculates energy savings in terms of site energy, which is the energy directly consumed by products at the locations where they are used. For electricity, DOE reports national energy savings in terms of primary energy savings, which is the savings in the energy that is used to generate and transmit the site electricity. For natural gas, the primary energy savings are considered to be equal to the site energy savings. DOE also calculates NES in terms of full-fuel-cycle (''FFC'') energy savings. The FFC metric includes the energy consumed in extracting, processing, and transporting primary fuels (*i.e.,* coal, natural gas, petroleum fuels), and thus presents a more complete picture of the impacts of energy conservation standards.[19] DOE's approach is based on the calculation of an FFC multiplier for each of the energy types used by covered products or equipment. For more information on FFC energy savings, see section IV.H.1 of this document.

2. Significance of Savings

To adopt standards for a covered product, DOE must determine that such action would result in ''significant'' energy savings. (42 U.S.C. 6295(o)(3)(B))) Although the term ''significant'' is not defined in the EPCA, the U.S. Court of Appeals, for the District of Columbia Circuit in *Natural Resources Defense Council* v. *Herrington,* 768 F.2d 1355, 1373 (D.C. Cir. 1985), opined that Congress intended ''significant'' energy savings in the context of EPCA to be savings that were not ''genuinely trivial.''

The significance of energy savings offered by a new or amended energy conservation standard cannot be determined without knowledge of the specific circumstances surrounding a given rulemaking.[20] For example, the United States has now rejoined the Paris Agreement and will exert leadership in confronting the climate crisis. Additionally, some covered products and equipment have most of their energy consumption occur during periods of peak energy demand. The impacts of these products on the energy infrastructure can be more pronounced than products with relatively constant demand. In evaluating the significance of energy savings, DOE considers differences in primary energy and full-fuel-cycle (''FFC'') effects for different covered products and equipment when determining whether energy savings are significant. Primary energy and FFC effects include the energy consumed in electricity production (depending on load shape), in distribution and transmission, and in extracting, processing, and transporting primary fuels (*i.e.,* coal, natural gas, petroleum fuels), and thus present a more complete picture of the impacts of energy conservation standards.

Accordingly, DOE evaluated the significance of energy savings on a case-by-case basis. As discussed in section V.C of this document, DOE is proposing to adopt TSL 5, which would save an estimated 0.49 quads of energy (FFC). DOE has initially determined the energy savings for the TSL proposed in this proposed rulemaking are nontrivial, and, therefore, DOE considers them ''significant'' within the meaning of 42 U.S.C. 6295(o)(3)(B).

E. Economic Justification

1. Specific Criteria

As noted previously, EPCA provides seven factors to be evaluated in determining whether a potential energy conservation standard is economically justified. (42 U.S.C. 6295(o)(2)(B)(i)(I)–(VII)) The following sections discuss how DOE has addressed each of those seven factors in this rulemaking.

a. Economic Impact on Manufacturers and Consumers

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

For individual consumers, measures of economic impact include the changes in LCC and PBP associated with new or amended standards. These measures are discussed further in the following section. For consumers in the aggregate, DOE also calculates the national net present value of the consumer costs and benefits expected to result from particular standards. DOE also evaluates the impacts of potential standards on identifiable subgroups of consumers that may be affected disproportionately by a standard.

b. Savings in Operating Costs Compared To Increase in Price (LCC and PBP)

EPCA requires DOE to consider the savings in operating costs throughout the estimated average life of the covered product in the type (or class) compared to any increase in the price of, or in the initial charges for, or maintenance expenses of, the covered product that are likely to result from a 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 product. The LCC analysis requires a variety of inputs, such as product prices, product energy consumption, energy prices, maintenance and repair costs, product lifetime, and discount rates appropriate for consumers. To account for uncertainty and variability in specific inputs, such as product lifetime and discount rate, DOE uses a distribution of

that considers impacts for products shipped in a 9-year period.

[19] The FFC metric is discussed in DOE's statement of policy and notice of policy amendment. 76 FR 51282 (Aug. 18, 2011), as amended at 77 FR 49701 (Aug. 17, 2012).

[20] A numeric threshold for determining the significance of energy savings was established in a final rule published on February 14, 2020 (85 FR 8626, 8670), but was subsequently eliminated in a final rule published on December 13, 2021 (86 FR 70892).

values, with probabilities attached to each value.

The PBP is the estimated amount of time (in years) it takes consumers to recover the increased purchase cost (including installation) of a more-efficient product through lower operating costs. DOE calculates the PBP by dividing the change in purchase cost due to a more-stringent standard by the change in annual operating cost for the year that standards are assumed to take effect.

For its LCC and PBP analysis, DOE assumes that consumers will purchase the covered products in the first full year of compliance with new or amended standards. The LCC savings for the considered efficiency levels are calculated relative to the case that reflects projected market trends in the absence of new or amended standards. DOE's LCC and PBP analysis is discussed in further detail in section IV.F of this document.

c. Energy Savings

Although significant conservation of energy is a separate statutory requirement for adopting an energy conservation standard, EPCA requires DOE, in determining the economic justification of a standard, to consider the total projected energy savings that are expected to result directly from the standard. (42 U.S.C. 6295(o)(2)(B)(i)(III)) As discussed in section III.D of this document, DOE uses the NIA spreadsheet models to project national energy savings.

d. Lessening of Utility or Performance of Products

In establishing product classes and in evaluating design options and the impact of potential standard levels, DOE evaluates potential standards that would not lessen the utility or performance of the considered products. (42 U.S.C. 6295(o)(2)(B)(i)(IV)) Based on data available to DOE, the standards proposed in this document would not reduce the utility or performance of the products under consideration in this rulemaking.

e. Impact of Any Lessening of Competition

EPCA directs DOE to consider the impact of any lessening of competition, as determined in writing by the Attorney General, that is likely to result from a proposed standard. (42 U.S.C. 6295(o)(2)(B)(i)(V)) It also directs the 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. 6295(o)(2)(B)(ii)) 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 publish and respond to the Attorney General's determination in the final rule. DOE invites comment from the public regarding the competitive impacts that are likely to result from this proposed rule. In addition, stakeholders may also provide comments separately to DOJ regarding these potential impacts. See the **ADDRESSES** section for information to send comments to DOJ.

f. Need for National Energy Conservation

DOE also considers the need for national energy and water conservation in determining whether a new or amended standard is economically justified. (42 U.S.C. 6295(o)(2)(B)(i)(VI)) The energy savings from the proposed standards are likely to provide improvements to the security and reliability of the Nation's energy system. 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 of this document.

DOE maintains that environmental and public health benefits associated with the more efficient use of energy are important to take into account when considering the need for national energy conservation. The proposed standards are likely to result in environmental benefits in the form of reduced emissions of air pollutants and greenhouse gases (''GHGs'') associated with energy production and use. As part of the analysis of the need for national energy and water conservation, DOE conducts an emissions analysis to estimate how potential standards may affect these emissions, as discussed in section IV.K of this document; the estimated emissions impacts are reported in section V.B.7 of this document.

g. Other Factors

In determining whether an energy conservation standard is economically justified, DOE may consider any other factors that the Secretary deems to be relevant. (42 U.S.C. 6295(o)(2)(B)(i)(VII)) To the extent DOE identifies any relevant information regarding economic justification that does not fit into the other categories described previously, DOE could consider such information under ''other factors.'' No other factors were considered in this analysis.

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 consumer of a product that meets the standard is less than three times the value of the first year's energy savings resulting from the standard, as calculated under the applicable DOE test procedure. DOE's LCC and PBP analyses generate values used to calculate the effects that proposed energy conservation standards would have on the payback period for consumers. These analyses include, but are not limited to, the 3-year payback period contemplated under the rebuttable-presumption test. In addition, DOE routinely conducts an economic analysis that considers the full range of impacts to consumers, manufacturers, the Nation, and the environment, 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 IV.F.9 of this document.

F. Other Issues

1. Regulatory Approach for Consumer Pool Heaters

In response to the March 2015 RFI, EEI stated that if DOE intends to establish new energy efficiency standards for electric resistance pool heaters and electric heat pump pool heaters, it must follow the process used by DOE when considering whether to include a product as a covered product under EPCA. (EEI, No. 6 at p. 2) In response, DOE notes that the December 11, 2009 NOPR that preceded the April 2010 final rule explained in detail that the definition of ''pool heater'' in EPCA covers both gas-fired pool heaters and electric pool heaters, including heat pump pool heaters. 74 FR 65852, 65866–65867. And, as noted previously, DOE has established a test procedure for electric pool heaters and is now proposing standards in this document.

In the October 2015 NODA, DOE requested comment on its determination to forgo a preliminary analysis for gas-fired pool heaters and noted that interested parties will have the opportunity to comment on DOE's analyses for gas-fired pool heaters during the next phase of the analysis. 80 FR 65169, 65171. In response, NPGA and EEI argued that DOE should publish a NODA for gas-fired pool heaters in order to provide the public with equal opportunities to provide comments for both products. (NPGA, No. 15 at p. 2; EEI, No. 21 at p. 2)

In response to these comments, DOE notes that the analysis conducted for gas-fired pool heaters in this proposed rulemaking follows similar methodologies to those presented and used in the April 2010 final rule. Stakeholders were informed that the analysis methodology employed in this proposed determination would be based on the prior rulemaking. As such, DOE determined that a preliminary analysis was not necessary for gas-fired pool heaters. Interested parties have an opportunity to comment on the analysis during the course of this proposed rulemaking.

Laclede stated that it opposes any limitation of minimum efficiency standards for consumer pool heaters to those fueled by natural gas and propane. (Laclede Group, No. 17 at p. 3) As noted previously, DOE is proposing to adopt the TE_I metric for gas-fired pool heater standard, as well as proposing to establish a new standard for electric pool heaters, in this document.

The CA IOUs encouraged DOE to establish standards for standby and off mode energy consumption separately from thermal efficiency, because establishing a requirement for an integrated thermal efficiency metric may lead to the standby and off mode energy consumption not being considered by manufacturers, as they are small relative to overall consumer pool heater energy consumption. The CA IOUs added that establishing separate standby and off mode requirements and thermal efficiency requirements will ensure that seasonal off switches remain on most consumer pool heaters. (CA IOUs, No. 20 at p. 3) In response, DOE notes that it is required by EISA 2007 to include the standby and off mode energy consumption in the test procedure of all covered products unless such an integrated test procedure is technically infeasible for a covered product. (42 U.S.C. 6295(gg)(2)(A)) DOE must prescribe separate standby mode and off mode energy use test procedure if an integrated test procedure is deemed technically infeasible. (42 U.S.C. 6295(gg)(2)(A)(ii)) DOE notes that such determinations are based on the technical characteristics of a product and, as such, are product specific. In the case of consumer pool heaters, in the December 2012 TP final rule DOE determined that the inclusion of the standby and off mode energy use into an integrated metric would provide a measurable performance differentiation and concluded that an integrated metric is technically feasible. 77 FR 74559, 74564 (December 17, 2012). DOE disagrees with the CA IOUs' assertion that the integrated thermal efficiency may lead to standby and off mode energy consumption not being considered by manufacturers. DOE has initially found that the presence of a seasonal off switch improves the integrated thermal efficiency and has included it as a technology option in its analysis. Standby and off mode energy consumption may have a large impact on the integrated thermal efficiency, primarily due to the large number of operational hours in standby and off modes as compared to active mode. For instance, the standby fuel consumption of a pilot light on a gas-fired pool heater has a dramatic impact on its integrated thermal efficiency. Likewise, DOE estimates that for a heat pump pool heater inclusion of the standby and off mode energy consumption can reduce the overall efficiency by as much as 8 percent.

2. Certification and Enforcement

DOE reviewed its certification and enforcement provisions as they pertain to consumer pool heaters and proposes several provisions to clarify its procedures for gas-fired pool heaters.

DOE proposes to harmonize its terminology related to the capacity of consumer pool heaters as it relates to certification. For gas-fired pool heaters, DOE proposes to use the term ''input capacity'' in its provisions. DOE notes that input capacity is already certified for basic models of gas-fired pool heaters and DOE's proposed revisions to its regulations are a clarification only. If standards for gas-fired pool heaters are adopted via this proposed rulemaking, DOE would consider requirements for reporting and certifying to TE_I in lieu of TE in a separate rulemaking.

If standards for electric pool heaters are adopted via this rulemaking, DOE would consider requirements for reporting and certifying active electrical power (as applicable) along with the representative value for integrated thermal efficiency in a separate rulemaking.

To provide clarity on how values would be determined for certification, DOE also proposes clarifications in its test procedure found in appendix P by adding definitions for the terms ''input capacity'' (Q_{IN}), ''active electrical power'' (PE), and ''output capacity'' (Q_{OUT}) and identifying which measured variables in the test procedure represent these characteristics. Specifically, DOE proposes to: Use values measured during the active mode test described in Section 2.10.1 of ANSI Z21.56 (*i.e.,* heating value times correction factor times the quantity of fossil-fuel used divided by the length of the test) to determine the input capacity of a fossil fuel-fired water heater, as this calculation was not stated clearly within appendix P; to clarify that active electrical power is represented by the variable PE; and to provide a calculation for output capacity so the product class for an electric pool heater can be appropriately determined.

Also, DOE proposes that for enforcement testing, the input capacity or active electrical power (as applicable) would be measured pursuant to appendix P and compared against the rated value certified by the manufacturer. If the measured input capacity or active electrical power (as applicable) is within ±2 percent of the certified value, then DOE would use the certified value when determining the applicable standard. The ±2 percent threshold is already used [21] within the DOE enforcement provisions and test procedures as a reasonable range for input capacity to account for manufacturing variations that may affect the input capacity.

During enforcement testing for a gas-fired pool heater, if the measured input capacity is not within ±2 percent of the certified value, then DOE would follow these steps to attempt to bring the fuel input rate to within ±2 percent of the certified value. First, DOE would attempt to adjust the gas pressure in order to increase or decrease the input capacity as necessary. If the input capacity is still not within ±2 percent of the certified value, DOE would then attempt to modify the gas inlet orifice (*i.e.,* drill) if the unit is equipped with one. Finally, if these measures do not bring the input capacity to within ±2 percent of the certified value, DOE would use the mean measured input capacity (either for a single unit sample or the average for a multiple unit sample) when determining the applicable standard for the basic model.

[21] For example, the enforcement provisions for commercial water heating equipment, at 10 CFR 429.134(n), requires that the tested input rate be within 2 percent of the certified rated input.

For an electric pool heater, DOE would not take any steps to modify the unit to bring the active electrical power of the unit within the ±2 percent threshold. Rather, if the active electrical power is not within ±2 percent of the certified value, DOE would use the measured active electrical power (either for a single unit sample or the average for a multiple unit sample) when determining the applicable standard for the basic model. DOE proposes this verification process to provide manufacturers with additional information about how DOE will evaluate compliance.

DOE requests comment on the proposal to add to its enforcement provisions to use a ±2 percent threshold on the certified value of input capacity or active electrical power (as applicable) when determining the applicable energy conservation standard for the basic model.

In response to the October 2015 NODA, AHRI expressed concern regarding the representation of the integrated thermal efficiency values. AHRI acknowledged that the inclusion of the standby and off mode consumptions in the TE_I calculation results in percentages that are lower than the coefficient of performance (''COP'') equivalent, but suggested that the relative scale of the ratings has been lost in this process. AHRI suggested that for products where the efficiency ratings are less than 100 percent, a change of one or two percentage points may make a difference. However, for products such as heat pump pool heaters with efficiency ratings that exceed 300 percent,[22] a difference of 1 or 2 points is inconsequential. (AHRI, No. 16 at p. 3)

In response, in the context of an initial analysis, DOE used the test procedure equations in appendix P to arrive at the analyzed efficiency levels examined in the NODA. See chapter 5 of the NODA TSD. For this NOPR, however, DOE proposes capacity-dependent standards as described in section IV.C.1 of this document. It is important to preserve a higher level of precision in the test procedure and certification criteria because the evaluated standards are continuous functions that vary greatly dependent on capacity of the pool heater (input capacity or active electrical power, as applicable). In order to clarify this precision, DOE would consider rounding requirements for consumer pool heater in a separate rulemaking addressing certification reports.

In response to the March 2015 RFI, Lochinvar and Raypak expressed concern that the use of the integrated thermal efficiency metric would reduce the efficiency ratings for consumer pool heaters. (Lochinvar, No. 2 at p. 2; Raypak, No. 4 at p. 2) Lochinvar highlighted that the small reduction in the efficiency rating would impose a significant burden on manufacturers who will be required to assign new model numbers to all products due to the efficiency reduction. (Lochinvar, No. 2 at p. 2) AHRI requested that DOE clarify whether manufacturers will be required to change model numbers when implementing the new efficiency metric. (AHRI, No. 7 at p. 2) Raypak requested clarification on how DOE will address products that currently meet the minimum 82% thermal efficiency requirement but would no longer meet the minimum standard. (Raypak, No. 4 at p. 2)

In response, DOE first clarifies that specifying amended energy conservation standards for consumer pool heaters in terms of TE_I rather than in terms of TE would not require new basic model numbers. Were certification to TE_I required, pursuant to 10 CFR 429.12(b)(7), manufacturers may submit updated or corrected certification information for basic models. Therefore, at such time as certification were required using TE_I manufacturers could submit an updated certification report with the TE_I for a given basic model rather than assign a new basic model number upon the compliance date of amended energy conservation standards.

Regarding the reduction in efficiency ratings for models rated using the TE_I metric relative to the TE metric, DOE accounted for the differences between the metrics in its analysis. DOE examined efficiency levels, including the baseline efficiency level corresponding to the current energy conservation standards, in terms of TE_I that account for to the inclusion of standby mode and off mode energy consumption and electrical energy consumption that will cause the TE_I value to be lower than the TE value of a given model. See section IV.C.1 for discussion of the TE_I efficiency levels analyzed. Furthermore, EPCA requires that when a test procedure amendment changes the measured energy efficiency, models in use before the date on which the amended energy conservation standard becomes effective that comply with the energy conservation standard applicable to such covered products on the day before such date shall be deemed to comply with the amended energy conservation standard. (42 U.S.C. 6293(e)(3))

DOE seeks comment on its proposed certification and enforcement provisions and clarifications.

IV. Methodology and Discussion of Related Comments

This section addresses the analyses DOE has performed for this rulemaking with regard to consumer pool heaters. Separate subsections address each component of DOE's analyses.

DOE used several analytical tools to estimate the impact of the standards proposed in this document. The first tool is a spreadsheet that calculates the LCC savings and PBP of potential amended or new energy conservation standards. The NIA uses a second spreadsheet set that provides shipments projections and calculates national energy savings and net present value of total consumer costs and savings expected to result from potential energy conservation standards. DOE uses the third spreadsheet tool, the Government Regulatory Impact Model (''GRIM''), to assess manufacturer impacts of potential standards. These three spreadsheet tools are available on the DOE website for this proposed rulemaking: *www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=44&action=viewcurrent.* Additionally, DOE used output from the latest version of the Energy Information Administration's (''EIA's'') *Annual Energy Outlook* (''*AEO*'') 2020, a widely known energy projection for the United States, for the emissions and utility impact analyses.

A. Market and Technology Assessment

DOE develops information in the market and technology assessment that provides an overall picture of the market for the products concerned, including the purpose of the products, the industry structure, manufacturers, market characteristics, and technologies used in the products. 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 (1) a determination of the scope of the rulemaking and product classes, (2) manufacturers and industry structure, (3) existing efficiency programs, (4) shipments information, (5) market and industry trends; and (6) technologies or design options that could improve the energy efficiency of consumer pool heaters. The

[22] Heat pump pool heaters move heat from the ambient air and to the pool water instead of heating the pool water directly, as is done with electric resistance pool heaters. Heat pumps move heat as opposed to generating heat, so a relatively small amount of energy is required to provide a large amount of heat.

findings of the market assessment inform downstream analyses, such as the engineering analysis and LCC analysis, and are presented in detail in chapter 3 of the NOPR TSD. In addition, chapter 3 of the TSD includes a detailed discussion of technology options for improving the energy efficiency of consumer pool heaters; the key findings and updates to the technology assessment are summarized in the following section.

1. Scope of Coverage and Product Classes

Under EPCA, pool heaters (which include electric pool heaters, and gas-fired pool heaters, and oil-fired pool heaters) are covered products. (42 U.S.C. 6292(a)(11)) EPCA defines ''pool heater'' as an ''appliance designed for heating nonpotable water contained at atmospheric pressure, including heating water in swimming pools, spas, hot tubs and similar applications.'' (42 U.S.C. 6291(25)) However, energy conservation standards have only been established for gas-fired pool heaters.[23] For this proposed rulemaking, DOE proposes to establish additional product classes for electric pool heaters, establish energy conservation standards for electric pool heaters, and for gas-fired pool heaters, to translate the existing standard from the TE metric to an equivalent level in terms of the TE_I metric and to amend the energy conservation standards. DOE has tentatively determined not to analyze potential standards for oil-fired pool heaters based on the understanding that such standards would result in minimal energy savings. DOE also did not perform energy conservation standards analysis for electric spa heaters as DOE was unable to identify technology options available to improve the efficiency of such products. Accordingly, DOE is not proposing amended standards for these products in this NOPR.

In the March 2015 RFI, DOE noted that oil-fired pool heaters have an extremely small market share and requested comment on the potential energy savings that could result from energy conservation standards for oil-fired pool heaters. 80 FR 15922, 15925. In response, Raypak and AHRI indicated that there is little opportunity for savings. (Raypak, No. 4 at p. 3; AHRI, No. 7 at p. 3) AHRI noted that they only knew of one oil-fired pool heater on the market currently. (AHRI, No. 7 at p. 3) EEI suggested that DOE should analyze oil-fired pool heaters if they have significant market share (*i.e.,* greater than 2%) in order to maintain fuel and market neutrality. (EEI, No. 6 at p. 4) For this NOPR, DOE tentatively determined not to analyze potential standards for oil-fired pool heaters based on its previous understanding that the market for oil-fired pool heaters is extremely limited and, thus, any standards would be unlikely to result in significant energy savings. DOE's market research and the comments from AHRI and Raypak indicate that oil-fired pool heaters comprise a very small share of the consumer pool heater market. DOE does not anticipate a significant number of consumers would choose an oil-fired pool heater as a substitute for a gas-fired or electric pool heater due to the high first cost associated with installing a fuel oil tank, and the ongoing cost of fuel oil for pool heating.

In response to the March 2015 RFI, AHRI suggested that DOE limit the scope to less than 400,000 Btu/h for gas- and oil-fired pool heaters and less than or equal to 140,000 Btu/h for heat pump pool heaters to make a clear distinction between residential and commercial products. (AHRI, No. 7 at p. 2) Raypak stated that gas-fired pool heaters typically range from 50,000 Btu/h to 400,000 Btu/h for residential pools and commercial pool heaters typically range from 200,000 Btu/h to 4,000,000 Btu/hr. Raypak also stated that it is not uncommon to see multiple smaller pool heaters used together instead of utilizing a larger pool heater(s). (Raypak, No. 4 at p. 4)

EPCA places no capacity limit on the pool heaters it covers in terms of its definition of ''pool heater.'' (42 U.S.C. 6291(25)) Furthermore, EPCA covers pool heaters as a ''consumer product,'' (42 U.S.C. 6291(2), 42 U.S.C. 6292(a)(11)) and defines ''consumer product,'' in part, as an article that ''to any significant extent, is distributed in commerce for personal use or consumption by individuals.'' (42 U.S.C. 6291(1)) Standards established for pool heaters as a consumer product under EPCA apply to any pool heater distributed to any significant extent as a consumer product for residential use, regardless of input capacity and including consumer pool heater models that may also be installed in commercial applications. DOE has initially concluded that further delineation by adding an input capacity limit is not necessary. As discussed in the April 2010 final rule, pool heaters marketed as commercial equipment contain additional design modifications related to safety requirements for installation in commercial buildings. 75 FR 20112, 20127. In that final rule, DOE noted that this would include pool heating systems that are designed to meet a high volume flow and are matched with a pump from the point of manufacture to accommodate the needs of commercial facilities. *Id.* DOE stated that manufacturers can distinguish those units from pool heaters distributed to any significant extent as a consumer product for residential use, regardless of input capacity. *Id.* at 75 FR 20127–20128. Moreover, standards for gas-fired pool heaters regardless of size have been in place since 1990, and to place a capacity limit on standards now would result in backsliding for products over the capacity limit, which would be contrary to the anti-backsliding provision in EPCA. (42 U.S.C. 6295(o)(1))

In response to the March 2015 RFI, AHRI suggested that DOE consider atmospheric gas-fired heaters separately from fan-assist gas-fired heaters. Similarly, AHRI suggested that DOE consider condensing and non-condensing products separately as well. (AHRI, No. 7 at p. 4)

EPCA requires that a rule prescribing an energy conservation standard for a type (or class) of covered products must specify a level of energy use higher or efficiency lower, than that which applies (or would apply) for such type (or class) for any group of covered products which have the same function or intended use, if the Secretary determines that covered 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 such feature justifies a higher or lower standard from that which applies (or will apply) to other products within such type (or class). (42 U.S.C. 6295(q)(1)) In making a determination concerning whether a performance-related feature justifies the establishment of a higher or lower standard, the Secretary shall consider such factors as the utility to the consumer of such a feature, and such other factors as the Secretary deems appropriate. (*Id.*) DOE is not proposing to increase the stringency of the standard for gas-fired pool heaters to a level that would be unachievable by the gas-fired pool heaters described by AHRI. The gas-fired pool heaters described by AHRI are subject to the current standard and presently there are atmospheric, fan-assist, non-condensing, and condensing models on the market in compliance with that

[23] EPCA prescribed a minimum thermal efficiency of pool heaters and initially only defined thermal efficiency of pool heaters in the context of test conditions for gas-fired pool heaters. (*See* 42 U.S.C. 6295(e)(2) and 42 U.S.C. 6291(26))

standard. As such, there is no need to evaluate in the present document whether atmospheric, fan-assist, non-condensing, and/or condensing gas-fired pool heaters provide a unique feature and if so whether such feature justifies a different standard for gas-fired pool heaters.

In the March 2015 RFI, DOE requested comment on whether capacity or other performance related features that may affect efficiency would justify the establishment of consumer pool heater product classes that would be subject to different energy conservation standards. 80 FR 15922, 15925. Specifically, DOE sought comment on whether heat pump technology was a viable design for applications which typically utilize electric resistance pool heaters.

The CA IOUs and ASAP et al. both encouraged DOE to regulate electric pool heaters under a single product class, and to consider heat pump technology as a design option for electric pool heaters. (CA IOUs, No. 5 at p. 5 and No. 20 at p. 5; ASAP et al., No. 3 at p. 1–2) Murray stated support for a uniform homogenous standard for all consumer pool heaters. (Murray, No. 14 at p. 1) The CA IOUs further noted that in DOE's residential water heater standard, electric resistance and heat pump water heaters are combined into one product class and are not treated separately. (CA IOUs, No. 5 at p. 5) The CA IOUs encouraged DOE to investigate the national savings potential from water heating in portable electric spas which is almost entirely provided by electric resistance heating. (CA IOUs, No. 5 at p. 5)

EEI suggested that separate product classes should be established for electric resistance pool heaters and heat pump pool heaters in DOE's analysis, and AHRI recommended that each fuel type (gas, electric, and heat pump) be analyzed separately. (EEI, No. 6 at p. 2; AHRI, No. 7 at p. 2) EEI asserted that electric resistance pool heaters and heat pump pool heaters are distinct products with different characteristics and as such require different product classes. EEI stated that key differences include space constraints and operational considerations. (EEI, No. 6 at pp. 2–3)

AHRI and Raypak stated that heat pump technology is not a viable design for all applications in which electric resistance pool heaters are found. (AHRI, No. 7 at p. 3; Raypak, No. 4 at p. 2) The electric resistance-type units are typically installed as a component into a larger, more complex piece of equipment such as a spa or hot tub. AHRI stated that heat pumps could not typically be installed in the same housing. They further asserted that electric resistance pool heaters are typically installed in indoor applications where heat pump technology is not a cost-effective substitution. (AHRI, No. 7 at p. 3)

Coates stated that heat pump pool heaters have proven ineffective in climates that do not have high temperature and high humidity, being expensive and unable to perform as needed. Coates indicated that electric resistance spa heaters range from 1.5 kW to 11 kW. Coates added that heat pump pool heaters are usually not acceptable for spas due to their slow heat-up time, high cost, and inability to heat during the cool or cold months in northern climates. (Coates, No. 8 at p. 2)

In response to Murray's comment, DOE notes that, in evaluating and establishing energy conservation standards, EPCA directs DOE to divide covered products into classes based on the type of energy used. EPCA also directs DOE to divide covered products into classes based on capacity or other performance-related feature if such feature justifies a different standard. (42 U.S.C. 6295(q))

DOE considered comments raised by stakeholders when considering whether separate product classes should be evaluated in its analysis of potential standards for electric resistance pool heaters and electric heat pump pool heaters. DOE recognizes that that the performance of a heat pump is dependent upon the air temperature and air humidity at which it operates. However, DOE disagrees with Coates's assertion that heat pump pool heaters are ineffective in colder climates. Although heat pump pool heaters perform best when operating within an environment with high air temperature and high air humidity, they are nonetheless capable of operating effectively in cooler climates during the swimming season. DOE is aware of consumer heat pump pool heaters currently on the market with the capability of operating at below-freezing temperatures. DOE recognizes that heat pump pool heaters may have difficulty providing adequate heat to pools if operating during the colder months in northern climates. Rare cases such as these could be accommodated through the use of heat pump pool heaters that incorporate electric resistance backup in their designs (as is done in the case of some heat pump water heater designs[24]). Therefore, DOE proposes to maintain a single product class for electric pool heaters.

For this analysis, DOE has tentatively determined to separate certain electric pool heaters into an ''electric spa heaters'' product class. ANSI/APSP/International Code Council (''ICC'') Standard 6–2013, ''American National Standard for Residential Portable Spas and Swim Spas'' (ANSI 6) provides recommended minimum guidelines for the design, equipment, installation, and use of residential portable spas and swim spas. Spas and hot tubs come in many different configurations but are distinguished in section 1 of ANSI 6 based on whether they are portable or built-in and within the portable distinction whether they are self-contained or non-self-contained. Lower capacity electric heaters used to heat water in spas are a covered product by virtue of being within EPCA's definition of pool heater. (42 U.S.C. 6291(25)) Electric spa heaters are often incorporated into the construction of a self-contained spa or hot tub, resulting in the heater performing its major function (heating spa water) in a space constrained environment. These space constraints preclude the use of higher efficiency technologies (heat pump) and manufacturers instead rely on electric resistance heating elements. DOE has initially determined that heat pump technology is not a viable option for electric spa heaters designed for use within a self-contained portable electric spa because the space required for a heat pump impedes its incorporation into the construction of a spa or hot tub. DOE has also initially determined that heat pump technology is a viable option for heating a spa or hot tub if the heater is separate from the construction of the hot tub or spa (*i.e.,* non-self-contained as defined in section 1 of ANSI 6). As a result, DOE has separated electric spa heaters from the analysis of electric pool heaters. The proposed definition of ''electric spa heater'' distinguishes this product based on capacity and whether the product is designed to be installed within a portable electric spa. The proposed definitions for ''electric spa heater'' and ''portable electric spa'' are presented later in this section.

Electric spa heaters rely on electric heating elements for which there is currently negligible opportunity for efficiency gains. Consequently, DOE did not perform energy conservation standards analysis for electric spa heaters as DOE did not initially identify technology options that could be implemented to improve the efficiency of these products.

For the October 2015 NODA analysis, DOE defined electric spa heaters to be

[24] DOE gave similar consideration to establishing a separate product class for heat pump water heaters and consistent with the proposal in this document, DOE determined that heat pump electric water heaters do not warrant a separate product class. *See,* 75 FR 20112, 20135 (April 16, 2010).

heaters that: (1) Have a rated output capacity of 11 kW (37,534 Btu/h) or less; and (2) are factory- or field-assembled within the envelope of a spa, hot tub, or pool as defined by 10 CFR 430.2. See chapter 3 of the October 2015 NODA TSD. In the October 2015 NODA, DOE identified the 11 kW threshold as being a typical output capacity below which electric resistance heaters are integrated in spas. *Id.* DOE tentatively used this threshold in the October 2015 NODA analysis based on its assessment of the market. The threshold was also suggested in response to the March 2015 RFI by Coates, a manufacturer of electric resistance spa and pool heaters. (Coates, No. 8 at p. 2) Table IV.1 lists the product classes for consumer pool heaters outlined in Table 2.4.1 of the October 2015 NODA TSD.

TABLE IV.1—OCTOBER 2015 NODA PRODUCT CLASSES FOR CONSUMER POOL HEATERS

Product class	Additional description	Analyzed in October 2015 NODA?
Gas-fired Pool Heater		No.
Electric Pool Heater		Yes.
Electric Spa Heater	Output Capacity ≤11 kW; Assembled within spa, hot tub, or pool envelope.	No.

In response to the scope of coverage presented in the October 2015 NODA, AHRI stated that the analysis appears not to consider the market segment [25] that may require capacities much higher than the largest heat pump pool heaters available on the market. AHRI stated that the analysis must consider the entire current market for electric pool heaters and should not establish an efficiency standard that will make products unavailable for some segments of that market. AHRI recommended DOE establish separate product classes for electric pool heaters based on a capacity breakpoint. (AHRI, No. 16 at p. 1)

DOE's review of the heat pump pool heater market found that most models have output capacities less than 200,000 Btu/h, however, DOE did find electric heat pump pool heaters with output capacities up to 500,000 Btu/h. Whereas gas-fired pool heaters are available with output capacities approaching 4,100,000 Btu/h. Therefore, DOE agrees with AHRI's comment that heat pump technology is not currently utilized to a significant extent in the high capacity pool heater market segment. As discussed in section IV.C.1 of this document, DOE is proposing capacity dependent energy conservation standards for gas-fired and electric pool heaters. Further, the estimated TE_I values for the high capacity heat pump pool heaters available on the market are greater than the proposed efficiency levels discussed in section V.C, therefore, there DOE has tentatively determined that it is not currently necessary to establish separate product classes for electric pool heaters based on a capacity breakpoint.

DOE requested comment regarding whether the product classes outlined in the October 2015 NODA adequately describes the electric pool heater market. See chapter 3 of the October 2015 NODA.

Several commenters agreed with DOE's position to exclude electric spa heaters from the analysis. (CA IOUs, No. 20 at p. 6; APSP and IHTA No. 18 at p. 1) APSP and AHRI agreed with DOE's assumption that heat pump technology could not be implemented within a spa heater. (APSP and IHTA No. 18 at p. 1; AHRI, No. 16 at p. 2) The CA IOUs encouraged DOE to explore the energy savings potential from portable electric spas in another rulemaking. (CA IOUs, No. 20 at p. 6)

AHRI agreed that the basic concept of the product classes is adequate for the consumer pool heater market but suggested further development be made to the electric spa heater definition. AHRI agreed with the specification of a maximum output capacity as part of the definition of the electric spa heater product class, noting that the 11 kW limit is reasonable for spa heaters. However, AHRI stated that the second part of the definition (assembled within spa, hot tub, or pool envelope) is not clear enough. AHRI noted that the definition appears to exclude spa heaters that may be physically separate from the spa, hot tub, or pool but which are required to heat water for those units. AHRI suggested that either the specification of an ''envelope'' needs to be described in greater detail, or such specification should be reconsidered. (AHRI, No. 16 at p. 2)

DOE has considered AHRI's comment and agrees that the criterion that an electric spa heater is shipped within the spa envelope may cause confusion and issues for replacement electric spa heaters intended for existing portable electric spas. Due to these concerns, DOE has amended the envelope criterion in the definition of an electric spa heater to include electric spa heaters that are designed to be installed within a portable electric spa, which does not preclude electric spa heaters that are sold and shipped outside of the envelope of a spa, hot tub, or pool. The updated proposed definition is presented later in this section of this document.

In response to the product classes presented in the October 2015 NODA, Tawney suggested that DOE set separate standards for electric pool heaters that have both heating and cooling capabilities. Tawney stated that the addition of reversing components creates a diminished performance for all other components (*i.e.,* the compressor, evaporator, and condenser) and, therefore, requiring the minimum efficiency level to be set equal for these two different types of products would create design issues for the manufacturer and consumers. (Tawney, No. 13 at p. 1)

DOE recognizes that heat/cool heat pumps have reverse cycle capabilities to provide the cooling function, and, theoretically, manufacturers could design products intended for heating and cooling differently from those intended for heating only (*i.e.,* different size heat exchanger coils). However, based on DOE's review of products currently on the market, DOE does not expect the reverse cycle capability would negatively impact the integrated thermal efficiency of heat/cool heat pumps in heating mode. DOE examined parts diagrams found in manufacturer literature of traditional heat pump pool heaters and heat/cool heat pump models within the same product family which revealed the addition of a reversing valve as the only differentiator between the two products. DOE then compared the rated heating efficiency of both models and found them to be identical in the majority of cases, indicating that the presence of the reversing valve and reverse cycle capability does not inherently reduce heating performance. Therefore, DOE has tentatively determined that the creation of a separate product classes for heat pump

[25] Very large pools or pool in colder climates. (AHRI, No. 16, at p. 1)

pool heaters with cooling capability is not necessary.

DOE requests comment on its assumption that electric pool heaters that have both heating and cooling capabilities do not suffer diminished efficiency performance in heating mode.

DOE analyzed new and amended standards for gas-fired pool heaters and electric pool heaters but did not analyze energy conservation standards for electric spa heaters (*i.e.,* electric pool heaters with output capacity ≤ 11 kW that are designed to be installed in a portable electric spa).

DOE requests comment on the product classes analyzed for this proposed rulemaking.

DOE is proposing definitions for electric pool heaters, electric spa heaters, gas-fired pool heaters, oil-fired pool heaters, and portable electric spas to clarify its regulations as they apply to consumer pool heaters. Based on comments received in response to the October 2015 NODA, DOE refined its definition for electric spa heaters. The proposed definitions are as follows:

Electric pool heater means a pool heater other than an electric spa heater that uses electricity as its primary energy source.

Electric spa heater means a pool heater that (1) uses electricity as its primary energy source; (2) has an output capacity (as measured according to appendix P to subpart B of part 430) of 11 kW or less; and (3) is designed to be installed within a portable electric spa.

Gas-fired pool heater means a pool heater that uses gas as its primary energy source.

Oil-fired pool heater means a pool heater that uses oil as its primary energy source.

Portable electric spa means a self-contained, factory-built spa or hot tub in which all control, water heating and water circulating equipment is an integral part of the product. Self-contained spas may be permanently wired or cord connected.

DOE requests comment on the proposed definitions for electric pool heater, electric spa heater, gas-fired pool heater, oil-fired pool heater, and portable electric spa.

DOE also proposes to define output capacity and provide equations for its calculation for electric pool and spa heaters in its test procedure at appendix P. As described in section III.B of this document, appendix P incorporates by reference ASHRAE 146. DOE's proposed calculation for output capacity for an electric pool or spa heater utilizes measurements already taken for other calculations in appendix P and therefore DOE does not consider this provision to result in any additional test procedure burden. DOE proposes to define the output capacity for electric pool heaters and spa heaters as follows:

Output capacity for an electric pool or spa heater means the maximum rate at which energy is transferred to the water.

DOE proposes separate equations for the calculation of output capacity of an electric resistance pool heater and electric heat pump pool heater. For electric pool heaters that rely on electric resistance heating elements, DOE proposes that the output capacity be calculated as:

$$Q_{OUT,ER} = k * W * (T_{mo} - T_{mi}) * (60/30)$$

where k is the specific heat of water, W is the mass of water collected during the test, T_{mo} is the average outlet water temperature recorded during the primary test, T_{mi} is the average inlet water temperature record during the primary test, all as defined in Section 11.1 of ASHRAE 146, and (60/30) is the conversion factor to convert unit from per 30 minutes to per hour.

DOE proposes that the output capacity of an electric pool heater that uses heat pump technology be calculated as:

$$Q_{OUT,HP} = k * W * (T_{ohp} - T_{ihp}) * (60/t_{HP})$$

where k is the specific heat of water, W is the mass of water collected during the test, T_{ohp} is the average outlet water temperature during the standard rating test, T_{ihp} is the average inlet water temperature during the standard rating test, all as defined in Section 11.2 of ASHRAE 146, and t_{HP} is the elapsed time of data recording during the thermal efficiency test on electric heat pump pool heater, as defined in Section 9.1 of ASHRAE 146, in minutes.

DOE requests comment on its proposed definition for output capacity, as well as its proposed calculations for determining the output capacity of electric pool heaters.

2. Technology Options

In response to the March 2015 RFI, Coates stated their concern that DOE used the term ''less efficient products, such as electric resistance pool heaters'' and that the efficiency of electric pool and spa heaters is very high (98 percent or higher). (Coates, No. 8 at p. 5) DOE agrees that electric resistance pool heaters have efficiencies around 98 percent. However, the statement DOE made compares the efficiency of electric resistance pool heaters to heat pump pool heaters which have efficiencies greater than 100 percent. 80 FR 15922, 15929 (March 26, 2015). Therefore, electric resistance pool heaters are less efficient than heat pump pool heaters.

In the October 2015 NODA market and technology analysis for electric pool heaters, DOE identified eight technology options that would be expected to improve the efficiency of electric pool heaters, as measured by the DOE test procedure: Insulation improvements; control improvements; heat pump technology; heat exchanger improvements (heat pump); compressor improvements (heat pump); expansion valve improvements (heat pump); fan improvements (heat pump); and off switch. See section 3.3 of chapter 3 of the October 2015 NODA TSD.

DOE received no comments suggesting technology options be added to those listed in the October 2015 NODA analysis for electric pool heaters. In this NOPR analysis, DOE added switching mode power supply to the list of technology options for electric pool heaters.

In the March 2015 RFI, DOE identified five technology options that it expected to improve the efficiency of gas-fired pool heaters, as measured by the DOE test procedure: Insulation improvements; control improvements; improved heat exchanger design; condensing heat exchanger technology; and electronic ignition systems. 80 FR 15922, 15925.

In response to the potential technology options identified for gas-fired pool heaters in the March 2015 RFI, Raypak stated that improved insulation, improved controls, and improved ignition systems are currently widely used and have little opportunity to provide improvements in thermal efficiency. (Raypak, No. at 4 at p. 3) AHRI stated that improved controls are expected to have minimal or negative impact on efficiency due to the large size of pools as modulating heat is not an effective way to heat up pools. AHRI stated that most gas-fired pool heaters on the market currently are equipped with electronic ignition systems and the pilot light only comes on when heat is called. AHRI also opined that condensing heat exchanger technology is not an economically feasible option for gas-fired pool heaters due to the relatively short burner operating hours. (AHRI, No. 7 at p. 3)

In response, DOE notes that in its review of the market and during the engineering analysis (*see* section IV.C of this document), DOE generally identifies technologies that are commonly incorporated at the baseline efficiency level, as well as those typically implemented to achieve higher efficiencies. In the technology assessment DOE identifies all technologies that are possibilities for improving efficiency, in the event that any models do not already utilize them. DOE's engineering analysis is based on the typical technology or combination of technologies used to achieve each efficiency level, as observed in products on the market.

For this NOPR analysis, DOE identified three more technology options that would be expected to improve the integrated thermal efficiency of gas-fired pool heaters as measured by the test procedure, which were not listed in the March 2015 RFI. These technologies include: Condensing pulse combustion, switch mode power supply, and seasonal off switch.

After identifying all potential technology options for improving the efficiency of consumer pool heaters, DOE performed the screening analysis (*see* section IV.B of this document or chapter 4 of the TSD) on these technologies to determine which could be considered further in the analysis and which should be eliminated.

B. Screening Analysis

DOE uses the following five screening criteria to determine which technology options are suitable for further consideration in an energy conservation standards rulemaking:

(1) *Technological feasibility.* Technologies that are not incorporated in commercial products or in working prototypes will not be considered further.

(2) *Practicability to manufacture, install, and service.* If it is determined that mass production and reliable installation and servicing of a technology in commercial products could not be achieved on the scale necessary to serve the relevant market at the time of the projected compliance date of the standard, then that technology will not be considered further.

(3) *Impacts on product utility or product availability.* If it is determined that a technology would have a significant adverse impact on the utility of the product for significant subgroups of consumers or would result in the unavailability of any covered product type with performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially the same as products generally available in the United States at the time, it will not be considered further.

(4) *Adverse impacts on health or safety.* If it is determined that a technology would have significant adverse impacts on health or safety, it will not be considered further.

(5) *Unique-Pathway Proprietary Technologies.* If a design option utilizes proprietary technology that represents a unique pathway to achieving a given efficiency level, that technology will not be considered further, due to the potential for monopolistic concerns.

10 CFR part 430, subpart C, appendix A, sections 6(b)(3) and 7(b).

In summary, if DOE determines that a technology, or a combination of technologies, fails to meet one or more of the listed five criteria, it will be excluded from further consideration in the engineering analysis.

The subsequent sections include comments from interested parties pertinent to the screening criteria, DOE's evaluation of each technology option against the screening analysis criteria, and whether DOE determined that a technology option should be excluded (''screened out'') based on the screening criteria. DOE did not receive any comments from interested parties related to the screening analysis.

1. Screened-Out Technologies

DOE eliminated condensing pulse combustion from its analysis having tentatively determined that it is not technologically feasible and not practical to manufacture, install, and service. Although condensing pulse combustion technology shows promising results in increasing efficiency, it has not yet penetrated the consumer pool heater market, and similar efficiencies are achievable with other technologies that have already been introduced on the market.

2. Remaining Technologies

Through a review of each technology, DOE tentatively concludes that all of the other identified technologies listed in section IV.A.2 met all five screening criteria to be examined further as design options in DOE's NOPR analysis. In summary, DOE did not screen out the technology options shown in Table IV.2 of this document and considers them as design options in the engineering analysis.

TABLE IV.2—TECHNOLOGY OPTIONS WHICH PASSED SCREENING CRITERIA

Technology option	Electric pool heater	Gas-fired pool heater
Insulation improvements	X	X
Control improvements	X	X
Heat pump technology	X	
Heat exchanger improvements	X	X
Expansion valve improvements	X	
Fan improvements	X	
Condensing heat exchanger		X
Electronic ignition systems		X
Switch mode power supply	X	X
Seasonal off switch	X	X

DOE has initially determined that these technology options are technologically feasible because they are being used or have previously been used in commercially-available products or commercially viable, existing prototypes. DOE also finds that all of the remaining technology options meet the other screening criteria (*i.e.,* practicable to manufacture, install, and service and do not result in adverse impacts on consumer utility, product availability, health, or safety, unique-pathway proprietary technologies). For additional details, see chapter 4 of the NOPR TSD.

C. Engineering Analysis

The purpose of the engineering analysis is to establish the relationship between the efficiency and cost of consumer pool heaters. There are two elements to consider in the engineering analysis; the selection of efficiency levels to analyze (*i.e.,* the ''efficiency analysis'') and the determination of product cost at each efficiency level (*i.e.,* the ''cost analysis''). In determining the performance of higher-efficiency products, DOE considers technologies and design option combinations not eliminated by the screening analysis. For each product class, DOE estimates the baseline cost, as well as the incremental cost for the product at efficiency levels above the baseline. The output of the engineering analysis is a set of cost-efficiency ''curves'' that are used in downstream analyses (*i.e.,* the LCC and PBP analyses and the NIA).

1. Efficiency Analysis

DOE typically uses one of two approaches to develop energy efficiency levels for the engineering analysis: (1) Relying on observed efficiency levels in the market (*i.e.,* the efficiency-level approach), or (2) determining the incremental efficiency improvements associated with incorporating specific design options to a baseline model (*i.e.,* the design-option approach). Using the efficiency-level approach, the efficiency levels established for the analysis are determined based on the market distribution of existing products (in other words, based on the range of efficiencies and efficiency level ''clusters'' that already exist on the market). Using the design option approach, the efficiency levels established for the analysis are determined through detailed engineering calculations and/or computer simulations of the efficiency improvements from implementing specific design options that have been identified in the technology assessment. DOE may also rely on a combination of these two approaches. For example, the efficiency-level approach (based on actual products on the market) may be extended using the design option approach to ''gap fill'' levels (to bridge large gaps between other identified efficiency levels) and/or to extrapolate to the max-tech level (particularly in cases where the max-tech level exceeds the maximum efficiency level currently available on the market).

In this proposed rulemaking, DOE relies on the efficiency-level approach. For the October 2015 NODA, DOE identified the efficiency levels for analysis based on a review of products on the market and then, as described in section IV.C.2 of this document, used a cost-assessment approach which includes product teardowns to determine the technologies used at each efficiency level and the associated manufacturing costs at those levels. See section 5.7 of chapter 5 of the October 2015 NODA TSD.

DOE continued to use the same analytical approaches for this NOPR. DOE received specific comments from interested parties on certain aspects of the engineering analysis in response to the October 2015 NODA. A brief overview of the methodology, a discussion of the comments DOE received, DOE's response to those comments, and any adjustments made to the engineering analysis methodology or assumptions as a result of those comments is presented in the sections below. See chapter 5 of the NOPR TSD for additional details about the engineering analysis.

a. Efficiency Levels

As noted previously, for analysis of consumer pool heater standards, DOE used an efficiency-level approach to identify incremental improvements in efficiency for each product class. An efficiency-level approach enabled DOE to identify incremental improvements in efficiency for efficiency-improving technologies that consumer pool heater manufacturers already incorporate in commercially available models. After identifying efficiency levels for analysis, DOE used a cost-assessment approach (section IV.C.2 of this document) to determine the manufacturer production cost (''MPC'') at each efficiency level identified for analysis.

Integrated thermal efficiency accounts for the fuel and electricity consumption in active, standby, and off modes. However, at the time the engineering analysis for this NOPR was performed, manufacturers had not yet begun publishing the integrated thermal efficiency of their products (there are no existing standards for electric pool heaters, and standards for gas-fired pool heaters are currently in terms of thermal efficiency as described in section III.B of this document). Therefore, in the gathering of information to inform the engineering analysis, DOE was limited to thermal efficiency in the case of gas-fired pool heaters, and coefficients of performance (''COP'') (set equal to thermal efficiency by the test procedure) in the case of heat pump pool heaters. DOE then calculated the integrated thermal efficiency by combining the thermal efficiency (as defined in section 5.1 of the DOE test procedure) of the product, with typical values for active mode, standby mode, and off mode energy consumption. DOE derived these typical values from test data and sought manufacturer feedback during confidential manufacturer interviews to confirm that the values were appropriate.

The energy consumption rate measurements that contribute to the integrated thermal efficiency metric are presented in Table IV.3 of this document, and vary by consumer pool heater type (*i.e.,* electric resistance, electric heat pump, and gas-fired). DOE notes that these measurements also vary by efficiency level. The ''typical case'' energy use assumptions used to determine the efficiency levels are presented in greater detail in sections IV.C.1.b and IV.C.1.c of this document.

TABLE IV.3—INPUTS TO INTEGRATED THERMAL EFFICIENCY BY CONSUMER POOL HEATER TYPE

Consumer pool heater type	Inputs to TE_I	Description
Electric Resistance Pool Heater	E_t	Thermal efficiency (11.1 of ASHRAE 146).
	PE	Average annual electrical energy consumption.
	E_C	Electrical consumption in Btu per 30 mins.
	$P_{W,SB}$	Standby power consumption rate.
	$P_{W,OFF}$	Off power consumption rate.
Heat Pump Pool Heater	E_t	Thermal efficiency (11.1 of ASHRAE 146).
	PE	Average annual electrical energy consumption.
	$E_{c,hp}$	Electrical consumption during test time.
	t_{HP}	Test time.
	$P_{W,SB}$	Standby power consumption rate.
	$P_{W,OFF}$	Off power consumption rate.
Gas-Fired Pool Heater	E_t	Thermal efficiency (2.10 of ANSI Z21.56).
	E_C	Electrical consumption in Btu per 30 mins.
	Q_{PR}	Consumption rate of pilot.
	$Q_{off,R}$	Off mode fuel consumption rate.
	$P_{W,SB}$	Standby power consumption rate.
	$P_{W,OFF}$	Off Power consumption rate.

The integrated thermal efficiency metric is the ratio of the seasonal useful output of the consumer pool heater divided by the annual input to the consumer pool heater. Based on manufacturer interviews, DOE has tentatively determined that standby and off mode electricity consumption do not increase as capacity increases. This causes differences in the resulting integrated thermal efficiencies for units at different capacities that have the same thermal efficiency and same standby and off mode energy consumption. Lower capacity units will have lower integrated thermal efficiency ratings due to standby and off mode energy use comprising a larger share of the total energy use of the product than for larger capacity units. To account for this, instead of standards that are fixed integrated thermal efficiency levels as presented in section 5.3 of chapter 5 of the October 2015 NODA TSD, DOE is proposing equation-based efficiency levels in which the integrated thermal efficiency level is a function of the capacity of the unit.

DOE developed these integrated thermal efficiency equations using a similar methodology to the one used to develop the integrated thermal efficiency levels in the October 2015 NODA analysis for electric pool heaters. See section 5.3 of chapter 5 of the October 2015 NODA. Specifically, DOE selected the efficiency levels based on thermal efficiency, and then determined the typical values for all other energy consumption rate values that contribute to the integrated thermal efficiency metric (*i.e.,* standby mode, off mode). DOE then calculated the integrated thermal efficiency as a function of capacity by utilizing these typical values for all efficiency levels other than the max-tech level. As discussed further in section IV.C.1.c of this document, the max-tech level is the maximum efficiency theoretically possible and uses technologies (*i.e.,* seasonal off switch and switch mode power supply) that result in energy consumption rate values that are lower than the typical values used for the other efficiency levels.

Additional information regarding the selection of efficiency levels is provided in the following sections and in chapter 5 of the NOPR TSD.

b. Baseline Levels

For each product class, DOE generally selects a baseline model as a reference point for each class, and measures changes resulting from potential energy conservation standards against the baseline. The baseline model in each product class represents the characteristics of a product typical of that class (*e.g.,* capacity, physical size). Generally, a baseline model is one that just meets current energy conservation standards, or, if no standards are in place, the baseline is typically the most common or least efficient unit on the market.

DOE uses the baseline model for comparison in several phases of the analyses, including the engineering analysis, LCC analysis, PBP analysis, and NIA. To determine energy savings that will result from a new or amended energy conservation standard, DOE compares energy use at each of the higher energy efficiency levels to the energy consumption of the baseline unit. Similarly, to determine the changes in price to the consumer that will result from an amended energy conservation standard, DOE compares the price of a baseline unit to the price of a unit at each higher efficiency level. In the March 2015 RFI, DOE requested information regarding typical energy use (fossil fuel and electricity) in all modes, including standby and off modes for all consumer pool heater types. 80 FR 15992, 15924.

Raypak responded that the typical fossil fuel energy use in standby and off modes is zero because gas-fired pool heaters only fire when there is a call for heat to maintain a set temperature. Raypak commented that the electricity consumption is limited to standby and off mode for all types of consumer pool heaters and that the magnitude of these electricity consumption values may change slightly based on the input capacity of the unit. (Raypak, No. 4 at p. 2)

DOE has found several consumer pool heaters on the market which utilize standing pilots. These pilot lights operate when the consumer pool heater is not in use and contribute to fossil fuel energy use in standby mode. DOE does not disagree that electricity consumption may change slightly based on input capacity but has tentatively determined to use a single typical value for the various types of electrical energy consumption based on feedback received during confidential manufacturer interviews. Table IV.4 of this document presents the baseline efficiency level identified for gas-fired pool heaters.

Table IV.4 Baseline Efficiency Level for Gas-Fired Pool Heaters

Efficiency Level	E_t (percent)	Q_{PR} (Btu/h)	$Q_{off,R}$ (Btu/h)	PE (W)	$P_{W,SB}$* (W)	$P_{W,OFF}$* (W)	TE_I** (percent)
EL 0	82	1,000	1,000	20	7.2	7.2	$\frac{82(Q_{IN}+68)}{Q_{IN}+85{,}344}$

* Presented in terms of Btu/h in appendix P.

** Equation comprises input capacity QIN and Et and assumptions for PW,SB, and PW,OFF at left and uses equation 5.4.3 in the DOE test procedure found in appendix P.

Table IV.5 of this document presents the baseline efficiency level identified for electric pool heaters. No comments were received in response to the October 2015 NODA in regard to the baseline efficiency level for electric pool heaters.

Table IV.5 Baseline Efficiency Level for Electric Pool Heaters

Efficiency Level	E_t (percent)	$P_{W,SB}$ (W)*	$P_{W,OFF}$ (W)*	TE_I** (percent)
EL 0	99	1.2	1.2	$\frac{99\,PE}{PE + 341}$

* Presented in terms of Btu/h in appendix P.

** Equation comprises active electrical power PE and assumptions for E_t, $P_{W,SB}$, and $P_{W,OFF}$ at left and uses equation 5.4.3 in the DOE test procedure found in appendix P.

Additional details on the selection of baseline models and the development of the baseline efficiency equations may be found in chapter 5 of the NOPR TSD.

c. Other Efficiency Levels

As part of DOE's analysis, the maximum available efficiency level is the highest efficiency model currently available on the market. DOE also defines a ''max-tech'' efficiency level to represent the maximum possible efficiency for a given product.

Table IV.6 of this document shows the efficiency levels DOE selected for the October 2015 NODA analysis. See section 5.3 of chapter 5 of the October 2015 NODA. As described previously in this section, all else being equal, the integrated thermal efficiency metric is expected to vary depending on a consumer pool heater's capacity. The integrated thermal efficiencies listed in Table IV.6 are based on an output capacity of 110,000 Btu/h. (Note, the large increase in integrated thermal efficiency between EL 0 and EL 1 is the result of a technology option change from electric resistance elements as the heat source to a heat pump.)

TABLE IV.6—OCTOBER 2015 NODA EFFICIENCY LEVEL FOR ELECTRIC POOL HEATERS AT OUTPUT CAPACITY OF 110,000 BTU/H

Efficiency level	E_t (percent)	$P_{W,SB}$ (W) *	$P_{W,OFF}$ (W) *	TE_I ** (percent)
EL 0	99	1.2	1.2	99
EL 1	360	5.2	5.2	344
EL 2	520	5.2	5.2	486
EL 3	580	5.2	5.2	538
EL 4	600	5.2	5.2	556
EL 5	610	5.2	5.2	564

* Presented in terms of Btu/h in appendix P.

** Values are based on E_t and assumptions for $P_{W,SB}$ and $P_{W,OFF}$ at left, and uses equation 5.4.3 in the DOE test procedure found in appendix P.

DOE requested comment on the efficiency levels presented in the October 2015 NODA analysis, including the typical standby and off mode energy consumption of electric pool heaters.

In response to the October 2015 NODA analysis, AHRI stated that many manufacturers have not measured the standby and off mode consumption for many of their consumer pool heater models. Therefore, AHRI stated that they are not able to address the ''typical'' values used in the preliminary analysis. AHRI also stated that the efficiency levels presented in the October 2015 NODA analysis were acceptable. (AHRI, No. 16 at p. 2, 3)

In response to the efficiency levels presented in the October 2015 NODA for electric pool heaters ASAP and NRDC and CA IOUs encouraged DOE to re-evaluate the max-tech level for electric pool heaters. The commenters stated that the AHRI database includes models that exceed a COP of 6.1, the level presented as max-tech in the October 2015 NODA. The commenters stated that those units with a COP greater than 6.1 are smaller in capacity than the representative unit size of 110,000 Btu/h. (CA IOUs, No. 20 at p. 5; ASAP and NRDC, No. 19 at p. 2) CA IOUs stated their belief that larger capacity units could achieve similarly high COP levels. (CA IOUs, No. 20, at p. 5)

DOE recognizes that there are models on the market with higher COP ratings than the assumed COP rating used in the max-tech energy level. However, as noted by commenters, these units have a lower capacity than DOE's representative capacity. DOE has not identified larger residential heat pump pool heaters with a COP rating greater than 6.1 on the market or in prototypes. Smaller heat pump pool heaters with a COP greater than 6.1 may not be representative of efficiency improvements of which larger heat pump pool heaters are capable. Therefore, DOE maintained the same COP max-tech level used in the October 2015 NODA as an input to the integrated thermal efficiency equation for this analysis.

ASAP and NRDC urged DOE to evaluate a level that incorporates technology options presented in the October 2015 NODA TSD that may not be present in currently available consumer pool heaters including electronically commutated motor (''ECM'') fan motors (*i.e.,* brushless permanent magnet (''BPM'') motors),[26] toroidal transformers, and an off switch. (ASAP and NRDC, No. 19 at p. 3)

In response to these comments, DOE has incorporated standby and off mode technology options at the max-tech level to decrease the standby and off mode electricity consumption and thereby increase the integrated thermal efficiency at that level. These technology options include: Transformer improvements, switching mode power supply, and a seasonal off switch.

As was noted in chapter 3 of the October 2015 NODA TSD, the efficiency

[26] ''ECM'' refers to the constant-airflow BPM offerings of a specific motor manufacturer. DOE refers to this technology using the generic term, ''BPM motor.''

of permanent split capacitor (''PSC'') motors is highest at a single speed, with significant diminishing operation efficiency at other speeds, whereas BPM motors are capable of maintaining a high operating efficiency at multiple speeds. However, the energy savings associated with this technology may be limited as heat pump pool heaters operate at full capacity to satisfy the call for heat. As noted by ASAP and NRDC, heat pump pool heaters on the market do not currently utilize BPM fan motors. Therefore, DOE has not been able to test products in order to determine the magnitude of efficiency improvement, if any, that could be expected due to the incorporation of BPM motors.

DOE requests comment on the efficiency improvement expected from replacing a PSC fan motor with a BPM fan motor in heat pump pool heater.

AHRI stated that the use of straight (EL 1) or twisted (EL 2) titanium tube coils are two different ways to get to the same end. AHRI further commented that the two different design features described for EL 1 and EL 2, respectively, do not inherently result in the significantly different efficiencies estimated in the analysis. AHRI stated that the efficiency that will result from the use of straight or twisted titanium tubing will be based on the effectiveness of the overall design of the heat exchanger; the twisted tube provides no significant efficiency improvement of itself. (AHRI, No. 16 at pp. 3–4)

In response to AHRI's assertions, DOE notes that for electric pool heaters it selected efficiency levels and units for teardown based on the published coefficients of performance of models currently on the market (as integrated thermal efficiency data were not yet available). As shown in Table IV.7, the heat exchanger design of the model DOE analyzed at EL 1 in the October 2015 NODA included two straight titanium tube coils in submerged water tanks; at EL2, the model that was analyzed had a heat exchanger consisting of a single twisted titanium tube coil in concentric counter-flow PVC pipe. These models were included in the engineering analysis described in chapter 5 of the October 2015 NODA TSD. DOE did not assume *a priori* that the concentric/counter-flow PVC heat exchanger design would result in a certain efficiency increase compared to the submerged coil design, but rather found that these were the design paths for units with such rated efficiencies on the market. Upon further review of the models on the market, DOE has tentatively determined that consideration of two straight titanium tube coils in submerged water tanks as a design option for EL 1, as presented in the October 2015 NODA, does not represent a typical design for the lowest efficiency heat pump pool heater and, as discussed later in section IV.C.2.c of this document, this design option is more expensive than other designs that are similar to those used at the other ELs. As such, DOE has amended the design option for EL 1 to a heat pump with a heat exchanger consisting of a single twisted titanium tube coil in concentric counter-flow PVC pipe as this design better resembles the lowest efficiency heat pump pool heater on the market.

Table IV.7 provides a description of the typical technological change at each efficiency level for electric pool heaters.

TABLE IV.7—TECHNOLOGY DESCRIPTION BY EFFICIENCY LEVEL FOR ELECTRIC POOL HEATERS

Efficiency level	Technology
EL 0	Electric Resistance.
EL 1 *	Heat Pump, twisted Titanium tube coil in concentric/counter flow PVC Pipe.
EL 2	EL1 + increased evaporator surface area.
EL 3	EL2 + increased evaporator surface area.
EL 4	EL3 + increased evaporator surface area.
EL 5	EL4 + condenser coil length + seasonal off switch + switch mode power supply.

* The EL 1 design option has been updated from that presented in the October 2015 NODA. The description in the October 2015 NODA was, ''Heat Pump, two straight Titanium tube coils in submerged water tanks.''

Table IV.8 shows the efficiency levels DOE selected for the NOPR analysis for electric pool heaters based on application of the design options presented in Table IV.7.

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Table IV.8 Efficiency Levels for Electric Pool Heaters

Efficiency Level	E_t (percent)	$P_{W,SB}$* (W)	$P_{W,OFF}$* (W)	TE_I‡ (percent)
EL 0	99	1.2	1.2	$\frac{99\ PE}{PE + 341}$
EL 1	410	5.7	5.7	$\frac{410\ PE}{PE + 1{,}619}$
EL 2	520	5.7	5.7	$\frac{520\ PE}{PE + 1{,}619}$
EL 3	580	5.7	5.7	$\frac{580\ PE}{PE + 1{,}619}$
EL 4	600	5.7	5.7	$\frac{600\ PE}{PE + 1{,}619}$
EL 5†	610	3.1	0	$\frac{610\ PE}{PE + 443}$

* Presented in terms of Btu/h in appendix P.
† The max-tech efficiency level includes standby and off mode technology options.
‡ Equation comprises assumptions for E_t, $P_{W,SB}$, and $P_{W,OFF}$ at left and uses equation 5.4.3 in the DOE test procedure found in appendix P.

In the March 2015 RFI, DOE also requested information on the max-tech efficiency levels for gas-fired pool heaters. 80 FR 15922, 15926. In response, Raypak stated that the max-tech efficiency level for gas-fired pool heaters would be in the range of 94 to 96-percent thermal efficiency. Raypak stated that the selection of heat exchanger materials for gas-fired pool heaters restricts the max-tech efficiency from being higher because the materials used have to be resistant to the chemicals used in pools, particularly when the pool chemistry is not properly maintained. (Raypak, No. 4 at p. 3)

DOE analyzed a max-tech efficiency level of 95-percent thermal efficiency in this NOPR analysis based on its review of the gas-fired pool heater market. At the time of the analysis, 95-percent thermal efficiency represented the highest level available on the market.

Table IV.9 shows the efficiency levels DOE analyzed for this NOPR with respect to gas-fired pool heaters. DOE selected the thermal efficiency levels based on its review of the gas-fired pool heaters market.

Table IV.9 Efficiency Levels for Gas-Fired Pool Heaters

Efficiency Level	E_t (percent)	Q_{PR} (Btu/h)	$Q_{off,R}$ (Btu/h)	PE (W)	$P_{W,SB}$* (W)	$P_{W,OFF}$* (W)	TE_I† (percent)
EL 0	82	1,000	1,000	20	7.2	7.2	$\frac{82(Q_{IN}+68)}{Q_{IN}+85{,}344}$
EL 1	82	0	0	20	7.2	7.2	$\frac{82(Q_{IN}+68)}{Q_{IN}+2{,}113}$
EL 2	84	0	0	144	7.2	7.2	$\frac{84(Q_{IN}+491)}{Q_{IN}+2{,}536}$
EL 3**	95	0	0	220	4.6**	0**	$\frac{95(Q_{IN}+751)}{Q_{IN}+1{,}409}$

* Presented in terms of Btu/h in appendix P.

** The max-tech efficiency level includes standby and off mode technology options.

† Equation comprises assumptions for E_t, $P_{W,SB}$, and $P_{W,OFF}$ at left and uses equation 5.4.3 in the DOE test procedure found in appendix P.

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DOE seeks comment from interested parties regarding the efficiency levels selected for the NOPR analysis.

Table IV.10 provides a description of the typical technological change(s) at each efficiency level for gas-fired pool heaters.

TABLE IV.10—TECHNOLOGY DESCRIPTION BY EFFICIENCY LEVEL FOR GAS-FIRED POOL HEATERS

Efficiency level	Technology
EL 0	Standing Pilot + Cu or CuNi Finned Tube + Atmospheric.
EL 1	Electronic Ignition + Cu or CuNi Finned Tube + Atmospheric.
EL 2	Electronic Ignition + Cu or CuNi Finned Tube + Blower Driven Gas/Air Mix.
EL 3	Condensing + CuNi and Cu Finned Tube + seasonal off switch + switch mode power supply.

DOE seeks comment from interested parties regarding the typical technological changes associated with each efficiency level.

See section VII.E for a list of issues on which DOE seeks comment.

2. Cost Analysis

The cost analysis portion of the engineering analysis is conducted using one or a combination of cost approaches. The selection of cost approach depends on a suite of factors, including the availability and reliability of public information, characteristics of the regulated product, the availability and timeliness of purchasing the product on the market. The cost approaches are summarized as follows:

- *Physical teardowns:* Under this approach, DOE physically dismantles a commercially available product, component-by-component, to develop a detailed bill of materials for the product.
- *Catalog teardowns:* In lieu of physically deconstructing a product, DOE identifies each component using parts diagrams (available from manufacturer websites or appliance repair websites, for example) to develop the bill of materials for the product.
- *Price surveys:* If neither a physical nor catalog teardown is feasible (for example, for tightly integrated products such as fluorescent lamps, which are infeasible to disassemble and for which parts diagrams are unavailable) or cost-prohibitive and otherwise impractical (*e.g.* large commercial boilers), DOE conducts price surveys using publicly available pricing data published on major online retailer websites and/or by soliciting prices from distributors and other commercial channels.

At the start of the engineering analysis, DOE identified the energy efficiency levels associated with consumer pool heaters on the market using data gathered in the market assessment. DOE also identified the technologies and features that are typically incorporated into products at the baseline level and at the various energy efficiency levels analyzed above the baseline. Next, DOE selected products for the physical teardown analysis having characteristics of typical products on the market at the representative capacity. DOE gathered information from performing a physical teardown analysis (see section IV.C.2.a of this document) to create detailed bill of materials (BOMs), which included all components and processes used to manufacture the products. DOE used the BOMs from the teardowns as inputs to calculate the MPC for products at various efficiency levels spanning the full range of efficiencies from the baseline to the maximum technology available. DOE reexamined and revised its cost assessment performed for the October 2015 NODA analysis.

During the development of the analysis for the NOPR, DOE held interviews with manufacturers to gain insight into the consumer pool heater industry, and to request feedback on the engineering analysis. DOE used the information gathered from these interviews, along with the information obtained through the teardown analysis and public comments, to refine its MPC estimates for this rulemaking. Next, DOE derived manufacturer markups using publicly-available consumer pool heater industry financial data in conjunction with manufacturers' feedback. The markups were used to convert the MPCs into manufacturer sales prices (MSPs). Further information on comments received and the analytical methodology is presented in the following subsections. For additional detail, see chapter 5 of the NOPR TSD.

a. Teardown Analysis

To assemble BOMs and to calculate the manufacturing costs for the different components in consumer pool heaters, DOE disassembled multiple units into their base components and estimated the materials, processes, and labor required for the manufacture of each individual component, a process referred to as a ''physical teardown.''

Using the data gathered from the physical teardowns, DOE characterized each component according to its weight, dimensions, material, quantity, and the manufacturing processes used to fabricate and assemble it.

DOE also used a supplementary method, called a ''virtual teardown,'' which examines published manufacturer catalogs and supplementary component data to estimate the major physical differences between a product that was physically disassembled and a similar product that was not. For supplementary virtual teardowns, DOE gathered product data such as dimensions, weight, and design features from publicly-available information, such as manufacturer catalogs.

The teardown analysis allowed DOE to identify the technologies that manufacturers typically incorporate into their products, along with the efficiency levels associated with each technology or combination of technologies. The BOMs from the teardown analysis were then used as inputs to calculate the MPC for each product that was torn down. The MPC's resulting from the teardowns were used to develop an industry average MPC for each efficiency level of each product class analyzed.

More information regarding details on the teardown analysis can be found in chapter 5 of the NOPR TSD.

b. Cost Estimation Method

The costs of individual models are estimated using the content of the BOMs (*i.e.,* materials, fabrication, labor, and all other aspects that make up a production facility) to generate the MPCs. For example, these MPCs include overhead and depreciation. DOE collected information on labor rates, tooling costs, raw material prices, and other factors as inputs into the cost estimates. For purchased parts, DOE 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 [27] (*i.e.,* tube, sheet metal) are estimated using the average of the most recent 5-year period. The cost of transforming the intermediate materials into finished parts was estimated based on current industry pricing at the time of analysis.[28]

c. Manufacturing Production Costs

DOE estimated the MPC at each efficiency level considered for each product class, from the baseline through the max-tech and then calculated the percentages attributable to each cost category (*i.e.,* materials, labor, depreciation, and overhead). These percentages are used to validate the assumptions by comparing them to manufacturers' actual financial data published in annual reports, along with feedback obtained from manufacturers during interviews. DOE uses these production cost percentages in the MIA (see section IV.J of this document).

DOE's analysis focused on a single representative capacity for each product class analyzed. DOE selected a representative output capacity of 110,000 Btu/h for electric pool heaters and a representative input capacity of 250,000 Btu/h for gas-fired pool heaters.[29] DOE selected these representative capacities based on the number of available models on the market and by referencing a number of sources, including information collected for the market and technology assessment, as well as information obtained from product literature. DOE then sought feedback on the representative capacities during confidential manufacturer interviews.

AHRI stated that the MPC estimates for electric pool heaters presented in the October 2015 NODA analysis are significantly flawed. AHRI stated that the relationship of manufacturing cost to efficiency for heat pump pool heaters is relatively linear and proportional, similar to other consumer products. AHRI suggested that the design features assumed for EL 1 and EL 2 mischaracterize how those respective efficiency levels are achieved and provide an unrealistic estimate of MPC, *i.e.,* a 40% improvement in the EL 1 efficiency cannot be achieved for only a $1 increase in MPC. (AHRI, No. 16 at p. 3–4)

As discussed in section IV.C.1.c, the electric pool heaters selected for teardown and to represent each efficiency level were based on the published coefficients of performance of models currently on the market (as integrated thermal efficiency data were not yet available). DOE did not assume *a priori* that the concentric/counter-flow PVC heat exchanger design would result in a certain efficiency increase compared to the submerged coil design, but rather found that these were the design paths for units with such rated efficiencies on the market. Further, as demonstrated by DOE's cost-efficiency curves, although the design at EL 2 provides a large improvement in efficiency as compared to the design evaluated at EL 1 in the October 2015 NODA, DOE's estimate of the MPC based on its teardown analysis indicated that the cost to manufacture the product with a heat exchanger as designed at EL 2 was not substantially more than that at EL 1. For the analysis conducted for this NOPR, as discussed in section IV.C.1.c, DOE has tentatively determined to change the design option for the electric pool heater EL 1 to be more similar to the design options at the other ELs (*i.e.,* twisted Titanium tube coil in concentric/counter flow PVC Pipe).

For this NOPR analysis, DOE revised the cost analysis assumptions it used for the October 2015 NODA analysis based on updated pricing information (for raw materials and purchased parts) and additional manufacturer feedback. This resulted in refined MPCs and production cost percentages.

Table IV.11 presents DOE's estimates of the MPC's by efficiency level for electric pool heaters in the NOPR analysis. The integrated thermal efficiencies and MPCs listed in Table IV.11 are based on an output capacity of 110,000 Btu/h.

TABLE IV.11—MANUFACTURING PRODUCTION COST FOR ELECTRIC POOL HEATERS AT REPRESENTATIVE OUTPUT CAPACITY OF 110,000 BTU/H

Efficiency level	TE_I (percent)	MPC ($2020)
EL 0	99	893
EL 1	387	1,093

[27] American Metals Market, available at *www.amm.com/.*

[28] U.S. Department of Labor, Bureau of Labor Statistics, Producer Price Indices, available at *www.bls.gov/ppi/.*

[29] For gas-fired pool heaters, manufacturers are currently required to certify input capacity pursuant to 10 CFR 429.12. For electric heat pump pool heaters, manufacturers currently use output capacity in order to represent the capacity of a unit. DOE used a combination of the AHRI directory data (*www.ahridirectory.org/*) and product literature to obtain data regarding electric heat pump pool heater output capacity.

TABLE IV.11—MANUFACTURING PRODUCTION COST FOR ELECTRIC POOL HEATERS AT REPRESENTATIVE OUTPUT CAPACITY OF 110,000 BTU/H—Continued

Efficiency level	TE_I (percent)	MPC ($2020)
EL 2	483	1,144
EL 3	534	1,188
EL 4	551	1,220
EL 5	595	1,304

In developing the MPCs for gas-fired pool heaters for this NOPR, DOE considered the heat exchanger material and whether a model would utilize a cupronickel or copper heat exchanger at a given efficiency level. DOE surveyed the market and found that the percentage of models at each efficiency level that currently utilize copper or cupronickel heat exchangers and assumed that, under an amended standard, the percentage would remain unchanged.[30]

DOE requests comment on its assumption that the fraction of shipments which utilize cupronickel heat exchangers would not change as a result of amended standards.

Table IV.12 presents DOE's estimates of the MPCs by efficiency level for gas-fired pool heaters in the NOPR analysis. The integrated thermal efficiencies and MPCs listed in Table IV.12 are based on an input capacity of 250,000 Btu/h.

TABLE IV.12—MANUFACTURING PRODUCTION COST FOR GAS-FIRED POOL HEATERS AT REPRESENTATIVE INPUT CAPACITY OF 250,000 BTU/H

Efficiency level	TE_I (percent)	MPC ($2020)
EL 0	61.1	659
EL 1	81.3	665
EL 2	83.3	827
EL 3	94.8	1,157

Chapter 5 of the NOPR TSD presents additional detail regarding the development of DOE's estimates of the MPCs for consumer pool heaters.

d. Manufacturer Markups

To account for manufacturers' non-production costs and profit margin, DOE applies a non-production cost multiplier (the manufacturer markup) to the MPC. The resulting MSP is the price that DOE research suggests the manufacturer can sell a given unit into the marketplace under a standards scenario. To meet new or amended energy conservation standards, manufacturers typically redesign their baseline products. These design changes typically increase MPCs relative to those of previous baseline MPCs. Depending on the competitive environment for these particular products, some or all of the increased production costs may be passed from manufacturers to retailers and eventually to customers in the form of higher purchase prices. As production costs increase, manufacturers may also incur additional overhead (*e.g.,* warranty costs).

The manufacturer markup has an important bearing on profitability. A high markup under a standards scenario suggests manufacturers can readily pass along the increased variable costs and some of the capital and product conversion costs (the one-time expenditures) to consumers. A low markup suggests that manufacturers will have greater difficulty recovering their investments, product conversion costs, and/or incremental MPCs.

DOE estimated manufacturer markups based on publicly available financial information for consumer pool heater manufacturers, and information obtained during manufacturer interviews, DOE assumed the non-production cost markup—which includes selling, general, and administrative (''SG&A'') expenses, research and development (''R&D'') expenses, interest, and profit—to be 1.33 for gas-fired pool heaters and 1.28 for electric pool heaters. See chapter 5 of the NOPR TSD for more details about the manufacturer markup calculation.

e. Manufacturer Interviews

Throughout the rulemaking process, DOE has sought and continues to seek feedback and insight from interested parties that would improve the information used in its analyses. DOE interviewed manufacturers as a part of the NOPR manufacturer impact analysis (*see* section IV.J.3 of this document). During the interviews, DOE sought feedback on all aspects of its analyses for consumer pool heaters. For the engineering analysis, DOE discussed the analytical assumptions and estimates, cost analysis, and cost-efficiency curves with consumer pool heater manufacturers. DOE considered all the information manufacturers provided when refining the cost analysis and assumptions. DOE incorporated equipment and manufacturing process figures into the analysis as averages to avoid disclosing sensitive information about individual manufacturers' products or manufacturing processes. More details about the manufacturer interviews are contained in chapter 12 of the NOPR TSD.

D. Markups Analysis

The markups analysis develops appropriate markups (*e.g.,* wholesaler and distributors, pool contractors, pool retailers, pool builders) in the distribution chain and sales taxes to convert the MSP estimates derived in the engineering analysis to consumer prices, which are then used in the LCC and PBP analysis. At each step in the distribution channel, companies add markup to the price of the product to cover business costs and profit margin.

[30] For example, assume that at EL 1, 60 percent of the market currently uses copper heat exchangers and 40 percent of the market currently uses cupronickel heat exchangers. Then, if EL 1 was chosen as the amended standard level, DOE assumes that 60 percent of the market would continue to use copper heat exchangers and 40 percent of the market would continue to use cupronickel heat exchangers.

For consumer pool heaters, the main parties in the distribution chain are: (1) Manufacturers; (2) wholesalers or distributors; (3) pool contractors; (4) pool retailers; (5) buying groups;[31] and (6) pool builders. For each actor in the distribution chain except for manufacturers, DOE developed baseline and incremental markups. Baseline markups are applied to the price of products with baseline efficiency, while incremental markups are applied to the difference in price between baseline and higher-efficiency models (the incremental cost increase). The incremental markup is typically less than the baseline markup and is designed to maintain similar per-unit operating profit before and after new or amended standards.[32]

At each step in the distribution channel, companies add markup to the price of the product to cover business costs and profit margin. For the electric pool heater October 2015 NODA, DOE characterized two markets in which pool products pass from the manufacturer to residential and commercial consumers:[33] (1) Replacement or new installation of consumer pool heater for existing swimming pool or spa; (2) installation of consumer pool heater in new swimming pool or spa. For this NOPR, DOE gathered data from several sources including 2020 Pkdata report,[34] POOLCORP's 2020 Form 10–K,[35] PRNewswire,[36] PoolPro Magazine,[37] Aqua Magazine,[38] and Pool and Spa News[39] to determine the distribution channels and fraction of shipments going through each distribution channel. The distribution channels for replacement or new installation of a consumer pool heater for existing swimming pool or spa are characterized as follows:[40]

Manufacturer → Wholesaler → Pool Contractor → Consumer
Manufacturer → Wholesaler → Pool Retailer → Consumer
Manufacturer → Pool Retailer → Consumer
Manufacturer → Buying Group → Pool Contractor → Consumer

The distribution channels for installation of consumer pool heaters in a new swimming pool or spa are characterized as follows:[41]

Manufacturer → Wholesaler → Pool Builder → Consumer
Manufacturer → Buying Group → Pool Builder → Consumer

Lochinvar stated that the distribution channels for pool heaters sold for commercial applications are similar to those used in commercial packaged boiler and commercial water heater rulemakings. (Lochinvar, No. 2 at p. 2) Lochinvar did not provide specific fractions of shipments for each distribution channel. For the NOPR analysis, DOE estimated that half of consumer pool heaters installed in commercial applications would use similar distribution channels to commercial packaged boilers and commercial water heaters (Manufacturer → Wholesaler → Mechanical Contractor → Consumer for replacements and new owners; and Manufacturer → Wholesaler → Mechanical Contractor → General Contractor → Consumer for new swimming pool construction),[42] while the remaining consumer pool heaters would have the distribution channels described previously.

DOE requests comment on whether the distribution channels described above are appropriate for consumer pool heaters and are sufficient to describe the distribution markets. In addition, DOE seeks input on the percentage of products being distributed through the different distribution channels, and whether the share of products through each channel varies based on product class, capacity, or other features.

To estimate average baseline and incremental markups, DOE relied on several sources, including: (1) Form 10–K from U.S. Securities and Exchange Commission (''SEC'') for Pool Corp (pool wholesaler and retailers);[43] (2) form 10–K from U.S. SEC for the Home Depot, Lowe's, Wal-Mart, and Costco (for pool retailers); (3) U.S. Census Bureau 2017 Annual Retail Trade Report for miscellaneous store retailers (NAICS 453) (for direct pool retailers),[44] (4) U.S. Census Bureau 2017 Economic Census data[45] on the residential and commercial building construction industry (for pool builder, pool contractor, and general and plumbing/mechanical contractors for commercial applications); and (5) the Heating, Air Conditioning & Refrigeration Distributors International (''HARDI'') 2013 Profit Report[46] (for wholesalers for

[31] Buying groups are intermediaries between the pool heater manufacturers and contractors. A buying group is a coalition of companies within a shared category who leverage their collective purchasing power to negotiate price reductions from manufacturers.

[32] Because the projected price of standards-compliant products is typically higher than the price of baseline products, using the same markup for the incremental cost and the baseline cost would result in higher per-unit operating profit. While such an outcome is possible, DOE maintains that in markets that are reasonably competitive it is unlikely that standards would lead to a sustainable increase in profitability in the long run.

[33] DOE estimates that 6 percent of electric pool heaters and 13 percent of gas pool heaters will be shipped to commercial applications in 2028. See section IV.E.1 of this document for further discussion.

[34] Pkdata, *2020 Residential and Commercial Swimming Pool, Hot Tub, and Pool Heater Customized Report for LBNL,* October 15, 2020, available at: *www.pkdata.com/datapointstrade.html#/* (last accessed April 15, 2021).

[35] POOLCORP, *2020 Form 10–K,* available at: *dd7pmep5szm19.cloudfront.net/603/0000945841-21-000022.pdf* (last accessed April 15, 2021).

[36] PRNewswire, *United Aqua Group, one of the nation's largest organizations dedicated to the professional pool construction, service and retail industry, announces that POOLCORP® is no longer the preferred distributor for its swimming pool products or building materials,* May 15, 2018, available at: *www.prnewswire.com/news-releases/united-aqua-group-one-of-the-nations-largest-organizations-dedicated-to-the-professional-pool-construction-service-and-retail-industry-announces-that-poolcorp-is-no-longer-the-preferred-distributor-for-its-swimming-pool-produ-300648220.html* (last accessed April 15, 2021).

[37] PoolPro, *Channel Choices,* PoolPro Magazine, March 5, 2018, available at: *poolpromag.com/channel-choices/* (last accessed April 15, 2021).

[38] Herman, E., *Distributors: The Middleman's Role,* Aqua Magazine, December 2017, available at: *aquamagazine.com/features/the-middleman-s-role.html* (last accessed April 15, 2021).

[39] Green, L., *Forward Thinking: A Look at Distributor Sector in Pool, Spa Industry Distributors adapt with the times*, Pool and Spa News, March 27, 2015, available at: *www.poolspanews.com/business/retail-management/forward-thinking-a-look-at-distributor-sector-in-pool-spa-industry_o* (last accessed April 15, 2021).

[40] Based on 2020 Pkdata, in residential pools and spas, DOE assumes that the consumer pool heater goes through the wholesaler 45 percent of the time, 10 percent of the time wholesaler to retailer, 40 percent of the time directly through the pool retailer, and 5 percent of the time through the buying group.

[41] Based on 2020 Pkdata, DOE estimated that about 40 percent of consumer pool heater installations in new pools are distributed through a wholesaler and about 60 percent are distributed through a buying group.

[42] Based on 2020 Pkdata, which showed a much larger fraction of pool heaters being sold through distributors (about 70 percent) and directly to end users (about 20 percent) in commercial applications compared to pool heaters in residential applications.

[43] U.S. Securities and Exchange Commission, *SEC 10–K Reports* (2016–2020), available at *www.sec.gov/* (last accessed April 15, 2021).

[44] U.S. Census Bureau, *2017 Annual Retail Trade Report,* available at *www.census.gov/programs-surveys/arts.html* (last accessed April 15, 2021). Note that the 2017 Annual Retail Trade Report is the latest version of the report that includes detailed operating expenses data.

[45] U.S. Census Bureau, *2017 Economic Census Data.* available at *www.census.gov/programs-surveys/economic-census.html* (last accessed April 15, 2021).

[46] Heating, Air Conditioning & Refrigeration Distributors International (''HARDI''), *2013 HARDI Profit Report,* available at *hardinet.org/* (last

commercial applications). DOE assumes that the markups for buying group is half of the value of pool wholesaler markups derived from Pool Corp's form 10–K. In addition, DOE used the 2005 Air Conditioning Contractors of America's (''ACCA'') Financial Analysis on the Heating, Ventilation, Air-Conditioning, and Refrigeration (''HVACR'') contracting industry [47] to disaggregate the mechanical contractor markups into replacement and new construction markets for consumer pool heaters used in commercial applications.

In addition to the markups, DOE obtained state and local taxes from data provided by the Sales Tax Clearinghouse.[48] These data represent weighted average taxes that include county and city rates. DOE derived shipment-weighted average tax values for each region considered in the analysis.

DOE requests comment on the data sources used to establish the markups for the parties involved with the distribution of covered products.

Chapter 6 of the NOPR TSD provides details on DOE's development of markups for consumer pool heaters.

E. Energy Use Analysis

The purpose of the energy use analysis is to determine the annual energy consumption of consumer pool heaters at different efficiencies in representative U.S. applications, and to assess the energy savings potential of increased consumer pool heater efficiency. The energy use analysis estimates the range of energy use of consumer pool heaters in the field (*i.e.,* as they are actually used by consumers). The energy use analysis provides the basis for other analyses DOE performed, particularly assessments of the energy savings and the savings in consumer operating costs that could result from adoption of amended or new standards.

1. Pool Heater Consumer Samples

DOE created individual consumer samples for seven pool heater market types: (1) pool heaters in single family homes that serve a swimming pool only (pool type 1); (2) pool heaters in single family homes that serve both a swimming pool and spa (pool type 2); (3) pool heaters in single family homes that serve a spa only (pool type 3); [49] (4) pool heaters in single-family community swimming pools or spas (pool type 4); (5) pool heaters in multi-family community swimming pools or spas (pool type 5); (6) pool heaters in indoor commercial swimming pools or spas (pool type 6); (7) pool heaters in outdoor commercial swimming pools or spas (pool type 7). DOE used the samples not only to determine pool heater annual energy consumption, but also as the basis for conducting the LCC and PBP analysis.

For the October 2015 NODA, DOE used EIA 2009 Residential Energy Consumption Survey (''RECS 2009'') to establish a sample of single family homes that use an electric pool heater in swimming pool or spa or both.[50] For the NOPR, DOE used the EIA's 2015 Residential Energy Consumption Survey (''RECS 2015'') to establish a sample of single family homes that use an electric or gas-fired pool heater in a swimming pool or spa or both.[51] RECS 2015 includes information such as the household or building owner demographics, fuel types used, months swimming pool used in the last year, energy consumption and expenditures, and other relevant data.

For consumer pool heaters used in indoor swimming pools in commercial applications, DOE developed a sample using the 2012 Commercial Building Energy Consumption Survey (''CBECS 2012'').[52] CBECS 2012 does not provide data on community pools or outdoor swimming pools in commercial applications. To develop samples for consumer pool heaters in single or multi-family community pools and/or spas, DOE used a combination of RECS 2015, U.S. Census 2017 American Home Survey Data, and the 2020 Pkdata.[53] To develop a sample for pool heaters in outdoor swimming pools in commercial applications, DOE used a combination of CBECS 2012 and the 2020 Pkdata.

Table IV.13 shows the estimated weights for the samples of electric pool heaters and gas pool heaters by the seven pool heater market types. See chapter 7 of the NOPR TSD for more details about the creation of the samples and the regional breakdowns.

TABLE IV.13—FRACTION OF ELECTRIC POOL HEATERS AND GAS-FIRED POOL HEATERS BY POOL HEATER MARKET

Pool type ID	Description	Electric pool heaters (%)	Gas-fired pool heaters (%)
1	Single Family with Pool Heater Serving Swimming Pool Only	58.4	32.5
2	Single Family with Pool Heater Serving Swimming Pool + Spa	28.3	28.7
3	Single Family with Pool Heater Serving Spa Only	7.1	25.7
4	Community Pools or Spas (Single-Family)	0.8	1.5
5	Community Pools or Spas (Multi-Family)	2.8	5.1
6	Commercial Indoor Pools and Spas	1.0	3.9
7	Commercial Outdoor Pools and Spas	1.5	2.6

accessed April 15, 2021). Note that the 2013 HARDI Profit Report is the latest version of the report.

[47] Air Conditioning Contractors of America (''ACCA''), *Financial Analysis for the HVACR Contracting Industry* (2005), available at *www.acca.org/store#/storefront* (last accessed April 15, 2021). Note that the 2005 Financial Analysis for the HVACR Contracting Industry is the latest version of the report and is only used to disaggregate the mechanical contractor markups into replacement and new construction markets.

[48] Sales Tax Clearinghouse Inc., *State Sales Tax Rates Along with Combined Average City and County Rates* (Feb. 8, 2021), available at *thestc.com/STrates.stm* (last accessed April 15, 2021).

[49] For electric pool heater sample, DOE only considered a small fraction of large spas that require a pool heater large than 11 kW. For this NOPR, the fraction of spas with an electric pool heater larger than 11 kW was determined based on 2020 Pkdata and DOE's shipments analysis.

[50] U.S. Department of Energy–Energy Information Administration. *2009 RECS Survey Data,* available at *www.eia.gov/consumption/residential/data/2009/* (last accessed April 15, 2021).

[51] U.S. Department of Energy–Energy Information Administration. *2015 RECS Survey Data,* available at *www.eia.gov/consumption/residential/data/2015/* (last accessed April 15, 2021). RECS 2015 uses the term hot tub instead of spa. When a household has a pool heater and spa heater of the same fuel, RECS 2015 does not provide information about whether the pool heater is used for both. For the NOPR, DOE assumes that in this case, a single pool heater is used to heat both the pool and spa.

[52] U.S. Department of Energy–Energy Information Administration. *2012 CBECS Survey Data,* available at *www.eia.gov/consumption/commercial/data/2012/* (last accessed April 15, 2021).

[53] Pkdata. *2020 Residential and Commercial Swimming Pool, Hot tub, and Pool Heater Customized Report for LBNL,* available at *www.pkdata.net/datapointstrade.html* (last accessed April 15, 2021).

AHRI stated that although the RECS information is readily available and useful, the usage and installation circumstances of electric pool heaters may be such that a more detailed estimate of installations per state is needed to properly analyze an efficiency standard for electric pool heaters. AHRI stated that because climate affects the electricity use of electric pool heaters, any changes in the assumed geographical distribution of electric pool heaters would alter electricity use. (AHRI, No. 16 at p. 4) DOE contends that RECS provides a reasonable distribution of users of electric pool heaters, since it closely matches regional data for electric pool heaters from 2020 Pkdata. DOE acknowledges that there is some uncertainty related to the distribution of electric pool heaters and discusses its assumptions in more detail in appendix 7A of the NOPR TSD.

EEI stated that because commercial pools, including community pools, commercial indoor spas or pools, and commercial outdoor swimming pools, are usually much larger in volume and operate for many more hours during the year than pools in residential applications, their inclusion in the analysis distorts the baseline energy usage and the impacts of energy efficiency improvements. EEI stated that because commercial swimming pool heaters are outside of the scope of this residential product rulemaking, any data or estimates associated with such units should be removed from the final analysis. (EEI, No. 21 at p. 5, 13)

EPCA specifies pool heaters as a consumer product that is a covered product for the purpose of the Energy Conservation Program for Consumer Products Other Than Automobiles. (42 U.S.C. 6292(a)(11)) EPCA defines ''consumer product,'' in part, as ''any article [. . .] of a type- (A) which in operation consumes, or is designed to consume, energy [. . .]; and (B) which, to any significant extent, is distributed in commerce for personal use or consumption by individuals; without regard to whether such article of such type is in fact distributed in commerce for personal use or consumption by an individual[.] (42 U.S.C. 6291(1)) As such, if a product meets the definition of ''pool heater,'' regardless of whether that unit it is installed in a residential or commercial application, that product is still subject to regulation as a consumer product. Because pool heaters are considered a consumer product under this definition, and because the definition of pool heaters does not include a capacity limit, DOE's authority to consider energy conservation standards for pool heaters includes consumer pool heaters used in commercial settings.

To accurately estimate the costs and benefits of potential standards, DOE must consider all applications of the covered product, including commercial-sector usage of a consumer product. DOE limited consideration of pool heaters installed in commercial pools in its energy use analysis to pool heaters installed in commercial pools of similar size as pools in residential applications, because it has limited data on the number of pool heaters serving larger commercial pools and their energy use. For the NOPR, DOE revised its energy use estimates based on all available data, including recent data from the 2020 Pkdata about pool heaters in commercial applications. DOE notes that the fraction of electric pool heaters used in commercial applications decreased from 10 percent in the October 2015 NODA to 6 percent in the NOPR (see the section regarding residential and commercial applications in chapter 7 of the NOPR TSD).

AHRI stated that it seems unreasonable that the cold and relatively sparsely populated Mountain Census division would have a higher fraction of electric pool heaters than the Pacific Census division, which includes highly populated and warm California. (AHRI, No. 16 at p. 4) The CA IOUs stated that in California the vast majority of pool heaters are gas-fired, and that they understand that electric pool heaters are used extensively elsewhere throughout the country. (CA IOUs, No. 5 at p. 5)

In response, DOE notes that in RECS 2015, the Mountain Census division does consistently show a lower fraction of pool heaters than the Pacific Census division (see Table IV.14 for details), and these data are consistent with the comments from AHRI and the CA IOUs.

TABLE IV.14—FRACTION OF POOL HEATERS IN MOUNTAIN CENSUS DIVISION AND PACIFIC DIVISION

Region	Percent of existing installations in U.S.	
	Mountain Census division (percent)	Pacific division (percent)
All swimming pool heaters (gas-fired and electric)	10	21
Electric swimming pool heaters	4	11
All spa and hot tub heaters (gas-fired and electric)	8	26
Electric spa and hot tub heaters	9	23

Source: RECS 2015

DOE requests comment on the data sources and methodology used to establish pool heater consumer samples.

2. Energy Use Estimation

For the October 2015 NODA, to estimate the annual energy consumption of consumer pool heaters at the considered efficiency levels, DOE first calculated the pool heater load for each sampled consumer based on assumptions regarding the size of a typical pool, ambient conditions for different locations, length of the swimming pool season, and whether the pool has a cover.[54] For each household or building with a consumer pool heater, DOE matched the pool heating load to the sampled swimming pool based on household or building geographical location and an assumption of whether the pool is covered or not. DOE then used the pool heating load together with the consumer

[54] For the October 2015 NODA (80 FR 65169), RECS 2009 estimates of the annual energy consumption from the household's energy bills using conditional demand analysis does not provide separate estimates for electric pool heater energy use. Instead, RECS 2009 groups these pool heaters in the ''other devices and purposes not elsewhere classified.'' Furthermore, RECS 2009 does not provide any energy use data for community pools with pool heaters and CBECS 2012 does not provide separate energy use estimates for pool heaters in other commercial applications.

pool heater output[55] to determine the burner operating hours. The electricity or fuel consumption in active mode was calculated by multiplying the burner operating hours by the input capacity. For heat pump pool heaters, DOE accounted for the potential increase in pump electricity use due to longer operating hours of these products (see discussion below). For heat pump pool heaters, to account for variations of output capacity, input capacity, and COPs observed in the field, DOE determined these values based on the geographical location of the sampled household.

For the October 2015 NODA, DOE assumed that 32 percent of pools with consumer pool heaters use a cover and 68 percent of pools with consumer pool heaters do not use a cover based on comments from NRDC in a CEC pool pumps rulemaking.[56] See chapter 7 of the October 2015 NODA TSD.

EEI stated that since at least 2001, residential and commercial swimming pool heaters installed with or in new buildings are required to have covers, readily accessible on-off switches, and time switches. EEI also stated that assuming no pool cover overstates the baseline energy usage by at least 5 times the actual energy usage. (EEI, No. 21 at p. 6) For the October 2015 NODA, DOE did account for a fraction of installations with a pool cover. See chapter 7 of the October 2015 NODA TSD. DOE also notes that code requirements only affect pools built since these codes went into effect, and the timing of requirements for pools varies among the different States. Also, these building code requirements are focused on safety and do not necessarily require only pool covers. For example, Florida requirements can be met using fencing or alarms instead of pool covers.[57] California requires that when a building permit is issued for the construction of a new swimming pool or spa or the remodeling of an existing swimming pool or spa at a private single-family home, the respective swimming pool or spa is required to have a minimum of two drowning prevention safety features, one of which may be a pool cover.[58] Furthermore, there is a lack of statistics and data of the usage pattern of pool covers combined with pool heaters. For example, 2020 Pkdata shows that less than half of pool covers are installed primarily to reduce energy use, while the rest are primarily safety covers or only used to cover the pool during the winter season. In the absence of any other information, DOE maintained its assumptions on use of pool covers.

For the NOPR, DOE revised its energy use analysis based on all available data including RECS 2015,[59] CBECS 2012, a Consortium for Energy Efficiency (''CEE'') report,[60] a Brookhaven National Laboratory report,[61] and 2020 Pkdata. In particular, for consumer pool heaters in single family homes, DOE was able to use the energy use estimates provided in RECS 2015 to estimate the pool heater load for each sampled pool or spa. For consumer pool heaters in commercial buildings, DOE used the same energy use methodology as in the October 2015 NODA. See chapter 7 of the NOPR TSD for more details.

DOE requests comment on the overall methodology for determining consumer pool heater energy use.

a. Consumer Pool Heater Operating Hours

For the October 2015 NODA, DOE estimated that electric pool heaters operate on average approximately 400 hours per year at the representative output capacity of 110 kBtu/h. See chapter 7 of the October 2015 NODA TSD.

EEI asserted that the estimated operating hours appear to be overstated for most States or regions. (EEI, No. 21 at p. 6–8) For the October 2015 NODA, DOE's estimate of operating hours was based on a fixed output capacity of 110 kBtu/h for electric pool heaters. For this NOPR, DOE assigned a consumer pool heater size for each sampled pool or spa, so that the estimated operating hours vary by region and application. DOE estimated that electric resistance pool heaters operate on average approximately 260 hours per year and heat pump pool heaters operate on average approximately 360 hours per year. The decrease in consumer pool heater operating hours between the October 2015 NODA and the NOPR is primarily due to updating the methodology for assignment of pool size, changes in the methodology for estimating pool heater load, and changes in sample, which includes a decrease in the estimate of consumer pool heaters in commercial applications from 10 percent in the October 2015 NODA to 6 percent in the NOPR (for more details see chapter 7 of the NOPR TSD). DOE estimated that gas-fired pool heaters operate on average approximately 190 hours per year.

EEI stated that for the South Atlantic region, DOE used the pool operating hours from Florida only (12 months of operation) and ignores the values from the other States that are estimated to operate for 5 months or 7 months. EEI stated that a weighted average for the region would be much more appropriate. (EEI, No. 21 at p. 8) For the October 2015 NODA, DOE's analysis for single-family pool heaters (which account for the majority of shipments) uses separate values for the number of months of operation for Florida compared to other States in the South Atlantic region. The analysis for pool heaters servicing community and commercial swimming pool is divided into Census divisions, and the South Atlantic values for the number of months are a shipment-weighted average between Florida and the different States in this region. For the NOPR, DOE's analysis for single-family pool heaters is based on the months the swimming pool is used, as reported in RECS 2015, in the last year for each individual household. For pool heaters servicing community and commercial pools, DOE kept its approach of using the shipment-weighted average between Florida and the other States in the South Atlantic region, as well as assigning a fraction of pools for year-round use.

Raypak and AHRI stated that gas-fired pool heaters heat a pool rapidly and so do not need to operate when the pool

[55] For heat pump pool heaters, pool heater output capacity is adjusted based on average outdoor conditions, since the rated output is measured at outdoor ambient conditions that are often different from actual field conditions. The adjustment is done based on coefficient of performance (COP) from heat pump pool heater data at different ambient conditions.

[56] NRDC's Response to CEC's Invitation to Participate in the Development of Appliance Energy Efficiency Measures 2013 Appliance Efficiency Pre-Rulemaking on Appliance Efficiency Regulations: Docket Number 12–AAER–2F—Residential Pool Pumps and Motors (May 2013), available at *efiling.energy.ca.gov/GetDocument.aspx?tn=70721&DocumentContentId=8266* (last accessed April 15, 2021).

[57] State of Florida. Chapter 515. Residential Swimming Pool Safety Act, available at *www.leg.state.fl.us/statutes/index.cfm?App_mode=Display_Statute&URL=0500-0599/0515/0515.html* (last accessed April 15, 2021).

[58] CA Health and Safety Code, section 115922, available at *https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?sectionNum=115922.&nodeTreePath=43.11.5.3&lawCode=HSC* (last accessed April 15, 2021).

[59] RECS 2015 provides separate estimates for electric spa heaters, natural gas pool heaters, and natural gas spa heaters in single family homes. However, RECS 2015 does not provide separate estimates for electric pool heater energy use and propane pool and spa heaters. Instead, RECS 2015 groups these pool heaters in the ''other devices and purposes not elsewhere classified.''

[60] Consortium for Energy Efficiency (CEE), *CEESM High Efficiency Residential Swimming Pool Initiative,* January 2013, available at *library.cee1.org/system/files/library/9986/CEE_Res_SwimmingPoolInitiative_01Jan2013_Corrected.pdf* (last accessed April 15, 2021).

[61] Brookhaven National Laboratory (BNL), *Performance Study of Swimming Pool Heaters,* January 2009, available at *www.bnl.gov/isd/documents/73878.pdf* (last accessed April 15, 2021).

is not in use; in contrast, heat pump pool heaters generally take several days to heat a pool. (Raypak, No. 4 at p. 7; AHRI, No. 7 at p. 9) DOE's analysis takes into account longer operating hours for heat pump pool heaters compared to gas-fired pool heaters and electric resistance pool heaters.

For the October 2015 NODA, DOE assigned different swimming pool use hours depending on the region the consumer pool heater is installed in, based on DOE's Energy Saver website assumptions.[62] See chapter 7 of the October 2015 NODA TSD. EEI stated that a study by the National Renewable Energy Laboratories (''NREL'') shows that in Florida, California, and Arizona (three of the top four States with the highest number of in-ground pools according to NRDC [63]), consumer pool heaters are used less than DOE's analysis would indicate. The report states that ''the majority of solar [pool heating] users actually use their pools from April through October, whereas a majority of non-users [of solar pool heating] only use their pools from May through September.'' [64] EEI stated that although this information is somewhat dated, it clearly shows that even in the best climates, a very small percentage of residential pool owners use their pools (and consumer pool heaters) anywhere close to the values estimated by DOE. (EEI, No. 21 at p. 8–9) In response, DOE contends that a study of users of solar pool heating (*i.e.,* those who own a home with a swimming pool heated by a solar collector) is not representative of users of electric and gas-fired pool heaters. Also, as stated in the NREL report, non-users of solar pool heaters include those who do not heat their pool at all and therefore the pool usage is not an appropriate comparison. For the NOPR, DOE used RECS 2015 data that include average number of pool and spa operating months for each of the single-family households with a pool and/or spa heater, as well as 2020 Pkdata that include average pool operating months by state for pool heaters in commercial pool applications.

The CA IOUs stated that portable electric spas are typically heated year-round, while consumer pool heaters often are only used occasionally during the swimming months. (CA IOUs, No. 5 at p. 5; CA IOUs, No. 20 at p. 7) DOE's analysis for electric pool heaters is not currently analyzing portable electric spa heaters, which are typically at or below 11 kW. DOE's analysis accounts for differences in operation between consumer pool heaters used in swimming pools compared to spas by using RECS 2015 reported months of use. RECS 2015 data show that on average heated swimming pools are used 5.2 months per year, while spas are used on average 7.4 months per year.

DOE requests comment on the data sources and methodology for determining consumer pool heater hours of operation as well as swimming pool and spa hours of operation.

b. Heat Pump Pool Heater Energy Use

For both the October 2015 NODA and NOPR, DOE took into account variations in heat pump pool heaters regarding output capacity, input capacity, and COPs observed in the field based on the geographical location.

Commenting on the March 2015 RFI, the CA IOUs stated that although heat pump pool heaters have diminished performance at temperatures below 55 °F, most consumer pool heaters only operate during the swimming months, when ambient temperatures are often significantly higher than 55 °F. They added that the outside air temperature constraint on heat pump technology has been successfully addressed in water heaters that utilize heat pump technology whenever possible, with electric resistance as a backup only when needed. (CA IOUs, No. 5 at p. 5)

DOE accounted for outdoor air temperature and pool season length in determining the energy use of heat pump pool heaters. In the October 2015 NODA, DOE assigned an average COP value for each heat pump efficiency level based on climate region (Hot Humid, Warm, or Cold climate). For example, for EL 2 the weighted COPs by region are 5.2 for the Hot Humid region, 4.6 for the Warm region, and 4.0 for the Cold region. See chapter 7 of the October 2015 NODA TSD. For the NOPR, DOE refined its methodology to adjust the COP for heat pumps based on pool season length and monthly average temperatures for the different climate regions in the analysis. For example, for EL 2 the weighted COPs by region are 5.44 for the Hot Humid region, 5.20 for the Warm region, and 3.76 for the Cold region. DOE is not aware of any hybrid units in the market that utilize electric resistance as a heat pump pool heater backup but agrees with CA IOUs that this is a potential solution for a fraction of installations that might require operation at very low ambient temperatures or during a period of high demand. DOE is aware of a hybrid gas-fired/heat pump unit.[65]

For the October 2015 NODA, DOE accounted for the potential increase in pool pump electricity use due to longer operating hours of heat pump pool heaters, since the pool pump used by the pool heater needs to operate while the pool heater heats the pool. DOE assumed that heat pumps would tend to run longer than an electric resistance pool heater with similar output capacity and would therefore require the pool pump to work longer. See chapter 7 of the October 2015 NODA TSD. ASAP and NRDC commented that typical daily pool pump operating hours are significantly higher than pool heater operating hours; therefore, the additional pool heater operating hours estimated for heat pump pool heaters would not necessarily translate directly to additional pool pump operating hours. (ASAP and NRDC, No. 19 at p. 3) Similarly, the CA IOUs stated that most pool heating is achieved during the normal daily filtration pumping cycle, minimizing the need for additional pumping energy to heat pools. The CA IOUs additionally stated as filtration pumping is increasingly met by energy efficient dual-speed, multi-speed, and variable-speed pumps, which often run at lower flows for a longer number of hours, the need for increased pumping for pool heating is further reduced. (CA IOUs, No. 20 at p. 6) The CA IOUs, ASAP, and NRDC encouraged DOE to ensure that it is not overestimating the additional pool pump energy required for heat pump pool heaters. (ASAP and NRDC, No. 19 at p. 3; CA IOUs, No. 20 at p. 6)

For the NOPR, DOE updated its analysis to take into account the coincidental heat pump pool heater and typical pool pump use, as well as the use of higher efficiency pumps. This revision decreased the impact of the heat pump pool heater on additional pool pump energy use by about half compared to the October 2015 NODA estimates.

DOE requests comment on the methodology used for determining heat pump pool heater energy use.

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[62] DOE Energy Saver, available at *www.energy.gov/energysaver/heat-pump-swimming-pool-heaters* (last accessed April 15, 2021).

[63] NRDC, NRDC's Response to CEC's Invitation to Participate in the Development of Appliance Energy Efficiency Measures 2013 Appliance Efficiency Pre-Rulemaking on Appliance Efficiency Regulations: Docket Number 12–AAER–2F Residential Pool Pumps and Motors (May 2013), available at *efiling.energy.ca.gov/GetDocument.aspx?tn=70721&DocumentContentId=8266* (last accessed April 15, 2021).

[64] Synapse Infusion Group, Inc., Report on Solar Pool Heating Quantitative Survey, August 1998–December 1998, April 1998, NREL/SR–550–26485, available at *www.nrel.gov/docs/fy99osti/26485.pdf* (last accessed April 15, 2021).

[65] Pentair. UltraTemp ETi Hybrid Heater, available at *www.pentair.com/en/products/pool-spa-equipment/pool-heaters/ultratemp-hybrid-heater.html* (last accessed April 15, 2021).

c. Consumer Pool Heater Standby and Off Mode Energy Use

Lochinvar estimated that, based on DOE's estimates of burner operating hours (''BOH'') and average pool operating hours (''POH''), the annual power consumption in standby mode and off mode will be between 0.1 percent and 1 percent of the total annual power consumption for all Lochinvar pool heaters. (Lochinvar, No. 2 at p. 2) DOE's estimate of annual power consumption in standby mode and off mode is consistent with Lochinvar's comment. Lochinvar stated that its gas-fired pool heaters use spark ignition and have no fossil fuel consumption in either standby mode or off mode. (Lochinvar, No. 2 at p. 1) Raypak stated that the typical fossil fuel energy use in standby mode and off mode is zero because gas-fired pool heaters only fire when there is a call for heat to maintain a setpoint temperature. Raypak also stated that standby and off-mode is limited to electricity consumption for all gas-fired, electric resistance, and electric heat pump pool heaters and that the magnitude of the electricity consumption may change slightly based on the input capacity of the unit. (Raypak, No. 4 at p. 2) DOE's understanding based on a review of the market and product literature is consistent with Raypak's comments about fossil fuel consumption in either standby or off mode for units not equipped with standing pilot ignition. DOE only accounted for standby or off mode fossil fuel consumption for gas-fired pool heaters equipped with standing pilot ignition. DOE's understanding based on a review of the market and product literature is also consistent with Raypak's comment that all pool heaters have standby and off mode electricity use. For all gas-fired pool heaters, regardless of ignition type, as well as for electric resistance and electric heat pump pool heaters, DOE's analysis accounts for standby and off mode electricity use.

For the October 2015 NODA, DOE assumed that most consumers are unlikely to set their electric pool heaters to the off mode during the non-heating season. See chapter 7 of the October 2015 NODA TSD. AHRI disagreed with this assumption and stated that in climates with a long and cold non-heating season, many consumers will put their pool heater in the off mode as part of the process of closing their pool for the season. AHRI stated that in parts of the country where the non-heating season is either relatively short or relatively mild, some consumers will also put their pool heater in the off mode. AHRI stated that in parts of the country where there is a minimal non-heating season, consumers are unlikely to put the pool heater in the off mode. (AHRI, No. 16 at p. 5)

Upon further consideration, including consideration of the comments received, for the NOPR, DOE revised its standby and off mode analysis to account for a large fraction of consumers that turn off their equipment during the non-pool heating season, especially in colder regions of the country. Chapter 7 of the NOPR TSD provides details on DOE's standby and off mode analysis for consumer pool heaters.

DOE requests comment on the methodology used for determining standby and off mode energy use.

3. Energy Use Results

For the October 2015 NODA, DOE estimated that the average electric pool heater load is 47.9 million Btu per year, which resulted in average energy use of 14,034 kWh per year for an electric resistance pool heater and 4,091 to 2,505 kWh per year for an electric heat pump pool heater, depending on the efficiency level. See chapter 7 of the October 2015 NODA TSD.

EEI stated that according to RECS 2005, the average electricity use of a consumer pool heater was 3,512 kWh per year. EEI stated that RECS 2005 also estimates that electric pool heaters use an average of 37.7 million Btu/year, corresponding to 11,046 kWh per year. EEI stated that RECS 2001 data show an average annual energy use for electric pool heaters, spa heaters, and hot tubs of 2,300 kWh/year. (EEI, No. 21 at p. 3)

The values presented by EEI do not represent pool heater electricity use, but instead represent the estimated electricity use for the domestic water heater. RECS data before 2015 did not report disaggregated pool heater energy use, but instead groups such energy use with other appliances (including pool pumps, furnace fans, freezers, dishwashers, lighting, etc.), while the domestic water heating energy use associated by the electric water heater is disaggregated.[66] For households with an electric pool heater in RECS 2009 this value (energy use with other appliances) is 16,953 kWh per year.[67] The quoted value reported by EEI from RECS 2005 of 3,512 kWh represents the domestic hot water energy use by the electric water heater for households with both an electric water heater and a pool heater.[68] Meanwhile the 37.7 million Btu/year figure in RECS 2005 represents the domestic hot water energy use for any water heater used in households with an electric pool heater.[69] Neither of these values include the electric pool heater energy use. The 2,300 kWh/year average annual energy use for electric pool heaters, spa heaters, and hot tubs from RECS 2001 [70] does not represent RECS 2001 data, but instead references a 1997 report.[71] It is important to note that this 2,300 kWh/year represents all electric pool heaters, spa heaters, and hot tubs, most of which are small spa heaters and hot tubs with electric resistance heaters below 11 kW (which are outside of the scope of the proposed standards). Therefore, the 2,300 kWh is not necessarily inconsistent with DOE's current energy use estimates for electric pool heaters. For the NOPR, the estimated shipment-weighted average electricity consumption for electric pool heaters in residential applications in 2028 is 2,635 kWh.

EEI also stated that pool pumps represent about 70 percent of energy used in swimming pools, consuming around 3,500 kWh per year, so electric pool heaters use about 29 percent of the residential swimming pool energy use in the US and Canada. EEI stated that using these data, an electric pool heater would use about 1,050 kWh per year. (EEI, No. 21 at p. 4) In response, the study cited by EEI includes all swimming pools with and without a pool heater. Swimming pools with both a pool heater and pool pump tend to consume much more energy than the numbers cited by EEI.

[66] Previous to the RECS 2015, RECS only reported disaggregated conditional demand analysis electricity use estimates for space heating, space cooling, water heating, and refrigerator appliances.

[67] This value includes a mixture of households with electric resistance and heat pump pool heaters.

[68] U.S. Department of Energy–Energy Information Administration. 2005 Residential Energy Consumption Survey: Energy Consumption and Expenditures Tables. Table WH6. Average Consumption for Water Heating by Major Fuels Used, 2005 Physical Units per Household, Page 8, available at *www.eia.gov/consumption/residential/data/2005/c&e/pdf/tablewh6.pdf* (last accessed April 15, 2021).

[69] U.S. Department of Energy–Energy Information Administration. 2005 Residential Energy Consumption Survey: Energy Consumption and Expenditures Tables. Table WH7. Average Consumption for Water Heating by Major Fuels Used, 2005 Million British Thermal Units (Btu) per Household, Page 8, available at *www.eia.gov/consumption/residential/data/2005/c&e/pdf/tablewh7.pdf* (last accessed April 15, 2021).

[70] U.S. Department of Energy–Energy Information Administration. 2001 Residential Energy Consumption Survey: Energy Consumption and Expenditures Tables. Table 2. Residential Consumption of Electricity by End Use, 2001, available at *www.eia.gov/consumption/residential/data/2001/index.php?view=consumption#Water* (last accessed April 15, 2021).

[71] Wenzel, Tom, Jonathan G. Koomey, Gregory J. Rosenquist, Marla Sanchez, and James W. Hanford. Energy Data Sourcebook for the U.S. Residential Sector, September 1997, page 128, available at *eta-publications.lbl.gov/sites/default/files/lbnl-40297.pdf* (last accessed April 15, 2021).

For this NOPR, DOE updated its energy use analysis to account for RECS 2015 and CBECS 2012 pool heater data. For residential applications, DOE estimated that on average electric resistance pool heater load is 22.9 million Btu per year, which resulted in average shipment-weighted energy use of 6,788 kWh per year, and on average electric heat pump pool heater load is 37.6 million Btu per year, which resulted in average shipment-weighted energy use of 2,315 kWh per year. For commercial applications,[72] DOE estimated that on average electric resistance pool heater load is 129.0 million Btu per year, which resulted in average shipment-weighted energy use of 38,187 kWh per year, and on average electric heat pump pool heater load is 151.6 million Btu per year, which resulted in average shipment-weighted energy use of 9,202 kWh per year.

For gas-fired pool heaters, DOE also based its analysis on RECS 2015 data, CBECS 2012 data, and updated energy use methodology. For residential applications, DOE estimated that the consumer pool heater load is 28.9 million Btu per year, which resulted in average shipment-weighted energy use of 35.0 million Btu per year. For commercial applications,[73] DOE estimated that on average gas-fired pool heater load is 206.2 million Btu per year, which resulted in average shipment-weighted energy use of 247.2 million Btu per year.

See chapter 7 of the NOPR TSD for further details.

F. Life-Cycle Cost and Payback Period Analysis

DOE conducted LCC and PBP analyses to evaluate the economic impacts on individual consumers of potential energy conservation standards for consumer pool heaters. The effect of new or amended energy conservation standards on individual consumers usually involves a reduction in operating cost and an increase in purchase cost. DOE used the following two metrics to measure consumer impacts:

• The LCC is the total consumer expense of an appliance or product over the life of that product, consisting of total installed cost (manufacturer selling price, distribution chain markups, sales tax, and installation costs) plus operating costs (expenses for energy use, maintenance, and repair). To compute the operating costs, DOE discounts future operating costs to the time of purchase and sums them over the lifetime of the product.

• The PBP is the estimated amount of time (in years) it takes consumers to recover the increased purchase cost (including installation) of a more-efficient product through lower operating costs. DOE calculates the PBP by dividing the change in purchase cost at higher efficiency levels by the change in annual operating cost for the year that amended or new standards are assumed to take effect.

For any given efficiency level, DOE measures the change in LCC relative to the LCC in the no-new-standards case, which reflects the estimated efficiency distribution of consumer pool heaters in the absence of new or amended energy conservation standards. In contrast, the PBP for a given efficiency level is measured relative to the baseline product.

For each considered efficiency level in each product class, DOE calculated the LCC and PBP for a nationally representative set of consumers. As stated previously, DOE developed consumer samples primarily from the 2015 RECS and 2012 CBECS. For each sample consumer, DOE determined the energy consumption for the consumer pool heater and the appropriate energy price. By developing a representative sample of consumers, the analysis captured the variability in energy consumption and energy prices associated with the use of consumer pool heaters.

Inputs to the calculation of total installed cost include the cost of the product—which includes MPCs, manufacturer markups, retailer and distributor markups, and sales taxes—and installation costs. Inputs to the calculation of operating expenses include annual energy consumption, energy prices and price projections, repair and maintenance costs, product lifetimes, and discount rates. DOE created distributions of values for product lifetime, discount rates, and sales taxes, with probabilities attached to each value, to account for their uncertainty and variability.

The computer model DOE uses to calculate the LCC and PBP relies on a Monte Carlo simulation to incorporate uncertainty and variability into the analysis. The Monte Carlo simulations randomly sample input values from the probability distributions and consumer pool heater user samples. For this proposed rule, the Monte Carlo approach is implemented in MS Excel together with the Crystal Ball™ add-on.[74] The model calculated the LCC and PBP for products at each efficiency level for 10,000 consumer pool heater installations per simulation run. The analytical results include a distribution of 10,000 data points showing the range of LCC savings for a given efficiency level relative to the no-new-standards case efficiency distribution. In performing an iteration of the Monte Carlo simulation for a given consumer, product efficiency is chosen based on its probability. If the chosen product efficiency is greater than or equal to the efficiency of the standard level under consideration, the LCC and PBP calculation reveals that a consumer is not impacted by the standard level. By accounting for consumers who already purchase more-efficient products, DOE avoids overstating the potential benefits from increasing product efficiency.

DOE calculated the LCC and PBP for all consumers of pool heaters as if each were to purchase a new product in the expected year of required compliance with new or amended standards. Any amended standards would apply to consumer pool heaters manufactured 5 years after the date on which any new or amended standard is published. (42 U.S.C. 6295(m)(4)(A)(ii)) For this analysis DOE assumed publication of a final rule, were standards to be amended, in 2023. Therefore, for purposes of its analysis, DOE used 2028 as the first year of compliance with any amended standards for consumer pool heaters.

Table IV.15 summarizes the approach and data DOE used to derive inputs to the LCC and PBP calculations. The subsections that follow provide further discussion. Details of the spreadsheet model, and of all the inputs to the LCC and PBP analyses, are contained in chapter 8 of the NOPR TSD and its appendices.

[72] DOE estimated that commercial applications account for 6 percent of electric pool heater shipments in 2028.

[73] DOE estimated that commercial applications account for 13 percent of gas-fired pool heater shipments in 2028.

[74] Crystal Ball™ is commercially-available software tool to facilitate the creation of these types of models by generating probability distributions and summarizing results within Excel, available at *www.oracle.com/middleware/technologies/crystalball.html* (last accessed April 15, 2021).

TABLE IV.15—SUMMARY OF INPUTS AND METHODS FOR THE LCC AND PBP ANALYSIS*

Inputs	Source/method
Product Cost	Derived by multiplying MPCs by manufacturer and retailer markups and sales tax, as appropriate. Used historical data to derive a price scaling index to project product costs.
Installation Costs	Baseline and incremental installation cost determined with data from 2021 RS Means.
Annual Energy Use	The total annual energy use multiplied by the hours per year. Average number of hours based on field data. *Variability:* Based on regional data and 2015 RECS and 2012 CBECS.
Energy Prices	*Natural Gas:* Based on EIA's Natural Gas Navigator data for 2020. *Propane:* Based on EIA's SEDS for 2019. *Electricity:* Based on EIA's Form 861 data for 2020. *Variability:* Regional energy prices determined for 10 regions for pool heaters in individual single-family homes and 9 census divisions for pool heaters in community and commercial pool heaters. Marginal prices used for both natural gas and electricity.
Energy Price Trends	Based on *AEO2021* price projections.
Repair and Maintenance Costs	Based on 2021 RS Means data and other sources. Assumed variation in cost by efficiency.
Product Lifetime	*Average:* 11.2 years for both electric and gas-fired pool heaters.
Discount Rates	*Residential:* Approach involves identifying all possible debt or asset classes that might be used to purchase the considered appliances, or might be affected indirectly. Primary data source was the Federal Reserve Board's Survey of Consumer Finances. *Commercial:* Calculated as the weighted average cost of capital for businesses purchasing pool heaters. Primary data source was Damodaran Online.
Compliance Date	2028.

* References for the data sources mentioned in this table are provided in the sections following the table or in chapter 8 of the NOPR TSD.

1. Product Cost

To calculate consumer product costs, DOE multiplied the MPCs developed in the engineering analysis by the markups described previously (along with sales taxes). DOE used different markups for baseline products and higher-efficiency products because DOE applies an incremental markup to the increase in MSP associated with higher-efficiency products. Many 82-percent thermal efficiency (EL 0 and EL 1) gas-fired pool heaters without low-NO_X burners are currently available that do not meet low-NO_X criteria in California, Utah, and Texas.[75] Thus, for the NOPR, DOE included the additional cost of a low-NO_X burner to all gas-fired pool heaters installed in certain California,[76] Utah,[77] or Texas [78] locations and applications. DOE assigned a fraction of installations outside these three regions the low-NO_X burner cost adder since the models are so widespread.[79]

DOE requests comments on its assumption that gas-fired pool heaters installed in California, Utah, or Texas would have a low-NO_X burner and the fraction of installations outside these three regions that would have a low-NO_X burner.

Commenting on the October 2015 NODA, EEI stated that publicly available information on websites shows price differentials between electric resistance pool heaters and heat pump pool heaters on the order of $2,000 or $3,000, at least two to three times more than DOE's estimates. (EEI, No. 21 at p. 11) DOE compared its estimated prices to available online retail prices for electric resistance pool heaters and heat pump pool heaters with a size close to 110 kBtu/h and found them to be consistent with DOE's analysis. DOE's derivation of product costs is discussed in more detail in sections IV.C.2 and IV.D of this document.

In the October 2015 NODA, DOE developed separate product price projections for baseline electric resistance pool heaters and heat pump pool heaters. For baseline electric resistance pool heaters, DOE used the historical producer price index (''PPI'') data from the Bureau of Labor Statistics' (''BLS'') for ''heating equipment (except warm air furnace) manufacturing'' from 1980 to 2014 to determine a constant

[75] Low-NO_x gas-fired pool heaters account for 11 percent of gas-fired pool heaters at EL 0 and 59 percent of pool heaters at EL 1.

[76] Low-NOx gas-fired pool heaters with a rated heat input capacity less than or equal to 2,000,000 Btu/h Hour are required in South Coast Air Quality Management District (''SCAQMD'') and San Joaquin Valley Air Pollution Control District (''SJAPCD''). SCAQMD Rule 1146.2, available at *www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1146–2.pdf;* SJAPCD Rule 4308, available at *www.valleyair.org/rules/currntrules/03–4308_CleanRule.pdf* (last accessed April 15, 2021). Low NO_X gas-fired pool heaters with a rated heat input capacity 400,001 to 2,000,000 Btu/h are required in Bay Area Air Quality Management District (''BAAQMD''). Regulation 9, available at *www.baaqmd.gov/~/media/dotgov/files/rules/reg-9-rule-6-nitrogen-oxides-emissions-from-natural-gasfired-water-heaters/documents/rg0906.pdf?la=en* (last accessed April 15, 2021).

[77] Low-NO_X gas-fired pool heaters with a rated heat input capacity less than 2,000,000 Btu/Hour. Utah Code 15A–6–102, available at *le.utah.gov/xcode/Title15A/Chapter6/15A–6–S102.html?v=C15A–6–S102_2017050920170509* (last accessed April 15, 2021).

[78] Low NO_X gas-fired pool heater with a rated heat input capacity less than or equal to 2,000,000 Btu/h Hour are required (except for units installed in single-family residences, used exclusively to heat swimming pools and hot tubs). Texas Administrative Code, Control of Air Pollution from Nitrogen Compounds, available at *texreg.sos.state.tx.us/public/readtac$ext.ViewTAC?tac_view=5&ti=30&pt=1&ch=117&sch=E&div=3&rl=Y* (last accessed April 15, 2021).

[79] Pires, K. *It's A Low-NO_X Life.* AQUA. November 2008, available at *aquamagazine.com/it-s-a-low-nox-life.html* (last accessed April 15, 2021).

price trend.[80] Because heat pump pool heaters share similar technology with heat pumps used for space conditioning, DOE used historical PPI data for ''unitary air conditioners manufacturing'' spanning the period 1978–2014 to determine a decreasing price trend for these products.[81] See chapter 8 of the October 2015 NODA TSD.

EEI stated that DOE provides no evidence for assuming that heat pump pool heater costs will decrease on a real basis, while electric resistance pool heater prices stay constant on a real basis. (EEI, No. 21 at p. 11) AHRI and EEI stated that pool heaters are significantly different from the space heating and cooling equipment used to derive the product price trend used in the October 2015 NODA analysis. AHRI and EEI also stated that there are different economies of scope and scale, as electric pool heater shipments are in the tens of thousands per year, while space heating and cooling equipment have shipments of about six to seven million units per year. (AHRI, No. 16 at p. 5; EEI, No. 21 at p. 10) AHRI stated that there is no economy of scale available to the manufacturers of heat pump pool heaters. (AHRI, No. 16 at p. 5) EEI also stated that over the past several years, the real price of unitary air conditioners has increased, and to project downward prices ignores this recent trend. EEI stated that DOE should only use data for pool heaters for price projections, and if not available, use the same price factor index projections for electric resistance pool heaters and heat pump pool heaters. (EEI, No. 21 at p. 10)

DOE acknowledges that use of a price trend for heat pumps may not accurately reflect the trend for heat pump pool heaters. For the NOPR, DOE used shipment-weighted wholesaler listed prices from 2003–2019 from the 2020 Pkdata report.[82] This data was used to produce different decreasing price trends for electric resistance pool heaters, heat pump pool heaters, and gas-fired pool heaters. DOE performed a sensitivity analysis on price trend as detailed in appendix 8C of the NOPR TSD. Further details about the development of the price trends can be found in chapter 8 and appendix 8C of the NOPR TSD.

DOE requests comments on its assumption and methodology for determining equipment price trends. DOE also requests data that would allow for use of different price trend projections for electric resistance and heat pump pool heaters.

2. Installation Cost

Installation cost includes labor, overhead, and any miscellaneous materials and parts needed to install the product. DOE estimates all the installation costs associated with fitting a consumer pool heater in a new housing unit, as a replacement for an existing pool heater, or in an existing pool without a pool heater (new owners). This includes any additional costs, such as electric modifications that would be required to install equipment at various efficiency levels. For the October 2015 NODA, DOE used 2015 RS Means for the materials and labor cost data needed to estimate the installation costs for electric pool heaters.[83] See chapter 8 and appendix 8C of the October 2015 NODA TSD. DOE accounted for regional differences in labor costs by using RS Means regional cost factors.

For the October 2015 NODA, DOE accounted for the increased cost of additional electrical requirements for new swimming pool and new owner installations. 80 FR 65169. For new electric pool heater owners (including owners of new swimming pools and owners of existing swimming pools), DOE assumed that an electric resistance pool heater would have higher electrical connection installation costs in comparison to the electrical requirements for a heat pump pool heater. For replacements in outdoor swimming pools, DOE assumed that the installation costs would be the same for all efficiency levels because the old consumer pool heater already has adequate electrical service for the new pool heater. For replacements in indoor installations, DOE assumed that they are all electrical resistance and that replacement with a heat pump pool heater would add a significant cost to run water piping and an electrical connection to outside the building, where the heat pump pool heater will be installed. See chapter 8 and appendix 8C of the October 2015 NODA TSD.

EEI stated that the difference in installation cost between efficiency levels for replacements of outdoor electric pool heaters is understated. EEI stated that based on information from *poolheatpumps.com* and *worldwidepoolheaters.com,* electric resistance pool heaters weigh between 40 and 50 pounds, while heat pump pool heaters weigh anywhere between 140 and 328 pounds (depending on the capacity and features). EEI stated that therefore, shipping and labor costs will be higher, as it is likely that a two-person crew will be needed to move and install the heat pump pool heater. It added that the existing electric resistance pool heater may be located in a space-constrained area, and addressing the space constraints to install a heat pump unit will increase the installation cost dramatically in a number of cases (on the order of thousands of dollars). (EEI, No. 21 at p. 12) DOE's estimates for installing a consumer pool heater come from RS Means, which assumes a two-person crew. DOE also accounts for significant increased installation costs for heat pump pool heaters installed indoors. Further details about the development of the heat pump installation costs can be found in chapter 8 of the NOPR TSD.

DOE seeks comment regarding the fraction of electric pool heater installations that are located in a space-constrained area that could increase the cost of installing a heat pump pool heater.

The October 2015 NODA analysis accounted for installing the electrical connection new swimming pool installations with electric pool heaters. AHRI stated that DOE needs to account for installing utilities in new pool installations. (AHRI, No. 7 at p. 6) For the NOPR, DOE added the cost of new gas piping and electrical connection for new swimming pool installations with a natural gas or propane pool heater.

For the NOPR, DOE updated the installation cost data using RS Means 2021[84] (including labor costs) and included the costs for installing a gas-fired pool heater. For gas-fired pool heaters, the incremental installation cost for the condensing design includes the cost of the condensate drain piping that goes from the consumer pool heater to a P-trap device[85] located at the sewer line entrance. See chapter 8 of the NOPR TSD for more details.

DOE requests comments on its assumption, methodology, and sources

[80] Bureau of Labor Statistics. Heating equipment PPI series ID: PCU 333414333414, available at *www.bls.gov/ppi/*(last accessed April 15, 2021).

[81] Bureau of Labor Statistics. Unitary air conditioners manufacturing product series ID: PCU333415333415E, available at *www.bls.gov/ppi/* (last accessed April 15, 2021).

[82] Pkdata, *2020 Residential and Commercial Swimming Pool, Hot tub, and Pool Heater Customized Report for LBNL,* October 15, 2020, available at: *www.pkdata.com/datapointstrade.html*#/ (last accessed April 15, 2021).

[83] RS Means Company, Inc., *RS Means Residential Cost Data 2015* (2015), available at *www.rsmeans.com/* (last accessed April 15, 2021).

[84] RS Means Company, Inc., *RS Means Residential Cost Data 2021* (2021), available at *www.rsmeans.com/* (last accessed April 15, 2021).

[85] A ''P-trap'' is required by many city codes. It helps to isolate the condensate from back-flowing into the pool water and prevents the sewer gas from back-flowing.

for determining installation costs for consumer pool heaters.

3. Annual Energy Consumption

For each sampled installation, DOE determined the energy consumption for a consumer pool heater at different efficiency levels using the approach described previously in section IV.E of this document.

a. Rebound Effect

Higher-efficiency consumer pool heaters reduce the operating costs for a consumer, which can lead to greater use of the consumer pool heater. A direct rebound effect occurs when a product that is made more efficient is used more intensively, such that the expected energy savings from the efficiency improvement may not fully materialize. At the same time, consumers benefit from increased utilization of products due to rebound. Overall consumer welfare (taking into account additional costs and benefits) is generally understood to increase from rebound. DOE did not find any data on the rebound effect that is specific to consumer pool heaters. In the April 2010 final rule, DOE estimated a rebound of 10 percent for pool heaters for the NIA but did not include rebound in the LCC analysis. 75 FR 20112, 20165. Given the uncertainty and lack of data specific to pool heaters, DOE does not include the rebound effect in the LCC analysis for this NOPR. DOE does include rebound in the NIA for a conservative estimate of national energy savings. DOE estimates a rebound effect of 10 percent for consumer pool heaters used in residential applications based on studies of other residential products and 0 percent for consumer pool heaters used in commercial applications. See section IV.H.2 for further details on how the rebound effect is applied in the NIA.

AHRI stated that DOE should include the rebound effect in the LCC analysis. AHRI stated that although the increased use of the heated pool is real, it has no real monetary value. AHRI stated that the increase in a consumer's monthly energy bill due to the rebound effect is real. (AHRI, No. 16 at p. 6) DOE disagrees that the benefit of using a heated pool more often has no real monetary value. The value of any service can be inferred from what a user will pay for it. In the case of a rebound effect, the user indirectly pays for the increased use by foregoing savings on the utility bill. For the LCC analysis, DOE does not include the rebound effect due to a lack of data specific to pool heaters. DOE recognizes, however, that increased consumer pool heater usage associated with the rebound effect provides consumers with increased welfare (*e.g.,* more pool usage or higher swimming pool water temperature). Economic theory suggests that, if it were able to monetize the welfare change to consumers due to the rebound effect, consumer welfare would increase.

DOE requests comments on its approach for determining the rebound effect, including the magnitude of the rebound effect and data sources specific to pool heaters.

4. Energy Prices

Because marginal electricity price more accurately captures the incremental savings associated with a change in energy use from higher efficiency, it provides a better representation of incremental change in consumer costs than average electricity prices. Therefore, DOE applied average electricity prices for the energy use of the product purchased in the no-new-standards case, and marginal electricity prices for the incremental change in energy use associated with the other efficiency levels considered.

For the October 2015 NODA, DOE derived average and marginal residential marginal electricity prices for 30 geographic regions and commercial average and marginal electricity prices for 9 census divisions based on data from EIA's form EIA–861M (formerly EIA–826).[86] 80 FR 65169.

EEI stated that if DOE analyzes commercial pools in this pool heater rulemaking, then the estimated residential energy prices must be decreased significantly to account for lower commercial electricity prices. (EEI, No. 21 at p. 13) In the October 2015 NODA and this NOPR, DOE used commercial energy prices for pool heaters in commercial applications and residential energy prices for pool heaters in residential applications.

For the NOPR, DOE derived average monthly residential and commercial marginal electricity and natural gas prices for the various regions using 2020 data from EIA, [87] [88] and average monthly residential and commercial LPG prices for the various regions using 2019 data from EIA.[89] The methodology and data sources are described in detail in appendix 8E of the NOPR TSD.

To estimate energy prices in future years, DOE multiplied the average regional energy prices by a projection of annual change in national-average residential or commercial energy price in the Reference case from *AEO2021*, which has an end year of 2050.[90] To estimate price trends after 2050, DOE used simple extrapolations of the average annual growth rate in prices from 2045 to 2050 based on the methods used in the 2021 Life-Cycle Costing Manual for the Federal Energy Management Program (''FEMP'').[91]

DOE requests comments on its approach for developing gas, LPG, and electricity prices.

5. Repair and Maintenance Costs

Repair costs are associated with repairing or replacing product components that have failed in an appliance; maintenance costs are associated with maintaining the operation of the product. Typically, small incremental increases in product efficiency produce no or only minor changes in repair and maintenance costs compared to baseline efficiency products.

For the October 2015 NODA, DOE used 2015 RS Means for the materials and labor cost data needed to estimate the maintenance and repair costs for electric pool heaters.[92] 80 FR 65169. In addition, DOE used information provided in comments, manufacturer literature, and expert consultants to calculate maintenance and repair costs, as well as the frequency of maintenance and repairs. DOE accounted for regional differences in labor costs by using RS Means regional cost factors.

DOE estimated that the repair cost for heat pump pool heaters is slightly greater than for electric resistance pool heaters due to the presence of more

[86] U.S. Department of Energy-Energy Information Administration, Form EIA–861M (formerly EIA–826) Database Monthly Electric Utility Sales and Revenue Data (2013), available at *www.eia.gov/electricity/data/eia861m/* (last accessed April 15, 2021).

[87] U.S. Department of Energy-Energy Information Administration, Form EIA–861M (formerly EIA–826) Database Monthly Electric Utility Sales and Revenue Data (1990–2020), available at *www.eia.gov/electricity/data/eia861m/* (last accessed April 15, 2021).

[88] U.S. Department of Energy-Energy Information Administration, Natural Gas Navigator (1990–2020), available at *www.eia.gov/dnav/ng/ng_pri_sum_dcu_nus_m.htm* (last accessed April 15, 2021).

[89] U.S. Department of Energy-Energy Information Administration, 2019 State Energy Consumption, Price, and Expenditure Estimates (SEDS) (2019), available at *www.eia.gov/state/seds/* (last accessed April 15, 2021).

[90] U.S. Department of Energy-Energy Information Administration, *Annual Energy Outlook 2021 with Projections to 2050,* available at *www.eia.gov/outlooks/aeo/* (last accessed April 15, 2021).

[91] Lavappa, Priya D. and J. D. Kneifel. *Energy Price Indices and Discount Factors for Life-Cycle Cost Analysis—2021 Annual Supplement to NIST Handbook 135.* National Institute of Standards and Technology (NIST). NISTIR 85–3273–36, available at *www.nist.gov/publications/energy-price-indices-and-discount-factors-life-cycle-cost-analysis-2021-annual* (last accessed April 15, 2021).

[92] RS Means Company, Inc., *RS Means Residential Cost Data 2015* (2015), available at *www.rsmeans.com/* (last accessed April 15, 2021).

complex components. DOE assumed that electric resistance pool heaters do not require maintenance. DOE assumed that a fraction of consumers maintain their heat pump pool heaters regularly, while the rest do not. DOE estimated the frequency of annual maintenance of heat pump pool heaters using data from RECS 2009 about how often air source heat pump (space heating and cooling) owners perform maintenance. DOE included the cost of preventative maintenance, such as cleaning the air filter and checking the evaporator and refrigeration system, in the maintenance cost of heat pump pool heaters.

AHRI stated that the estimated annual maintenance and repair costs are too low. AHRI is not aware of 2015 RS Means Facilities Repair and Maintenance Data specific to the repair and maintenance of heat pump pool heaters. (AHRI, No. 16 at p. 6) DOE determined maintenance and repair costs based on RS Means data for products that are similar to heat pump pool heaters, such as air source space heating and cooling heat pumps and air conditioners. For the NOPR, DOE used 2021 RS Means for the materials and labor cost data needed to estimate the maintenance and repair costs for electric pool heaters.[93] The methodology and data sources are described in detail in appendix 8F of the NOPR TSD.

Raypak stated that the repair costs for gas-fired pool heaters vary as a function of efficiency. Raypak stated that the lowest-efficiency products have the lowest repair costs because they are generally atmospheric units that do not have blowers and the associated controls. Raypak stated that fan-assisted pool heaters have higher repair costs, and condensing gas-fired pool heaters have the highest repair costs because of the use of materials that are more resistant to both the pool chemicals on one side and corrosive condensate on the other side of the heat exchanger. (Raypak, No. 4 at p. 6) For the NOPR, DOE included additional repair costs for higher efficiency gas-fired pool heaters (including repair costs associated with electronic ignition, controls, and blowers for fan-assisted designs) based on 2021 RS Means data.

Further detail regarding the maintenance and repair costs developed for consumer pool heaters can be found in chapter 8 of the NOPR TSD.

DOE requests comments on its approach for calculating maintenance and repair costs.

[93] RS Means Company, Inc., *RS Means Facilities Repair and Maintenance 2021* (2021), available at *www.rsmeans.com/* (last accessed April 15, 2021).

6. Product Lifetime

For the October 2015 NODA, DOE used consumer pool heater lifetime estimates from published literature and manufacturer input. The data allowed DOE to develop a survival function, which provides a distribution of lifetime ranging from 1 to 25 years with a mean value of 11 years. DOE assumes that the distribution of lifetimes accounts for the impact of the pool water quality on the life of the product, the level of maintenance of a consumer pool heater, and the fraction of consumers winterizing the consumer pool heater.

AHRI stated that an average lifetime of 10 years should be applied consistently throughout the analysis. (AHRI, No. 16 at p. 6) For the October 2015 NODA, the 11.2-year average estimate used was primarily based on published literature and manufacturer input from the RFI. For the NOPR, DOE updated its lifetime methodology by using historical shipments data and pool heater stock data from RECS 1987–2015 and 2020 Pkdata. The updated average lifetime is 11.2 years for both electric and gas-fired pool heaters. Appendix 8G of the NOPR TSD includes a sensitivity analysis of higher and lower lifetime estimates.

DOE welcomes additional comments and data regarding lifetime estimates, particularly in relation to differences between electric resistance pool heaters, heat pump pool heaters, and gas-fired pool heaters.

7. Discount Rates

In the calculation of LCC, DOE applies discount rates appropriate to households to estimate the present value of future operating costs. DOE estimated a distribution of residential discount rates for consumer pool heaters based on consumer financing costs and the opportunity cost of consumer funds.

DOE applies weighted average discount rates calculated from consumer debt and asset data, rather than marginal or implicit discount rates. DOE notes that the LCC does not analyze the appliance purchase decision, so the implicit discount rate is not relevant in this model. The LCC estimates net present value over the lifetime of the product, so the appropriate discount rate will reflect the general opportunity cost of household funds, taking this time scale into account. Given the long time horizon modeled in the LCC, the application of a marginal interest rate associated with an initial source of funds is inaccurate. Regardless of the method of purchase, consumers are expected to continue to rebalance their debt and asset holdings over the LCC analysis period, based on the restrictions consumers face in their debt payment requirements and the relative size of the interest rates available on debts and assets. DOE estimates the aggregate impact of this rebalancing using the historical distribution of debts and assets.

To establish residential discount rates for the October 2015 NODA LCC analysis, DOE identified all relevant household debt or asset classes in order to approximate a consumer's opportunity cost of funds related to appliance energy cost savings. It estimated the average percentage shares of the various types of debt and equity by household income group using data from the Federal Reserve Board's Survey of Consumer Finances[94] (''SCF'') for 1995, 1998, 2001, 2004, 2007, and 2010. Using the SCF and other sources, DOE developed a distribution of rates for each type of debt and asset by income group to represent the rates that may apply in the year in which amended standards would take effect. DOE assigned each sample household a specific discount rate drawn from one of the distributions. The average rate across all types of household debt and equity and income groups, weighted by the shares of each type, was 4.0 percent.

AHRI stated that the true marginal discount rates for consumers are much more likely to cluster around 8–9 percent than around 3–5 percent. AHRI stated that only a minority of consumers will be able to use cash or other savings to pay for a consumer pool heater. AHRI stated that even then, cash is not a low/no cost source of funds because it must be replaced with high cost funds or deferred consumption to rebuild the liquidity cushion. AHRI stated that the marginal source of funds for most consumers is credit card debt (estimated by DOE to have a rate of 14.2–15.0 percent). AHRI stated that according to the American Housing Survey, only 7 percent of respondents had home equity loans or lines of credit (the lowest cost of borrowing for most consumers). (AHRI, No. 16 at p. 7)

AHRI stated DOE applies weighted average discount rates calculated from consumer debt and asset data, rather than marginal or implicit discount rates, and as the LCC does not analyze the appliance purchase decision the implicit discount rate is not relevant in this model. For the NOPR, DOE maintained its existing approach to derive discount rates, but included data

[94] Board of Governors of the Federal Reserve System. *Survey of Consumer Finances.* 1995, 1998, 2001, 2004, 2007, and 2010, available at *www.federalreserve.gov/econres/scfindex.htm* (last accessed April 15, 2021).

from the 2013 SCF, 2016 SCF, and 2019 SCF, and updated several other data sources. The average rate in the NOPR analysis across all types of household debt and equity and income groups, weighted by the shares of each type, is 3.8 percent for electric pool heaters and 3.7 percent for gas-fired pool heaters.

To establish commercial discount rates for the fraction of instances where businesses are using consumer pool heaters, DOE estimated the weighted-average cost of capital using data from Damodaran Online.[95] The weighted-average cost of capital is commonly 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 their cost of capital is the weighted average of the cost to the firm of equity and debt financing. DOE estimated the cost of equity using the capital asset pricing model, which assumes that the cost of equity for a particular company is proportional to the systematic risk faced by that company. The average rate in the October 2015 NODA analysis across all commercial groups was 4.0 percent for electric resistance pool heaters. For the NOPR analysis, the commercial discount rate average is 5.5 percent for electric pool heaters and 5.5 percent for gas-fired pool heaters.

See chapter 8 of the NOPR TSD for further details on the development of consumer discount rates.

8. Energy Efficiency Distribution in the No-New-Standards Case

To accurately estimate the share of consumers that would be affected by a potential energy conservation standard at a particular efficiency level, DOE's LCC analysis considered the projected distribution (market shares) of product efficiencies under the no-new-standards case (*i.e.,* the case without amended or new energy conservation standards).

For the October 2015 NODA, to estimate the energy efficiency distribution of heat pump pool heaters in the compliance year, DOE used the 2015 AHRI Directory of the Certified Pool Heater models as a primary data source.[96] The fraction of heat pump pool heaters was adjusted to take into account standards in Florida[97] and California[98] that require higher efficiency heat pump pool heaters. The region and market specific fraction of electric resistance pool heaters was determined for each region and consumer pool heater market. For example, DOE assumed that warmer areas of the country such as Florida, which are better suited for heat pump installations, have a lower fraction of electric resistance installations (pool type 1, 2, 4, 5, and 7; see section IV.E.1 of this document), while large spas (pool type 3) have a larger fraction of electric resistance installations and all indoor installations (pool type 6) were estimated to be electric resistance pool heaters.

Raypak stated that there are no data available on shipments by efficiency and that all heat pump pool heater models and all electric resistance pool heater models have approximately the same efficiency range. Only gas-fired pool heaters have a range of efficiencies. (Raypak, No. 4 at p. 6) AHRI stated that by 2022, some percentage of commercial indoor pools will be heated with heat pump pool heaters. (AHRI, No. 16 at p. 7) The CA IOUs understand that heat pump pool heaters comprise most of the electric pool heater market, given their significantly higher efficiency compared to electric resistance pool heaters. (CA IOUs, No. 5 at p. 5)

For the NOPR, based on input from manufacturer interviews, DOE adjusted its fraction of electric resistance pool heaters in 2020, as shown in Table IV.16, by assuming a larger growth in heat pump pool heater shipments compared to electric resistance pool heater shipments and an overall lower total fraction of electric resistance pool heaters based on input from manufacturer interviews. DOE also updated the market shares of the different heat pump pool heater efficiency levels based on 2021 AHRI Directory of Certified Product Performance[99] and CEC's 2021 Modernized Appliance Efficiency Database System (''MAEDbS'')[100] for heat pump pool heaters models as well as manufacturer product literature. The fraction of heat pump pool heaters was also adjusted to take into account standards in Connecticut that require higher efficiency heat pump pool heaters,[101] in addition to standards in California and Florida. To extrapolate from 2020 to 2028, DOE assumed different growth rates for the electric resistance and heat pump pool heater shipments. These assumptions resulted in a 7.8 percent overall market share for electric resistance pool heaters in 2028.

[95] Damodaran Online, *Data Page: Costs of Capital by Industry Sector,* (2021), available at *pages.stern.nyu.edu/~adamodar/* (last accessed April 15, 2021).

[96] AHRI. *Directory of the Certified Pool Heater models,* available at *www.ahridirectory.org/* (last accessed April 15, 2021).

[97] 2017 Florida Energy & Conservation Code Chapter 4 section R403.10.5 states: ''Heat pump pool heaters shall have a minimum COP of 4.0 when tested in accordance with AHRI 1160, Table 2, Standard Rating Conditions-Low Air Temperature.'' State of Florida. Energy & Conservation Code, Chapter 4, available at *codes.iccsafe.org/content/FEC2017/chapter-4-re-residential-energy-efficiency?site_type=public* (last accessed April 15, 2021).

[98] California Title 20 Section 1605.3 (g) (3) states: ''For heat pump pool heaters manufactured on or after March 1, 2003, the average of the coefficient of performance (COP) at Standard Temperature Rating and the coefficient of performance (COP) at Low Temperature Rating shall be not less than 3.5.'' California Energy Commission. California Code of Regulations: Title 20. Public Utilities and Energy, Division 2. State Energy Resources Conservation and Development Commission, Chapter 4. Energy Conservation, Article 4. Appliance Efficiency Regulations (Refs & Annos), 1605.3. State Standards for Non-Federally-Regulated Appliances available at *govt.westlaw.com/calregs/Document/IEEDE2D64EF7B4F168C0E85379828A8C2?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default)* (last accessed April 15, 2021).

[99] AHRI. *Directory of Certified Heat Pump Pool Heater Models.* February 9, 2021, available at *www.ahridirectory.org* (last accessed April 15, 2021).

[100] CEC. *Modernized Appliance Efficiency Database System.* February 9, 2021, available at *cacertappliances.energy.ca.gov/Pages/Search/AdvancedSearch.aspx* (last accessed April 15, 2021).

[101] Connecticut's Regulations and Procedures for Establishing Energy Efficiency Standards for Certain Appliances and Products Section 16a–48–4(S)(4) states: ''Heat pump pool heaters shall have a coefficient of performance (COP) of not less than 3.5 at standard temperature rating and at low temperature rating.'' State of Connecticut. Title 16a—Planning and Energy Policy. 2015, available at *eregulations.ct.gov/eRegsPortal/Browse/RCSA/Title_16aSubtitle_16a-48Section_16a-48-4/* (last accessed April 15, 2021).

TABLE IV.16—MARKET SHARE OF ELECTRIC RESISTANCE POOL HEATERS BY CONSUMER POOL HEATER MARKET AND REGION IN 2028

Consumer pool heater market type * and region	Electric resistance pool heater market share (%)		Sample weight of pool heater market (%)
	2020	2028	
Pool Type = 1 and 2, 4, 5, 7 (in South Atlantic)	1.9	1.6	40.0
Pool Type = 1 and 2, 4, 5, 7 (in California, Connecticut)	3.8	3.2	13.4
Pool Type = 1 and 2, 4, 5, 7 (in Rest of Country)	7.5	6.3	38.4
Pool Type = 3 (in South Atlantic)	18.8	15.8	1.0
Pool Type = 3 (in California, Connecticut)	37.5	31.7	1.7
Pool Type = 3 (in Rest of Country)	75.0	63.4	4.5
Pool Type = 6	87.5	73.9	1.1
Overall Electric Resistance Market Share	9.2	7.8	

* Consumer Pool Heater Market Types are described in Table IV.13.

Raypak stated that the majority of the gas-fired pool heater market is and will continue to be at the minimum efficiency level (82-percent thermal efficiency) because of the high price of higher-efficiency models and the low number of annual operating hours. Raypak estimated that the market share for non-condensing gas-fired pool heaters is 98 percent, while the market share for condensing units is 2 percent or less. Raypak believes that this market share trend will continue in the absence of a significant increase in the efficiency standards. (Raypak, No. 4 at p. 5, 7)

For the NOPR, to estimate the energy efficiency distribution of gas-fired pool heaters for the compliance year, DOE used the DOE's 2021 Compliance Certification Management System (''CCMS'') [102] and CEC's 2021 MAEDbS [103] for gas-fired pool heaters models as well as manufacturer product literature. During manufacturer interviews, DOE received input that consumer pool heaters with standing pilot only represented about 4 percent of gas-fired pool heater shipments. In addition, DOE accounted for the ban on pilot lights in gas-fired pool heaters in California,[104] Connecticut,[105] Florida,[106] and New York.[107] DOE's NOPR estimates a higher fraction of gas-fired pool heaters will be above the baseline or condensing compared to Raypak's comment due to the number of models currently available. For example, DOE estimates that the EL 2 market share will be approximately 35 percent and the condensing efficiency level (EL 3) will be approximately 7 percent.

The estimated market shares in the no-new-standards case for consumer pool heaters used for the NOPR are shown in Table IV.17 and Table IV.18. See chapter 8 of the NOPR TSD for further information on the derivation of the efficiency distributions.

TABLE IV.17—EFFICIENCY DISTRIBUTION IN THE NO-NEW-STANDARDS CASE FOR ELECTRIC POOL HEATERS IN 2028

Efficiency level	Representative TE_I (%)	National market share (%)
EL 0	99	7.8
EL 1	387	11.7
EL 2	483	59.1
EL 3	534	9.1
EL 4	551	9.1
EL 5	595	3.1

TABLE IV.18—EFFICIENCY DISTRIBUTION IN THE NO-NEW-STANDARDS CASE FOR GAS-FIRED POOL HEATERS IN 2028

Efficiency level	Representative TE_I (%)	National market share (%)
EL 0	61.1	4.9
EL 1	81.3	43.6
EL 2	83.3	45.3
EL 3	94.8	6.2

DOE welcomes additional comments and data regarding estimates for energy efficiency distribution for 2020 and future distribution in 2028.

9. Payback Period Analysis

The payback period is the amount of time it takes the consumer to recover the additional installed cost of more-efficient products, compared to baseline products, through energy cost savings. Payback periods are expressed in years.

[102] DOE. *Compliance Certification Management System.* February 9, 2021, available at *www.regulations.doe.gov/certification-data/* (last accessed April 15, 2021).

[103] CEC. *Modernized Appliance Efficiency Database System.* February 9, 2021, available at *cacertappliances.energy.ca.gov/Pages/Search/AdvancedSearch.aspx* (last accessed April 15, 2021).

[104] California Title 20 Section 1605.3(g)(1) states: ''Energy Design Standard for Natural Gas Pool Heaters. Natural gas pool heaters shall not be equipped with constant burning pilots.'' California Energy Commission. California Code of Regulations: Title 20. Public Utilities and Energy, Division 2. State Energy Resources Conservation and Development Commission, Chapter 4. Energy Conservation, Article 4. Appliance Efficiency Regulations (Refs & Annos), 1605.3. State Standards for Non-Federally-Regulated Appliances available at *govt.westlaw.com/calregs/Document/IEEDE2D64EF7B4F168C0E85379828A8C2?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default)* (last accessed April 15, 2021).

[105] Connecticut's Regulations and Procedures for Establishing Energy Efficiency Standards for Certain Appliances and Products Section 16a–48–4(S)(2) states: ''Natural gas pool heaters shall not be equipped with a constantly burning pilot light.'' State of Connecticut. Title 16a—Planning and Energy Policy. 2015, available at *eregulations.ct.gov/eRegsPortal/Browse/RCSA/Title_16aSubtitle_16a-48Section_16a-48-4/* (last accessed April 15, 2021).

[106] 2017 Florida Energy & Conservation Code Chapter 4 section R403.10.4 states: ''Pool heaters fired by natural or LP gas shall not have continuously burning pilot lights.'' State of Florida. Energy & Conservation Code, Chapter 4, available at *codes.iccsafe.org/content/FEC2017/chapter-4-re-residential-energy-efficiency?site_type=public* (last accessed September 2, 2021).

[107] 2020 Energy Conservation Construction Code of New York State Chapter 4 section R403.10.1 states: ''Gas-fired heaters shall not be equipped with continuously burning ignition pilots.'' State of New York, available at *codes.iccsafe.org/content/NYSECC2020P1* (last accessed September 2, 2021).

Payback periods that exceed the life of the product mean that the increased total installed cost is not recovered in reduced operating expenses.

The inputs to the PBP calculation for each efficiency level are the change in total installed cost of the product and the change in the first-year annual operating expenditures relative to the baseline. The PBP calculation uses the same inputs as the LCC analysis, except that discount rates are not needed.

As noted previously, EPCA establishes a rebuttable presumption that a standard is economically justified if the Secretary finds that the additional cost to the consumer of purchasing a product complying with an energy conservation standard level will be less than three times the value of the first year's energy savings resulting from the standard, as calculated under the applicable test procedure. (42 U.S.C. 6295(o)(2)(B)(iii)) For each considered efficiency level, DOE determined the value of the first year's energy savings by calculating the energy savings in accordance with the applicable DOE test procedure, and multiplying those savings by the average energy price projection for the year in which compliance with the new and amended standards would be required.

G. Shipments Analysis

DOE uses projections of annual product shipments to calculate the national impacts of potential or new amended energy conservation standards on energy use, net present value (''NPV''), and future manufacturer cash flows.[108] The shipments model takes an accounting approach, tracking market shares of each product class and the vintage of units in the stock. Stock accounting uses product shipments as inputs to estimate the age distribution of in-service product stocks for all years. The age distribution of in-service product stocks is a key input to calculations of both the NES and NPV, because operating costs for any year depend on the age distribution of the stock.

For the October 2015 NODA, DOE estimated electric pool heater shipments by projecting shipments in three market segments: (1) Replacements; (2) new swimming pool owners; and (3) new owners with an existing swimming pool that did not previously have an electric pool heater,[109] as follows:

(1) To project electric pool heater replacement shipments in the residential sector, DOE developed retirement functions for electric pool heaters from the lifetime estimates (see section IV.F.6 of this document) and applied them to the existing products in the stock. DOE estimated the existing stock of products using estimated historical shipments and survival function for electric pool heaters from the lifetime estimates. DOE took into account replacement rate of retired (failed) residential electric pool heaters, which DOE estimated to be 70 percent (in other words 30 percent are not replaced).[110]

(2) To project shipments to the new swimming pool market in the residential sector, DOE utilized projected new swimming pool (inground and above ground) installations and saturation rates. DOE estimated projected new swimming pool (inground and above ground) installations based on 2015 Pkdata and projected saturation rates based on saturation data from 2015 Pkdata and 1990–2009 RECS data.[111]

(3) To project shipments to new owners in existing swimming pools that did not previously have an electric pool heater in the residential sector, DOE estimated that a small fraction of existing swimming pools (0.1 percent) would add an electric pool heater.[112]

In addition, in the October 2015 NODA to account for consumer pool heaters in commercial applications, DOE assumed that the market for electric pool heaters used in commercial swimming pools and spas (including community swimming pools and spas) accounted for about 10 percent of the total electric pool heaters market over the analysis period.

AHRI stated that the projected rate of growth in future shipments of electric pool heaters is significantly overestimated. AHRI also stated that the rate of growth in historical shipments of heat pump pool heaters does not support the rate of increase estimated by DOE. (AHRI, No. 16 at p. 7) EEI also questioned the dramatic increase in electric pool heater shipments from 2015 through 2040. (EEI, No. 21 at p. 13)

For the NOPR, DOE updated its shipments estimates based on information from manufacturer interviews, 2016 Pkdata,[113] 2020 Pkdata,[114] and RECS 2015 data, a revised regression methodology for determining projected new swimming pool shipments, and a modified approach for projecting electric pool heaters in standalone spas (without connecting to swimming pools) and in the commercial sector. As a result, DOE projected a lower average annual growth rate of electric pool heater shipments for the NOPR compared to the October 2015 NODA. In regard to heat pump pool heaters, DOE did not have access to the historical data mentioned by AHRI. See chapter 9 of the NOPR TSD for details.

For the NOPR, DOE used a similar approach for projecting gas-fired pool heater shipments. There are limited historical gas-fired pool heater shipments data that were used to calibrate the shipments model.[115 116 117] See chapter 9 of the NOPR TSD for details.

DOE requests comment on DOE's methodology and data sources used for projecting the future shipments of consumer pool heaters in the absence of amended energy conservation standards.

Because the standards-case projections take into account the increase in purchase price and the decrease in operating costs caused by amended standards, projected shipments for a standards case typically deviate from those for the no-new-standards case. Because purchase price tends to have a larger impact than operating cost on appliance purchase decisions, standards-case projections

[108] DOE uses data on manufacturer shipments as a proxy for national sales, as aggregate data on sales are lacking. In general, one would expect a close correspondence between shipments and sales.

[109] DOE assumed in the October 2015 NODA that new owners also account for potential switching between gas and electric pool heater products.

[110] In preparing the October 2015 NODA, DOE did not find historical shipments data for electric pool heaters, so DOE ''backcasted'' the shipments model (*i.e.,* applied the shipments model to years prior to 2015) to estimate historical shipments.

[111] Pkdata. 2015 Swimming Pool and Pool Heater Customized Report for LBNL, available at *www.pkdata.com/datapointstrade.html#/* (last accessed April 15, 2021).

[112] Number of existing swimming pools without an electric pool heater was based on 1990–2015 RECS data.

[113] Pkdata. *2016 Residential and Commercial Swimming Pool, Hot tub, and Pool Heater Customized Report for LBNL,* June 21, 2016, available at *www.pkdata.com/datapointstrade.html#/* (last accessed April 15, 2021).

[114] Pkdata. *2020 Residential Swimming Pool, Hot tub, and Pool Heater Customized Report for LBNL,* October 15, 2020, available at *www.pkdata.com/datapointstrade.html#/* (last accessed April 15, 2021).

[115] U.S. Department of Energy-Office of Codes and Standards, Technical Support Document: Energy Efficiency Standards for Consumer Products: Room Air Conditioners, Water Heaters, Direct Heating Equipment, Mobile Home Furnaces, Kitchen Ranges and Ovens, Pool Heaters, Fluorescent Lamp Ballasts & Television Sets, 1993. Washington, DC Vol. 1 of 3. Report No. DOE/EE–0009.

[116] Association of Pool & Spa Professionals (APSP). 2003–2009 Gas-fired Pool Heater Shipments Data (Comment #135 for 2010 Heating Products Final Rule), available at *www.regulations.gov/document/EERE-2006-STD-0129-0135* (last accessed April 15, 2021).

[117] 2016 Pkdata provided estimated combined historical shipments for electric and gas-fired pool heaters used in commercial applications from 2010–2015.

typically show a decrease in product shipments relative to the no-new-standards case.

EEI stated that if there is a dramatic increase in the efficiency standards for electric pool heaters, while the standards (and retail prices) for competing gas products do not change, it would be reasonable to project a much more dramatic impact on shipments of electric pool heaters than what is currently shown in the TSD. (EEI, No. 21 at p. 13) EEI stated that with a relative price elasticity of −0.68, a 10-percent increase in price would result in a 6.8-percent decrease in shipments. EEI stated that given the estimated incremental total installed cost increases, shipments would be reduced (before any fuel switching) by 10.7 percent to 20.1 percent, which is much higher than the decrease in shipments DOE projected of 5 percent to 7.7 percent. (EEI, No. 21 at p. 14)

DOE's relative price elasticity incorporates the energy cost savings of a more-efficient product as well as the increase in installed cost. Because the energy cost savings of a heat pump water heater are very large compared to the baseline product, the impact of the higher installed cost is lessened. DOE maintained its approach to estimate the impact of any proposed standard on consumer pool heater shipments, but it also conducted a sensitivity analysis that assumes that the energy cost savings of higher efficiency design options are given less weight. Appendix 10C of the NOPR TSD describes this analysis.

Raypak asserted that some consumers may repair existing pool heaters instead of purchasing new units. (Raypak, No. 4 at p. 7) The application of the relative price elasticity implicitly accounts for reduction in shipments for any reason, including extension of the lifetime by repairing existing pool heaters.

EEI stated that if electric resistance heaters are removed from the market, it is very likely that a significant portion of consumers will shift to natural gas-, propane-, or oil-fired pool heaters due to lower first costs. EEI stated that DOE should account for fuel switching in this analysis unless the proposed increases in gas or oil pool heater standards increase the efficiency and/or costs as much as for electric pool heaters. (EEI, No. 21 at p. 14)

DOE reasons that costs associated with switching from an electric pool heater to a gas-fired pool heater (such as extending the gas line, adding a propane tank, or accounting for venting) would tend to limit such switching.

To estimate the impact on shipments of the price increase for the considered efficiency levels, DOE used a relative price elasticity approach. DOE welcomes stakeholder input on the effect of amended standards on future consumer pool heater shipments.

DOE welcomes any additional information that would help to estimate the likely magnitude of fuel and equipment switching in response to the evaluated standards.

H. National Impact Analysis

The NIA assesses the NES and the NPV from a national perspective of total consumer costs and savings that would be expected to result from new or amended standards at specific efficiency levels.[118] ("Consumer" in this context refers to consumers of the product being regulated.) DOE calculates the NES and NPV for the potential standard levels considered based on projections of annual product shipments, along with the annual energy consumption and total installed cost data from the energy use and LCC analyses.[119] For the present analysis, DOE projected the energy savings, operating cost savings, product costs, and NPV of consumer benefits over the lifetime of consumer pool heaters sold from 2028 through 2057.

DOE evaluates the impacts of new or amended standards by comparing a case without such standards with standards-case projections. The no-new-standards case characterizes energy use and consumer costs for each product class in the absence of new or amended energy conservation standards. For this projection, DOE considers historical trends in efficiency and various forces that are likely to affect the mix of efficiencies over time. DOE compares the no-new-standards case with projections characterizing the market for each product class if DOE adopted new or amended standards at specific energy efficiency levels (*i.e.,* the TSLs or standards cases) for that class. For the standards cases, DOE considers how a given standard would likely affect the market shares of products with efficiencies greater than the standard.

DOE uses a spreadsheet model to calculate the energy savings and the national consumer costs and savings from each TSL. Interested parties can review DOE's analyses by changing various input quantities within the spreadsheet. The NIA spreadsheet model uses typical values (as opposed to probability distributions) as inputs.

Table IV.19 summarizes the inputs and methods DOE used for the NIA analysis for the NOPR. Discussion of these inputs and methods follows the table. See chapter 10 of the NOPR TSD for further details.

TABLE IV.19—SUMMARY OF INPUTS AND METHODS FOR THE NATIONAL IMPACT ANALYSIS

Inputs	Method
Shipments	Annual shipments from shipments model.
Modeled Compliance Date of Standard	2028.
Efficiency Trends	No-new-standards case: Based on historical data. Standards cases: Roll-up in the compliance year and then DOE estimated growth in shipment-weighted efficiency in all the standards cases, except max-tech.
Annual Energy Consumption per Unit	Annual weighted-average values are a function of energy use at each TSL.
Total Installed Cost per Unit	Annual weighted-average values are a function of cost at each TSL. Incorporates projection of future product prices based on historical data.
Annual Energy Cost per Unit	Annual weighted-average values as a function of the annual energy consumption per unit and energy prices.
Repair and Maintenance Cost per Unit	Annual values do not change with efficiency level.
Energy Price Trends	*AEO2021* projections (to 2050) and extrapolation thereafter.
Energy Site-to-Primary and FFC Conversion	A time-series conversion factor based on *AEO2021* (to 2050) and extrapolation thereafter.
Discount Rate	3 percent and 7 percent.

[118] The NIA accounts for impacts in the 50 states and U.S. territories.

[119] For the NIA, DOE adjusts the installed cost data from the LCC analysis to exclude sales tax, which is a transfer.

TABLE IV.19—SUMMARY OF INPUTS AND METHODS FOR THE NATIONAL IMPACT ANALYSIS—Continued

Inputs	Method
Present Year	2021.

1. Product Efficiency Trends

A key component of the NIA is the trend in energy efficiency projected for the no-new-standards case and each of the standards cases. Section IV.F.8 of this document describes how DOE developed an energy efficiency distribution for the no-new-standards case (which yields a shipment-weighted average efficiency) and for each of the considered product classes for the first full year of anticipated compliance with an amended or new standard. The approach is further described in chapter 10 of the NOPR TSD.

For the standards cases, DOE used a ''roll-up'' scenario to establish the shipment-weighted efficiency for the first full year that standards are assumed to become effective (2028). In this scenario, the market shares of products in the no-new-standards case that do not meet the standard under consideration would ''roll up'' to meet the new standard level, and the market share of products above the standard would remain unchanged. In the standards cases, the efficiency after the compliance year increases at a rate similar to that of the no-new-standards case.

To develop no-new standards case efficiency trends after 2020, DOE assumed an annual decreasing trend of negative 2 percent in the market share for the minimum efficiency levels (EL 0) for both electric and gas-fired pool heaters. This resulted in a market share for EL 0 of 8 percent in 2028 and 4 percent in 2057 for electric pool heaters and 4 percent in 2028 and 2 percent in 2057 for gas-fired pool heaters.

2. National Energy Savings

The NES analysis involves a comparison of national energy consumption of the considered products between each potential standards case (TSL) and the case with no new or amended energy conservation standards. DOE calculated the national energy consumption by multiplying the number of units (stock) of each product (by vintage or age) by the unit energy consumption (also by vintage). DOE calculated annual NES based on the difference in national energy consumption for the no-new-standards case and for each higher efficiency standard case. DOE estimated energy consumption and savings based on site energy and converted the electricity consumption and savings to primary energy (*i.e.,* the energy consumed by power plants to generate site electricity) using annual conversion factors derived from *AEO2021.* Cumulative energy savings are the sum of the NES for each year over the timeframe of the analysis.

Use of higher-efficiency products is occasionally associated with a direct rebound effect, which refers to an increase in utilization of the product due to the increase in efficiency. DOE did not find any data on the rebound effect specific to consumer pool heaters. DOE applied a rebound effect of 10 percent for consumer pool heaters used in residential applications based on studies of other residential products and 0 percent for consumer pool heaters used in commercial applications (see section IV.F.3.a for more details). The April 2010 final rule also utilized a 10 percent rebound when calculating the NES. 75 FR 20112, 20165. The calculated NES at each efficiency level is therefore reduced by 10 percent in residential applications. DOE does not include the rebound effect in the NPV analysis.

In 2011, in response to the recommendations of a committee on ''Point-of-Use and Full-Fuel-Cycle Measurement Approaches to Energy Efficiency Standards'' appointed by the National Academy of Sciences, DOE announced its intention to use full-fuel-cycle (''FFC'') measures of energy use and greenhouse gas and other emissions in the national impact analyses and emissions analyses included in future energy conservation standards rulemakings. 76 FR 51281 (Aug. 18, 2011). After evaluating the approaches discussed in the August 18, 2011 notice, DOE published a statement of amended policy in which DOE explained its determination that EIA's National Energy Modeling System (''NEMS'') is the most appropriate tool for its FFC analysis and its intention to use NEMS for that purpose. 77 FR 49701 (Aug. 17, 2012). NEMS is a public domain, multi-sector, partial equilibrium model of the U.S. energy sector[120] that EIA uses to prepare its *Annual Energy Outlook.* The FFC factors incorporate losses in production and delivery in the case of natural gas (including fugitive emissions) and additional energy used to produce and deliver the various fuels used by power plants. The approach used for deriving FFC measures of energy use and emissions is described in appendix 10B of the NOPR TSD.

NPGA commented that the calculation of primary (source) energy savings is misleading and unnecessary given the use of FFC analysis. NPGA further stated that DOE's reliance on an additional energy consumption calculation conflicts with the purpose and function of FFC analysis. NPGA urged DOE to rely on the FFC analysis to calculate NES as the best estimation of energy consumption and as intended by the agency's formal policy adoption of FFC. (NPGA, No. 15 at p. 3)

As indicated in section I and Table V.23 of this document, DOE primarily uses FFC energy savings when considering the energy savings from standards. DOE presents primary energy savings in some tables for information purposes.

NPGA stated that there is no clear difference between the FFC analysis that measures energy consumption in ''extracting, processing, and transporting'' versus primary (source) energy that measures energy loss in transmission and distribution and in electricity generation.'' (NPGA, No. 15 at p. 3) The FFC includes primary energy as well as upstream energy, which refers to the extracting, processing, and transporting of the primary fuels, such as coal or natural gas that are used to generate electricity. In contrast, losses in transmission and distribution and in electricity generation refer to the losses in the conversion from the primary fuel to electricity and in distribution of electricity.

[120] For more information on NEMS, refer to *The National Energy Modeling System: An Overview 2009,* DOE/EIA–0581, Oct. 2009, available at *www.eia.gov/forecasts/aeo/nems/overview/pdf/0581(2009).pdf* (last accessed April 15, 2021).

EEI stated that the national average site-to-source conversion factors ignore the significant variation in electric generation by region. EEI also stated that the factors incorrectly assign a fossil fuel heat rate to renewable electric generation. (EEI, No. 21 at p. 15)

DOE's approach uses end-use dependent site-to-primary energy conversion factors. The correlation between regional variations in end-use energy consumption and regional variations in the mix of generation technologies is accounted for by this approach. Regarding renewable electric generation, DOE uses the same convention that EIA uses in national energy statistics. Renewable electric generation technologies transform the inputs of solar, wind, and hydro energy into electricity, but characterizing these inputs in terms of primary energy consumption is difficult and not very relevant for national energy accounting. The convention used by EIA reflects the likelihood that renewable electricity generation displaces conventional fossil fuel generation.

EEI stated that the factors that convert site electricity use to primary energy use in the October 2015 NODA NIA spreadsheet increase slightly from 2035 to 2040 without explanation and with no improvement after 2040. EEI stated that the post-2035 increase does not comport with the expected fuel mix that will be generating electricity post-2030. (EEI, No. 21 at pp. 14–15)

The increase from 2035 to 2040 is consistent with the projections of the mix of electricity generation in *AEO2015,* which was used in the October 2015 NODA. Regarding the factors after 2040, the marginal conversion factors derived from projections in *AEO2015* do not show a clear trend, so DOE refrained from projecting a change after 2040. For the NOPR, DOE used conversion factors based on *AEO2021,* which shows a generally flat trend from 2035 to 2050 for these factors. *AEO2021* provides trends up to 2050, after which DOE maintained the 2050 value.

EEI expressed concern that DOE used an annual conversion factor for an appliance that operates primarily during the summer season in the majority of the country. EEI stated that if DOE is going to use annualized data, it should at least recognize in its analysis that summer usage often corresponds with the use of more solar electricity (central station and distributed). (EEI, No. 21 at pp. 15–16)

DOE acknowledges that marginal site-to-source conversion factors in the summer may vary from annual factors; however, *AEO* does not provide information that would allow for derivation of such factors. DOE notes that the greater use of solar electricity in the summer does not necessarily mean that solar electricity would be disproportionately reduced at the margin if electricity demand declines.

EEI stated that the site-to-source conversion factors do not account for the changes that are due to the Environmental Protection Agency's (''EPA'') Clean Power Plan (''CPP''). (EEI, No. 21 at p. 16) EEI also stated that any estimated upstream losses analysis regarding the production of electricity should properly account for new Federal regulations and increases in the use of lower carbon and renewable electric generation. (EEI, No. 21 at p. 16)

On July 8, 2019, EPA published a final rule repealing the Clean Power Plan. 84 FR 32520. As stated previously, for this NOPR, DOE used projections from *AEO2021.* The *AEO2021* reference case does not include the CPP but does account for recent Federal regulations. Because renewable electricity generation is assigned a fossil-fuel-equivalent site-to-primary factor, increases in the share of such generation would have little impact on the site-to-source conversion factors.

3. Net Present Value Analysis

The inputs for determining the NPV of the total costs and benefits experienced by consumers are (1) total annual installed cost, (2) total annual operating costs (energy costs and repair and maintenance costs), and (3) a discount factor to calculate the present value of costs and savings. DOE calculates net savings each year as the difference between the no-new-standards case and each standards case in terms of total savings in operating costs versus total increases in installed costs. DOE calculates operating cost savings over the lifetime of each product shipped during the projection period.

As discussed in section IV.F.1 of this document, DOE used historical shipment-weighted wholesaler prices to produce different decreasing price trends for electric resistance pool heaters, heat pump pool heaters, and gas-fired pool heaters. DOE's projection of product prices is described in appendix 10C of the NOPR TSD.

To evaluate the effect of uncertainty regarding the price trend estimates, DOE investigated the impact of different product price projections on the consumer NPV for the considered TSLs for consumer pool heaters. In addition to the default price trend, DOE considered two product price sensitivity cases: (1) A low price—high declining trend case based on exponential fit to 2003 to 2014 wholesale price data from the 2020 Pkdata report[121] for electric resistance pool heaters, heat pump pool heaters, and gas-fired pool heaters, and (2) a constant price trend. The derivation of these price trends and the results of these sensitivity cases are described in appendix 10C of the NOPR TSD.

The operating cost savings are the sum of the differences in energy cost savings, maintenance, and repair costs, which are calculated using the estimated energy savings in each year and the projected price of the appropriate form of energy. To estimate energy prices in future years, DOE multiplied the calculated 2020 national average and marginal residential and commercial energy prices by the projection of annual national-average residential or commercial energy price changes from the Reference case from *AEO2021,* which has an end year of 2050.[122] To estimate price trends after 2050, DOE used the average of annual growth rates in prices from 2045 through 2050.[123] As part of the NIA, DOE also analyzed scenarios that used inputs from variants of the *AEO2021* Reference case that have lower and higher economic growth. Those cases have lower and higher energy price trends compared to the Reference case. NIA results based on these cases are presented in appendix 10D of the NOPR TSD.

In calculating the NPV, DOE multiplies the net savings in future years by a discount factor to determine their present value. For this NOPR, DOE estimated the NPV of consumer benefits using both a 3-percent and a 7-percent real discount rate. DOE uses these discount rates in accordance with guidance provided by the Office of Management and Budget (''OMB'') to Federal agencies on the development of regulatory analysis.[124] The discount

[121] Pkdata, *2020 Residential and Commercial Swimming Pool, Hot tub, and Pool Heater Customized Report for LBNL,* October 15, 2020, available at */www.pkdata.com/datapointstrade.html#/* (last accessed April 15, 2021).

[122] The regional 2020 average and marginal energy prices are converted to national averages using the regional weights calculated by the pool heater sample discussed in section IV.E.1. The census division price trends from *AEO2021* are also converted to national average values using the pool heater sample weights.

[123] Lavappa, Priya D. and J.D. Kneifel. *Energy Price Indices and Discount Factors for Life-Cycle Cost Analysis—2021 Annual Supplement to NIST Handbook 135.* National Institute of Standards and Technology (NIST). NISTIR 85–3273–36, available at *www.nist.gov/publications/energy-price-indices-and-discount-factors-life-cycle-cost-analysis-2021-annual* (last accessed April 15, 2021).

[124] United States Office of Management and Budget. Circular A–4: Regulatory Analysis.

rates for the determination of NPV are in contrast to the discount rates used in the LCC analysis, which are designed to reflect a consumer's perspective. The 7-percent real value is an estimate of the average before-tax rate of return to private capital in the U.S. economy. The 3-percent real value represents the ''social rate of time preference,'' which is the rate at which society discounts future consumption flows to their present value.

I. Consumer Subgroup Analysis

In analyzing the potential impact of new or amended energy conservation standards on consumers, DOE evaluates the impact on identifiable subgroups of consumers that may be disproportionately affected by a new or amended national standard. The purpose of a subgroup analysis is to determine the extent of any such disproportional impacts. DOE evaluates impacts on particular subgroups of consumers by analyzing the LCC impacts and PBP for those particular consumers from alternative standard levels. For this NOPR, DOE analyzed the impacts of the considered standard levels on senior-only households and small businesses.[125] The analysis used subsets of the consumer pool heater sample composed of households or buildings that meet the criteria for the subgroup. DOE used the LCC and PBP spreadsheet model to estimate the impacts of the considered efficiency levels on these subgroups. Chapter 11 in the NOPR TSD describes the consumer subgroup analysis.

J. Manufacturer Impact Analysis

1. Overview

DOE performed an MIA to estimate the financial impacts of new and amended energy conservation standards on manufacturers of consumer pool heaters and to estimate the potential impacts of such standards on employment and manufacturing capacity. The MIA has both quantitative and qualitative aspects and includes analyses of projected industry cash flows, the INPV, investments in research and development (''R&D'') and manufacturing capital, and domestic manufacturing employment. Additionally, the MIA seeks to determine how new and amended energy conservation standards might affect manufacturing employment, capacity, and competition, as well as how standards contribute to overall regulatory burden. Finally, the MIA serves to identify any disproportionate impacts on manufacturer subgroups, including small business manufacturers.

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 include data on the industry cost structure, unit production costs, product shipments, manufacturer markups, and investments in R&D and manufacturing capital required to produce compliant products. The key GRIM outputs are the INPV, which is the sum of industry annual cash flows over the analysis period, discounted using the industry-weighted average cost of capital, and the impact to domestic manufacturing employment. The model uses standard accounting principles to estimate the impacts of more-stringent energy conservation standards on a given industry by comparing changes in INPV and domestic manufacturing employment between a no-new-standards case and the various standards cases *(i.e.,* TSLs). To capture the uncertainty relating to manufacturer pricing strategies following new and amended standards, the GRIM estimates a range of possible impacts under different markup scenarios.

The qualitative part of the MIA addresses manufacturer characteristics and market trends. Specifically, the MIA considers such factors as a potential standard's impact on manufacturing capacity, competition within the industry, the cumulative impact of other DOE and non-DOE regulations, and impacts on manufacturer subgroups. The complete MIA is outlined in chapter 12 of the NOPR TSD.

DOE conducted the MIA for this proposed rulemaking in three phases. In Phase 1 of the MIA, DOE prepared a profile of the consumer pool heater manufacturing industry based on the market and technology assessment, preliminary manufacturer interviews, and publicly-available information. This included a top-down analysis of consumer pool heater manufacturers that DOE used to derive preliminary financial inputs for the GRIM (*e.g.,* revenues; materials, labor, overhead, and depreciation expenses; selling, general, and administrative expenses (''SG&A''); and R&D expenses). DOE also used public sources of information to further calibrate its initial characterization of the consumer pool heater manufacturing industry, including company filings of form 10–K from the SEC,[126] corporate annual reports, industry trade association product database from AHRI,[127] the U.S. Census Bureau's *Economic Census,*[128] and reports from Dun & Bradstreet.[129]

In Phase 2 of the MIA, DOE prepared a framework industry cash-flow analysis to quantify the potential impacts of new and amended energy conservation standards. The GRIM uses several factors to determine a series of annual cash flows starting with the announcement of the standard and extending over a 30-year period following the compliance date of the standard. These factors include annual expected revenues, costs of sales, SG&A and R&D expenses, taxes, and capital expenditures. In general, energy conservation standards can affect manufacturer cash flow in three distinct ways: (1) Creating a need for increased investment, (2) raising production costs per unit, and (3) altering revenue due to higher per-unit prices and changes in sales volumes.

In addition, during Phase 2, DOE developed interview guides to distribute to manufacturers of consumer pool heaters in order to develop other key GRIM inputs, including product and capital conversion costs, and to gather additional information on the anticipated effects of energy conservation standards on revenues, direct employment, capital assets, industry competitiveness, and subgroup impacts.

In Phase 3 of the MIA, DOE conducted structured, detailed interviews with representative manufacturers. During these interviews, DOE discussed engineering, manufacturing, procurement, and financial topics to validate assumptions used in the GRIM and to identify key issues or concerns. See section IV.J.3 of this document for a description of the key issues raised by manufacturers during the interviews. As part of Phase 3, DOE also evaluated subgroups of manufacturers that may be disproportionately impacted by new and amended standards or that may not be accurately represented by the average cost assumptions used to develop the industry cash flow analysis. Such manufacturer subgroups may include small business manufacturers, low-volume manufacturers, niche players, and/or manufacturers exhibiting a cost

September 17, 2003. Section E, available at *www.whitehouse.gov/sites/whitehouse.gov/files/omb/circulars/A4/a-4.pdf* (last accessed April 15, 2021).

[125] DOE did not evaluate low-income consumer subgroup impacts for pool heaters because the sample size of the subgroups is too small for meaningful analysis.

[126] See *www.sec.gov/edgar.shtml.*

[127] See *www.ahridirectory.org/NewSearch?programId=36&searchTypeId=3.*

[128] See *www.census.gov/programs-surveys/asm/data.html.*

[129] See *www.dnb.com.*

structure that largely differs from the industry average. DOE identified one manufacturer subgroup for a separate impact analysis: Small business manufacturers. The small business subgroup is discussed in section VI.B, ''Review under the Regulatory Flexibility Act'' of this document, and in chapter 12 of the NOPR TSD.

2. Government Regulatory Impact Model and Key Inputs

DOE uses the GRIM to quantify the changes in cash flow due to new and amended standards that result in a higher or lower industry value. The GRIM uses a standard, annual discounted 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 new and amended energy conservation standards. The GRIM spreadsheet uses the inputs to arrive at a series of annual cash flows, beginning in 2021 (the base year of the analysis) and continuing to 2057. DOE calculated INPVs by summing the stream of annual discounted cash flows during this period. For manufacturers of consumer pool heaters, DOE used a real discount rate of 7.4 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 the no-new-standards case and each standards case. The difference in INPV between the no-new-standards case and a standards case represents the financial impact of the new and amended energy conservation standards on consumer pool heater manufacturers. As discussed previously, DOE developed critical GRIM inputs using a number of sources, including publicly available data, results of the engineering analysis, and information gathered from industry stakeholders during the course of manufacturer interviews. The GRIM results are presented in section V.B.2. of this document. Additional details about the GRIM, the discount rate, and other financial parameters can be found in chapter 12 of the NOPR TSD.

a. Manufacturer Production Costs

Manufacturing more efficient products is typically more expensive than manufacturing baseline products 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 covered products can affect the revenues, gross margins, and cash flow of the industry.

In the MIA, DOE used the MPCs calculated in the engineering analysis, as described in section IV.C and in chapter 5 of the NOPR TSD. DOE used information from its teardown analysis, described in section IV.C.2 of this document to disaggregate the MPCs into material, labor, depreciation, and overhead costs. To calculate the MPCs for products above the baseline, DOE added incremental material, labor, depreciation, and overhead costs from the engineering cost-efficiency curves to the baseline MPCs. These cost breakdowns were validated with manufacturers during manufacturer interviews.

For a complete description of the MPCs, see chapter 5 of the NOPR TSD.

b. Shipments Projections

The GRIM estimates manufacturer revenues based on total unit shipment projections and the distribution of those shipments by efficiency level. Changes in sales volumes and efficiency mix over time can significantly affect manufacturer finances. For the no-new-standards case, the GRIM uses the NIA's annual shipment projections derived from the shipment analysis from the reference year, 2021, to the end of the analysis period in 2057. For the standards case shipment projection, the GRIM uses the NIA standards case shipment projections. The NIA assumes elasticity in demand as explained in section IV.G and chapter 9 of the NOPR TSD. Therefore, the total number of shipments per year in the standards cases could be fewer than the total number of shipments per year in the no-new-standards case. DOE assumed that products that did not meet the analyzed standards in the no-new-standards case in the compliance year and beyond, would become minimally compliant products in the standards cases. This is referred to as a ''roll up'' shipment scenario (*i.e.,* new and amended energy conservation standards only impact models and shipments that do not meet the adopted standards).

For a complete description of the shipments analysis, see chapter 9 of the NOPR TSD.

c. Product and Capital Conversion Costs

New and amended energy conservation standards could cause manufacturers to incur conversion costs to bring their production facilities and product designs into compliance. DOE evaluated the level of conversion-related expenditures that would be needed to comply with each considered efficiency level in each product 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 investments in research, development, testing, marketing, and other non-capitalized costs necessary to make product designs comply with new and amended energy conservation standards. Capital conversion costs are investments in property, plant, and equipment necessary to adapt or change existing production facilities such that new compliant product designs can be fabricated and assembled.

To evaluate the level of capital conversion costs manufacturers would likely incur to comply with new and amended energy conservation standards, DOE used data gathered from manufacturer interviews as well as information derived from the product teardown analysis and engineering model. In developing its conversion cost estimates, DOE conservatively assumed manufacturers would redesign all noncompliant heat pump pool heater models and gas-fired pool heater models to comply with new and amended energy conservation standards. Manufacturers could choose to drop some models that do not meet the levels prescribed by new and amended standards. Therefore, total product and capital conversion costs may be lower than the estimates calculated as part of this analysis.

Product conversion are calculated on a per model basis and are primarily driven by R&D costs. R&D costs include redesign, selection and purchasing of new components, and testing to demonstrate compliance with adopted energy conservation standards for those redesigned models. DOE assumed that manufacturers would discontinue all their electric resistance pool heater models for any standard level above baseline for electric pool heaters, because electric resistance pool heaters use different technologies and designs than heat pump pool heaters. Consequently, no redesign costs are assigned to the redesign of electric resistance pool heater models. For heat pump pool heaters, all design options include growing the size of the evaporator. DOE assumed that the per model redesign effort is the same irrespective of how much the size of the evaporator is increased and the per model redesign cost does not vary by the analyzed standard for electric pool heaters, however, the number of models that would be required to be redesigned would vary by the analyzed standard. DOE estimated a redesign effort of six months of engineering time per model for electric heat pump pool heaters.

For gas-fired pool heaters, DOE estimated that the redesign effort varies by efficiency level. The design option analyzed at EL 1 replaces the standing pilot with an electronic ignition system. This entails a component swap and requires the addition of a sparker. DOE estimates a total of two months of engineering time per model to redesign a model with a standing pilot to an electronic ignition. The design option analyzed at EL 2 incorporates a blower. Product conversion costs involve the selection, qualification, and safety testing of the blower. DOE estimated a redesign effort of 18 months of engineering time per model, or three fully utilized engineers for a period of six months. The design option analyzed at max-tech level incorporates condensing technology. This requires a significant amount of redesign to fine tune the gas-fired pool heater such that it can accommodate condensate. DOE estimated a redesign effort of 24 months of engineering per model, or four fully utilized engineers for a period of six months each.

The product conversion costs presented in Table IV.20 also include costs of testing and demonstrating compliance that would result from new and amended standards. Since gas-fired pool heaters already must meet DOE energy conservation standards, only the models that are redesigned because of amended energy conservation standards would have to be retested to demonstrate compliance with the standards. In contrast, electric pool heaters are not currently required to be tested to demonstrate compliance with a DOE energy conservation standard. Therefore, for the analyzed TSLs that set standards for electric pool heaters, manufacturers would have to test all electric pool heater models to comply with potential standards.

Capital conversion costs are estimated on a per manufacturer basis. DOE developed a list of manufacturers of gas-fired, heat pump, and electric resistance pool heaters using manufacturer websites and public databases such as AHRI [130] and DOE's publicly available Compliance Certification Database.[131] For gas-fired pool heaters capital conversion costs would be minimal at EL 1 and EL 2, which would likely not require the use of condensing technology to meet these efficiency levels. However, manufacturers would likely be required to use condensing technology to meet EL 3. This would require larger investments from manufacturers to necessitate major changes to tooling to make condensing heat exchangers as well as changes to injection molding machinery to accommodate larger cabinet sizes.

In general, DOE assumes 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 and amended standards. The conversion cost figures used in the GRIM can be found in Table IV.20 and in section V.B.2.a of this document. For additional information on the estimated capital and product conversion costs, see chapter 12 of the NOPR TSD.

Table IV.20 Industry Product and Capital Conversion Costs per Efficiency Level

	Units	Product Class	Efficiency Level					
			Baseline	EL 1	EL 2	EL 3	EL 4	EL 5
Product Conversion Costs	*2020$ millions*	Gas-Fired	0.0	0.5	9.1	15.5		
		Electric	0.0	2.2	5.5	22.4	23.5	26.1
Capital Conversion Costs	*2020$ millions*	Gas-Fired	0.0	0.0	0.8	12.1		
		Electric	0.0	0.0	0.6	5.3	5.3	5.4

DOE seeks additional information on industry capital and product conversion costs of compliance associated with the analyzed energy conservation standards for consumer pool heaters evaluated in this NOPR.

d. Stranded Assets

In addition to capital and product conversion costs, new and amended energy conservation standards could create stranded assets (*i.e.,* tooling and equipment that would have enjoyed longer use if the energy conservation standard had not made them obsolete). In the compliance year, manufacturers write down the remaining undepreciated book value of existing tooling and equipment rendered obsolete by new and amended energy conservation standards.

DOE assumed that manufacturers discontinue all electric resistance pool heaters for any electric pool heater standard above baseline. Manufacturers of electric resistance pool heaters typically purchase components from vendors and assemble them in-house. These manufacturers do not own capital equipment or machinery and therefore stranded assets are limited for electric resistance pool heater manufacturers. DOE estimated stranded assets for the electric pool heater industry at $0.7 million for any level above baseline. This includes welding machines and other tools used to assemble these products.

Based on manufacturer interviews, manufacturers could strand assets for gas-fired pool heaters if standards were set at max-tech. Manufacturers stated that existing injection molding machines, fin presses, and fin dies could be orphaned. DOE estimated the industry stranded assets for gas-fired pool heaters to be $5.6 million if standards were set at max-tech.

DOE requests comment on the estimated stranded assets for both electric resistance pool heaters and gas-fired pool heaters.

e. Manufacturer Markup Scenarios

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 product class and efficiency level, and then added the cost of shipping. Modifying these markups in the standards case yields different sets of impacts on manufacturers. For the MIA, DOE modeled two standards-case manufacturer markup scenarios to represent uncertainty regarding the potential impacts on prices and profitability for manufacturers following the implementation of new and amended energy conservation standards: (1) A preservation of gross

[130] See *www.ahridirectory.org/* (last accessed April 15, 2021).

[131] See *www.regulations.doe.gov/certification-data* (last accessed April 15, 2021).

margin percentage markup scenario; and (2) a preservation of per-unit operating profit markup scenario. These scenarios lead to different manufacturer markup values that, when applied to the 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'' manufacturer markup across all efficiency levels. 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 consumer pool heater manufacturers, and information obtained during manufacturer interviews, DOE assumed the non-production cost manufacturer markup—which includes SG&A expenses, R&D expenses, interest, and profit—to be 1.33 for gas-fired pool heaters and 1.28 for electric pool heaters. These manufacturer markups are consistent with the ones DOE assumed in the engineering analysis (see section IV.C of this document). Therefore, DOE assumes that this scenario represents the upper bound to industry profitability under energy conservation standards.

Under the preservation of per-unit operating profit markup scenario, DOE modeled a scenario in which manufacturers are not able to increase per-unit operating profit in proportion to increases in MPCs. Under this scenario, as the MPCs increase, manufacturers are generally required to reduce the manufacturer markup to maintain a cost competitive offering in the market. Therefore, gross margin (as a percentage) shrinks in the standards cases. This manufacturer markup scenario represents the lower bound to industry profitability under new and amended energy conservation standards.

A comparison of industry financial impacts under the two manufacturer markup scenarios is presented in section V.B.2.a of this document.

3. Manufacturer Interviews

DOE conducted additional interviews with manufacturers following the October 2015 NODA as part of the NOPR analysis. In these interviews, DOE asked manufacturers to describe their major concerns with new and amended consumer pool heater energy conservation standards. Manufacturers identified three major areas of concern: (1) Use of integrated thermal efficiency metric for electric pool heaters; (2) cost and complexity of installing condensing gas-fired pool heaters; and (3) impact on profitability. 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.

a. Use of Integrated Thermal Efficiency Metric for Electric Pool Heaters

Manufacturers stated that the coefficient of performance is currently used by industry and consumers to evaluate the efficiency of electric heat pump pool heaters. This metric is accepted throughout the industry and is widely used in state regulations such as California, Connecticut, and Florida. Manufacturers commented that changing the metric to integrated thermal efficiency would be confusing to consumers, because it shows efficiencies over 100 percent. Furthermore, using integrated thermal efficiency would make the comparison between existing heat pumps with a coefficient of performance label, and heat pumps with an integrated thermal efficiency metric more difficult.

b. Cost and Complexity of Installing Condensing Gas-Fired Pool Heaters

Manufacturers indicated that a condensing standard would require greater investment in R&D and capital equipment than a non-condensing standard and would also raise per-unit production costs, resulting in higher end-user purchase prices. They expressed concern that the combination of higher installation costs and retail prices for condensing pool heaters could deter consumers from purchasing new units, potentially impacting manufacturer revenues and reducing the prospective energy savings from new and amended standards.

c. Impacts on Profitability

Manufacturers have indicated that it would be optimistic for DOE to assume that as MPCs increase in response to energy conservation standards, manufacturers would be able to maintain the same gross margin percentage markup. Manufacturers stated that consumer pool heaters are typically purchased on a first-cost basis and they indicated that they do not earn a premium on more efficient units. They indicated that consumer pool heaters are relatively low-margin offerings and consumers are typically more concerned with capacity and speed of heating than with efficiency and therefore look to purchase the least expensive consumer pool heater at the right capacity.

K. Emissions Analysis

The emissions analysis consists of two components. The first component estimates the effect of potential energy conservation standards on power sector and site (where applicable) combustion emissions of CO_2, NO_X, SO_2, and Hg. The second component estimates the impacts of potential standards on emissions of two additional greenhouse gases, CH_4 and N_2O, as well as the reductions to emissions of other gases due to ''upstream'' activities in the fuel production chain. These upstream activities comprise extraction, processing, and transporting fuels to the site of combustion.

The analysis of power sector emissions of CO_2, NO_X, SO_2, and Hg uses marginal emissions factors that were derived from data in *AEO2021,* as described in section IV.M of this document. Details of the methodology are described in the appendices to chapters 13 and 15 of the TSD for this NOPR.

Power sector emissions of CO_2, CH_4, and N_2O are estimated using Emission Factors for Greenhouse Gas Inventories published by the EPA.[132] The FFC upstream emissions are estimated based on the methodology described in chapter 15 of the NOPR TSD. The upstream emissions include both emissions from extraction, processing, and transportation of fuel, and ''fugitive'' emissions (direct leakage to the atmosphere) of CH_4 and CO_2.

The on-site operation of certain consumer pool heaters requires combustion of fossil fuels and results in emissions of CO_2, NO_X, SO_2, CH_4, and N_2O at the sites where these products are used. DOE accounted for the reduction in these site emissions and the associated FFC upstream emissions due to potential standards. Site emissions of these gases were estimated using Emission Factors for Greenhouse Gas Inventories and emissions intensity factors from an EPA publication.[133]

The emissions intensity factors are expressed in terms of physical units per megawatt-hour (MWh) or million British thermal units (MMBtu) of site energy savings. Total emissions reductions are estimated using the energy savings calculated in the national impact analysis.

[132] Available at *www.epa.gov/sites/production/files/2021-04/documents/emission-factors_apr2021.pdf* (last accessed July 12, 2021).

[133] U.S. Environmental Protection Agency. External Combustion Sources. In *Compilation of Air Pollutant Emission Factors.* AP–42. Fifth Edition. Volume I: Stationary Point and Area Sources. Chapter 1, available at *www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emissions-factors* (last accessed April 15, 2021).

1. Air Quality Regulations Incorporated in DOE's Analysis

DOE's no-new-standards case for the electric power sector reflects the *AEO2021,* which incorporates the projected impacts of existing air quality regulations on emissions. *AEO2021* generally represents current legislation and environmental regulations, including recent government actions, that were in place at the time of preparation of *AEO2021,* including the emissions control programs discussed in the following paragraphs.[134]

SO_2 emissions from affected electric generating units (''EGUs'') are subject to nationwide and regional emissions cap-and-trade programs. Title IV of the Clean Air Act sets an annual emissions cap on SO_2 for affected EGUs in the 48 contiguous States and the District of Columbia (DC). (42 U.S.C. 7651 *et seq.*) SO_2 emissions from numerous States in the eastern half of the United States are also limited under the Cross-State Air Pollution Rule (''CSAPR''). 76 FR 48208 (Aug. 8, 2011). CSAPR requires these States to reduce certain emissions, including annual SO_2 emissions, and went into effect as of January 1, 2015.[135] *AEO2021* incorporates implementation of CSAPR, including the update to the CSAPR ozone season program emission budgets and target dates issued in 2016, 81 FR 74504 (Oct. 26, 2016). Compliance with CSAPR is flexible among EGUs and is enforced through the use of tradable emissions allowances. 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 another regulated EGU.

However, beginning in 2016, SO_2 emissions began to fall as a result of the Mercury and Air Toxics Standards (''MATS'') for power plants. 77 FR 9304 (Feb. 16, 2012). In the MATS final 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 are being reduced as a result of the control technologies installed on coal-fired power plants to comply with the MATS requirements for acid gas. To continue operating, coal power plants must have either flue gas desulfurization or dry sorbent injection systems installed. Both technologies, which are used to reduce acid gas emissions, also reduce SO_2 emissions. Because of the emissions reductions under the MATS, 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 another regulated EGU. Therefore, energy conservation standards that decrease electricity generation would generally reduce SO_2 emissions. DOE estimated SO_2 emissions reduction using emissions factors based on *AEO2021.*

CSAPR also established limits on NO_X emissions for numerous States in the eastern half of the United States. Energy conservation standards would have little effect on NO_X emissions in those States covered by CSAPR emissions limits if excess NO_X emissions allowances resulting from the lower electricity demand could be used to permit offsetting increases in NO_X emissions from other EGUs. In such case, NO_X emissions would remain near the limit even if electricity generation goes down. A different case could possibly result, depending on the configuration of the power sector in the different regions and the need for allowances, such that NO_X emissions might not remain at the limit in the case of lower electricity demand. In this case, energy conservation standards might reduce NO_X emissions in covered States. Despite this possibility, DOE has chosen to be conservative in its analysis and has maintained the assumption that standards will not reduce NO_X emissions in States covered by CSAPR. Energy conservation standards would be expected to reduce NO_X emissions in the States not covered by CSAPR. DOE used *AEO2021* data to derive NO_X emissions factors for the group of States not covered by CSAPR.

The MATS limit mercury emissions from power plants, but they do not include emissions caps and, as such, DOE's energy conservation standards would be expected to slightly reduce Hg emissions. DOE estimated mercury emissions reduction using emissions factors based on *AEO2021,* which incorporates the MATS.

DOE welcomes any additional comments on the approach for conducting the emissions analysis for pool heaters.

L. Monetizing Emissions Impacts

As part of the development of this proposed rule, for the purpose of complying with the requirements of Executive Order 12866, DOE considered the estimated monetary benefits from the reduced emissions of CO_2, CH_4, N_2O, NO_X, and SO_2 that are expected to result from each of the TSLs considered. In order to make this calculation analogous to the calculation of the NPV of consumer benefit, DOE considered the reduced emissions expected to result over the lifetime of products shipped in the projection period for each TSL. This section summarizes the basis for the values used for monetizing the emissions benefits and presents the values considered in this NOPR.

On March 16, 2022, the Fifth Circuit Court of Appeals (No. 22–30087) granted the federal government's emergency motion for stay pending appeal of the February 11, 2022, preliminary injunction issued in *Louisiana* v. *Biden,* No. 21–cv–1074–JDC–KK (W.D. La.). As a result of the Fifth Circuit's order, the preliminary injunction is no longer in effect, pending resolution of the federal government's appeal of that injunction or a further court order. Among other things, the preliminary injunction enjoined the defendants in that case from ''adopting, employing, treating as binding, or relying upon'' the interim estimates of the social cost of greenhouse gases—which were issued by the Interagency Working Group on the Social Cost of Greenhouse Gases on February 26, 2021—to monetize the benefits of reducing greenhouse gas emissions. In the absence of further intervening court orders, DOE will revert to its approach prior to the injunction and present monetized benefits where appropriate and permissible under law. DOE requests comment on how to address the climate benefits and other non-monetized effects of the proposal.

1. Monetization of Greenhouse Gas Emissions

For the purpose of complying with the requirements of Executive Order 12866, DOE estimates the monetized benefits of the reductions in emissions

[134] For further information, see the Assumptions to *AEO2021* report that sets forth the major assumptions used to generate the projections in the Annual Energy Outlook. Available at *www.eia.gov/outlooks/aeo/assumptions/* (last accessed April 15, 2021).

[135] CSAPR requires states to address annual emissions of SO_2 and NO_X, precursors to the formation of fine particulate matter ($PM_{2.5}$) pollution, in order to address the interstate transport of pollution with respect to the 1997 and 2006 $PM_{2.5}$ National Ambient Air Quality Standards (''NAAQS''). CSAPR also requires certain states to address the ozone season (May-September) emissions of NO_X, a precursor to the formation of ozone pollution, in order to address the interstate transport of ozone pollution with respect to the 1997 ozone NAAQS. 76 FR 48208 (Aug. 8, 2011). EPA subsequently issued a supplemental rule that included an additional five states in the CSAPR ozone season program; 76 FR 80760 (Dec. 27, 2011) (Supplemental Rule).

of CO_2, CH_4, and N_2O by using a measure of the social cost (''SC'') of each pollutant (*e.g.,* SC–GHGs). These estimates represent the monetary value of the net harm to society associated with a marginal increase in emissions of these pollutants in a given year, or the benefit of avoiding that increase. These estimates are intended to include (but are not limited to) climate-change-related changes in net agricultural productivity, human health, property damages from increased flood risk, disruption of energy systems, risk of conflict, environmental migration, and the value of ecosystem services. DOE exercises its own judgment in presenting monetized climate benefits as recommended by applicable Executive Orders and guidance, and DOE would reach the same conclusion presented in this notice in the absence of the social cost of greenhouse gases, including the February 2021 Interim Estimates presented by the Interagency Working Group on the Social Cost of Greenhouse Gases.

DOE estimated the global social benefits of CO_2, CH_4, and N_2O reductions (*i.e.,* SC–GHGs) using the estimates presented in the Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990 published in February 2021 by the Interagency Working Group on the Social Cost of Greenhouse Gases (IWG) (IWG, 2021).[136] The SC–GHGs is the monetary value of the net harm to society associated with a marginal increase in emissions in a given year, or the benefit of avoiding that increase. In principle, SC–GHGs includes the value of all climate change impacts, including (but not limited to) changes in net agricultural productivity, human health effects, property damage from increased flood risk and natural disasters, disruption of energy systems, risk of conflict, environmental migration, and the value of ecosystem services. The SC–GHGs therefore, reflects the societal value of reducing emissions of the gas in question by one metric ton. The SC–GHGs is the theoretically appropriate value to use in conducting benefit-cost analyses of policies that affect CO_2, N_2O and CH_4 emissions. As a member of the IWG involved in the development of the February 2021 SC–GHG TSD), the DOE agrees that the interim SC–GHG estimates represent the most appropriate estimate of the SC–GHG until revised estimates have been developed reflecting the latest, peer-reviewed science.

The SC–GHGs estimates presented here were developed over many years, using transparent process, peer-reviewed methodologies, the best science available at the time of that process, and with input from the public. Specifically, in 2009, an interagency working group (IWG) that included the DOE and other executive branch agencies and offices was established to ensure that agencies were using the best available science and to promote consistency in the social cost of carbon (SC–CO_2) values used across agencies. The IWG published SC–CO_2 estimates in 2010 that were developed from an ensemble of three widely cited integrated assessment models (IAMs) that estimate global climate damages using highly aggregated representations of climate processes and the global economy combined into a single modeling framework. The three IAMs were run using a common set of input assumptions in each model for future population, economic, and CO_2 emissions growth, as well as equilibrium climate sensitivity (ECS)—a measure of the globally averaged temperature response to increased atmospheric CO_2 concentrations. These estimates were updated in 2013 based on new versions of each IAM. In August 2016 the IWG published estimates of the social cost of methane (SC–CH_4) and nitrous oxide (SC–N_2O) using methodologies that are consistent with the methodology underlying the SC–CO_2 estimates. The modeling approach that extends the IWG SC–CO_2 methodology to non-CO_2 GHGs has undergone multiple stages of peer review. The SC–CH_4 and SC–N_2O estimates were developed by Marten et al. (2015) and underwent a standard double-blind peer review process prior to journal publication. In 2015, as part of the response to public comments received to a 2013 solicitation for comments on the SC–CO_2 estimates, the IWG announced a National Academies of Sciences, Engineering, and Medicine review of the SC–CO_2 estimates to offer advice on how to approach future updates to ensure that the estimates continue to reflect the best available science and methodologies. In January 2017, the National Academies released their final report, Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide, and recommended specific criteria for future updates to the SC–CO_2 estimates, a modeling framework to satisfy the specified criteria, and both near-term updates and longer-term research needs pertaining to various components of the estimation process (National Academies, 2017). Shortly thereafter, in March 2017, President Trump issued Executive Order 13783, which disbanded the IWG, withdrew the previous TSDs, and directed agencies to ensure SC–CO_2 estimates used in regulatory analyses are consistent with the guidance contained in OMB's Circular A–4, ''including with respect to the consideration of domestic versus international impacts and the consideration of appropriate discount rates'' (E.O. 13783, Section 5(c)).

On January 20, 2021, President Biden issued Executive Order 13990, which re-established the IWG and directed it to ensure that the U.S. Government's estimates of the social cost of carbon and other greenhouse gases reflect the best available science and the recommendations of the National Academies (2017). The IWG was tasked with first reviewing the SC–GHG estimates currently used in Federal analyses and publishing interim estimates within 30 days of the E.O. that reflect the full impact of GHG emissions, including by taking global damages into account. The interim SC–GHG estimates published in February 2021, specifically the SC–CH_4 estimates, are used here to estimate the climate benefits for this proposed rulemaking. The E.O. instructs the IWG to undertake a fuller update of the SC–GHG estimates by January 2022 that takes into consideration the advice of the National Academies (2017) and other recent scientific literature.

The February 2021 SC–GHG TSD provides a complete discussion of the IWG's initial review conducted under E.O. 13990. In particular, the IWG found that the SC–GHG estimates used under E.O. 13783 fail to reflect the full impact of GHG emissions in multiple ways. First, the IWG found that a global perspective is essential for SC–GHG estimates because it fully captures climate impacts that affect the United States and which have been omitted from prior U.S.-specific estimates due to methodological constraints. Examples of omitted effects include direct effects on U.S. citizens, assets, and investments located abroad, supply chains, and tourism, and spillover pathways such as economic and political destabilization and global migration. In addition, assessing the benefits of U.S. GHG mitigation activities requires consideration of how those actions may affect mitigation activities by other

[136] *See* Interagency Working Group on Social Cost of Greenhouse Gases, *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide. Interim Estimates Under Executive Order 13990,* Washington, DC, February 2021. Available at: *www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf* (last accessed March 17, 2021).

countries, as those international mitigation actions will provide a benefit to U.S. citizens and residents by mitigating climate impacts that affect U.S. citizens and residents. If the United States does not consider impacts on other countries, it is difficult to convince other countries to consider the impacts of their emissions on the United States. As a member of the IWG involved in the development of the February 2021 SC–GHG TSD, DOE agrees with this assessment and, therefore, in this proposed rule DOE centers attention on a global measure of SC–GHG. This approach is the same as that taken in DOE regulatory analyses from 2012 through 2016. Prior to that, in 2008 DOE presented Social Cost of Carbon (SCC) estimates based on values the Intergovernmental Panel on Climate Change (IPCC) identified in literature at that time. As noted in the February 2021 SC–GHG TSD, the IWG will continue to review developments in the literature, including more robust methodologies for estimating a U.S.-specific SC–GHG value, and explore ways to better inform the public of the full range of carbon impacts. As a member of the IWG, DOE will continue to follow developments in the literature pertaining to this issue.

Second, the IWG found that the use of the social rate of return on capital (7 percent under current OMB Circular A–4 guidance) to discount the future benefits of reducing GHG emissions inappropriately underestimates the impacts of climate change for the purposes of estimating the SC–GHG. Consistent with the findings of the National Academies (2017) and the economic literature, the IWG continued to conclude that the consumption rate of interest is the theoretically appropriate discount rate in an intergenerational context (IWG 2010, 2013, 2016a, 2016b), and recommended that discount rate uncertainty and relevant aspects of intergenerational ethical considerations be accounted for in selecting future discount rates. As a member of the IWG involved in the development of the February 2021 SC–GHG TSD, DOE agrees with this assessment and will continue to follow developments in the literature pertaining to this issue.

While the IWG works to assess how best to incorporate the latest, peer reviewed science to develop an updated set of SC–GHG estimates, it set the interim estimates to be the most recent estimates developed by the IWG prior to the group being disbanded in 2017. The estimates rely on the same models and harmonized inputs and are calculated using a range of discount rates. As explained in the February 2021 SC–GHG TSD, the IWG has recommended that agencies revert to the same set of four values drawn from the SC–GHG distributions based on three discount rates as were used in regulatory analyses between 2010 and 2016 and subject to public comment. For each discount rate, the IWG combined the distributions across models and socioeconomic emissions scenarios (applying equal weight to each) and then selected a set of four values recommended for use in benefit-cost analyses: An average value resulting from the model runs for each of three discount rates (2.5 percent, 3 percent, and 5 percent), plus a fourth value, selected as the 95th percentile of estimates based on a 3 percent discount rate. The fourth value was included to provide information on potentially higher-than-expected economic impacts from climate change. As explained in the February 2021 SC–GHG TSD, and DOE agrees, this update reflects the immediate need to have an operational SC–GHG for use in regulatory benefit-cost analyses and other applications that was developed using a transparent process, peer-reviewed methodologies, and the science available at the time of that process. Those estimates were subject to public comment in the context of dozens of proposed rulemakings as well as in a dedicated public comment period in 2013.

DOE's derivations of the SC–GHG (*i.e.,* SC–CO_2, SC–N_2O, and SC–CH_4) values used for this NOPR are discussed in the following sections, and the results of DOE's analyses estimating the benefits of the reductions in emissions of these pollutants are presented in section V.B.6. of this document.

a. Social Cost of Carbon

The SC–CO_2 values used for this NOPR were generated using the values presented in the 2021 update from the IWG's February 2021 TSD. Table IV.21 shows the updated sets of SC–CO_2 estimates from the latest interagency update in 5-year increments from 2020 to 2050. The full set of annual values used is presented in appendix 14A of the NOPR TSD. For purposes of capturing the uncertainties involved in regulatory impact analysis, DOE has determined it is appropriate to include all four sets of SC–CO_2 values, as recommended by the IWG.[137]

TABLE IV.21—ANNUAL SC–CO_2 VALUES FROM 2021 INTERAGENCY UPDATE, 2020–2050

[2020$ per metric ton CO_2]

Year	Discount rate			
	5% (average)	3% (average)	2.5% (average)	3% (95th percentile)
2020	14	51	76	152
2025	17	56	83	169
2030	19	62	89	187
2035	22	67	96	206
2040	25	73	103	225
2045	28	79	110	242
2050	32	85	116	260

In calculating the potential global benefits resulting from reduced CO_2 emissions, DOE used the values from the 2021 interagency report, adjusted to 2020$ using the implicit price deflator for gross domestic product (GDP) from the Bureau of Economic Analysis. For each of the four sets of SC–CO_2 cases specified, the values for emissions in 2020 were $14, $51, $76, and $152 per metric ton avoided (values expressed in 2020$). DOE derived values from 2051 to 2070 based on estimates published by

[137] For example, the February 2021 TSD discusses how the understanding of discounting approaches suggests that discount rates appropriate for intergenerational analysis in the context of climate change may be lower than 3 percent.

EPA.[138] These estimates are based on methods, assumptions, and parameters identical to the 2020–2050 estimates published by the IWG. DOE derived values after 2070 based on the trend in 2060–2070 in each of the four cases in the IWG update.

DOE multiplied the CO_2 emissions reduction estimated for each year by the SC–CO_2 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 SC–CO_2 values in each case. See chapter 13 for the annual emissions reduction. See appendix 14A for the annual SC–CO_2 values.

b. Social Cost of Methane and Nitrous Oxide

The SC–CH_4 and SC–N_2O values used for this NOPR were generated using the values presented in the 2021 update from the IWG.[139] Table IV.22 shows the updated sets of SC–CH_4 and SC–N_2O estimates from the latest interagency update in 5-year increments from 2020 to 2050. The full set of annual values used is presented in appendix 14A of the NOPR TSD. To capture the uncertainties involved in regulatory impact analysis, DOE has determined it is appropriate to include all four sets of SC–CH_4 and SC–N_2O values, as recommended by the IWG.

TABLE IV.22—ANNUAL SC–CH_4 AND SC–N_2O VALUES FROM 2021 INTERAGENCY UPDATE, 2020–2050

[2020$ per metric ton]

Year	SC–CH_4 discount rate and statistic				SC–N_2O discount rate and statistic			
	5% (average)	3% (average)	2.5% (average)	3% (95th percentile)	5% (average)	3% (average)	2.5% (average)	3% (95th percentile)
2020	670	1500	2000	3900	5800	18000	27000	48000
2025	800	1700	2200	4500	6800	21000	30000	54000
2030	940	2000	2500	5200	7800	23000	33000	60000
2035	1100	2200	2800	6000	9000	25000	36000	67000
2040	1300	2500	3100	6700	10000	28000	39000	74000
2045	1500	2800	3500	7500	12000	30000	42000	81000
2050	1700	3100	3800	8200	13000	33000	45000	88000

DOE multiplied the CH_4 and N_2O emissions reduction estimated for each year by the SC–CH_4 and SC–N_2O estimates for that year in each of the cases. To calculate a present value of the stream of monetary values, DOE discounted the values in each of the cases using the specific discount rate that had been used to obtain the SC–CH_4 and SC–N_2O estimates in each case. See chapter 13 for the annual emissions reduction. See appendix 14A for the annual SC–CH_4 and SC–N_2O values.

2. Monetization of Other Air Pollutants

DOE estimated the monetized value of NO_X and SO_2 emissions reductions from electricity generation using benefit per ton estimates based on air quality modeling and concentration-response functions conducted for the Clean Power Plan final rule. 84 FR 32520. DOE used EPA's reported values for NO_X (as $PM_{2.5}$) and SO_2 for 2020, 2025, and 2030 calculated with discount rates of 3 percent and 7 percent, and EPA's values for ozone season NO_X, which do not involve discounting since the impacts are in the same year as emissions. DOE derived values specific to the sector for pool heaters using a method described in appendix 14A of the NOPR TSD. For this analysis DOE used linear interpolation to define values for the years between 2020 and 2025 and between 2025 and 2030; for years beyond 2030 the values are held constant.

DOE estimated the monetized value of NO_X and SO_2 emissions reductions from gas pool heaters using benefit per ton estimates from the EPA's ''Technical Support Document Estimating the Benefit per Ton of Reducing $PM_{2.5}$ Precursors from 17 Sectors'' (''EPA TSD'').[140] Although none of the sectors refers specifically to residential and commercial buildings, and by association pool heaters, the sector called ''area sources'' would be a reasonable proxy for residential and commercial buildings. ''Area sources'' represents all emission sources for which states do not have exact (point) locations in their emissions inventories. Because exact locations would tend to be associated with larger sources, ''area sources'' would be fairly representative of small dispersed sources like homes and businesses. The EPA TSD provides high and low estimates for 2016, 2020, 2025, and 2030 at 3- and 7-percent discount rates. DOE primarily relied on the low estimates to be conservative.

DOE multiplied the site emissions reduction (in tons) in each year by the associated $/ton values, and then discounted each series using discount rates of 3 percent and 7 percent as appropriate. DOE will continue to evaluate the monetization of avoided NO_X emissions and will make any appropriate updates for the final rule. Additional details on the monetization of NO_X and SO_2 emissions reductions are included in chapter 14 of the NOPR TSD.

M. Utility Impact Analysis

The utility impact analysis estimates several effects on the electric power generation industry that would result from the adoption of new or amended energy conservation standards. The utility impact analysis estimates the changes in installed electrical capacity and generation that would result for each TSL. The analysis is based on published output from the NEMS associated with *AEO2021.* NEMS produces the *AEO* Reference case, as well as a number of side cases that estimate the economy-wide impacts of changes to energy supply and demand. For the current analysis, impacts are quantified by comparing the levels of

[138] See EPA, *Revised 2023 and Later Model Year Light-Duty Vehicle GHG Emissions Standards: Regulatory Impact Analysis,* Washington, DC, December 2021. Available at: *https://www.epa.gov/system/files/documents/2021-12/420r21028.pdf* (last accessed January 13, 2022).

[139] See Interagency Working Group on Social Cost of Greenhouse Gases, *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide. Interim Estimates Under Executive Order 13990,* Washington, DC, February 2021. Available at: *www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf* (last accessed March 17, 2021).

[140] U.S. Environmental Protection Agency. Technical Support Document: Estimating the Benefit per Ton of Reducing $PM_{2.5}$ Precursors from 17 Sectors, available at: *www.epa.gov/benmap/estimating-benefit-ton-reducing-pm25-precursors-17-sectors* (last accessed August 11, 2021).

electricity sector generation, installed capacity, fuel consumption and emissions in the *AEO2021* Reference case and various side cases. Details of the methodology are provided in the appendices to chapters 13 and 15 of the NOPR TSD.

The output of this analysis is a set of time-dependent coefficients that capture the change in electricity generation, primary fuel consumption, installed capacity and power sector emissions due to a unit reduction in demand for a given end use. These coefficients are multiplied by the stream of electricity savings calculated in the NIA to provide estimates of selected utility impacts of potential new or amended energy conservation standards.

N. Employment Impact Analysis

DOE considers employment impacts in the domestic economy as one factor in selecting a proposed standard. Employment impacts from new or amended energy conservation standards include both direct and indirect impacts. Direct employment impacts are any changes in the number of employees of manufacturers of the products subject to standards, their suppliers, and related service firms. 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 appliances. Indirect employment impacts from standards consist of the net jobs created or eliminated in the national economy, other than in the manufacturing sector being regulated, caused by (1) reduced spending by consumers on energy, (2) reduced spending on new energy supply by the utility industry, (3) increased consumer spending on the products to which the new standards apply and other goods and services, 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.[141] There are many reasons for these differences, including wage differences and the fact that the utility sector is more capital-intensive and less labor-intensive than other sectors. Energy conservation standards have the effect of reducing consumer utility bills. Because reduced consumer expenditures for energy likely lead to increased expenditures in other sectors of the economy, the general effect of efficiency standards is to shift economic activity from a less labor-intensive sector (*i.e.,* the utility sector) to more labor-intensive sectors (*e.g.,* the retail and service sectors). Thus, the BLS data suggest that net national employment may increase due to shifts in economic activity resulting from energy conservation standards.

DOE estimated indirect national employment impacts for the standard levels considered in this NOPR using an input/output model of the U.S. economy called Impact of Sector Energy Technologies version 4 (''ImSET'').[142] 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 187 sectors most relevant to industrial, commercial, and residential building energy use.

DOE notes that ImSET is not a general equilibrium forecasting model, and that the uncertainties involved in projecting employment impacts, especially changes in the later years of the analysis. Because ImSET does not incorporate price changes, the employment effects predicted by ImSET may over-estimate actual job impacts over the long run for this rule. Therefore, DOE used ImSET only to generate results for near-term timeframes (2028–2033), where these uncertainties are reduced. For more details on the employment impact analysis, see chapter 16 of the NOPR TSD.

[141] U.S. Department of Commerce—Bureau of Economic Analysis. *Regional Multipliers: A User Handbook for the Regional Input-Output Modeling System (RIMS II).* 1997. U.S. Government Printing Office: Washington, DC. Available at *www.bea.gov/resources/methodologies/RIMSII-user-guide* (last accessed April 15, 2021).

[142] Livingston, O.V., S.R. Bender, M.J. Scott, and R.W. Schultz. *ImSET 4.0: Impact of Sector Energy Technologies Model Description and User Guide.* 2015. Pacific Northwest National Laboratory: Richland, WA. PNNL–24563. Available at *www.pnnl.gov/main/publications/external/technical_reports/PNNL-24563.pdf* (last accessed April 15, 2021).

V. Analytical Results and Conclusions

The following section addresses the results from DOE's analyses with respect to the considered energy conservation standards for consumer pool heaters. It addresses the TSLs examined by DOE, the projected impacts of each of these levels if adopted as energy conservation standards for consumer pool heaters, and the standards levels that DOE is proposing to adopt in this NOPR. Additional details regarding DOE's analyses are contained in the NOPR TSD supporting this document.

A. Trial Standard Levels

In general, DOE typically evaluates potential amended standards for products and equipment by grouping individual efficiency levels for each class into TSLs. Use of TSLs allows DOE to identify and consider manufacturer cost interactions between the equipment classes, to the extent that there are such interactions, and market cross elasticity from consumer purchasing decisions that may change when different standard levels are set. DOE analyzed the benefits and burdens of six TSLs for consumer pool heaters. DOE presents the results for the TSLs in this document, while the results for all efficiency levels that DOE analyzed are in the NOPR TSD.

Table V.1 presents the TSLs and the corresponding efficiency levels at the representative capacity (input for gas-fired, output for electric) that DOE has identified for potential amended energy conservation standards for consumer pool heaters. TSL 6 represents the max-tech energy efficiency for both electric and gas-fired pool heaters and represents the maximum energy savings possible given the specific efficiency levels analyzed by DOE (see section III.C.2 of this NOPR). TSL 5 represents efficiency levels below max-tech for both electric and gas-fired pool heaters and represents the maximum energy savings excluding max-tech efficiency levels. A greater fraction of gas-fired pool heater consumers experience a net cost compared to electric pool heater consumers at TSL 5. Therefore, TSL 4 is constructed with the same efficiency level for electric pool heaters (*i.e.,* EL 4) but the next highest efficiency level for gas-fired pool heaters (*i.e.,* EL 1). Finally, because EL 1 is the lowest analyzed efficiency level above baseline, TSLs 3, 2, and 1 are also constructed with EL 1 for gas-fired pool heaters as opposed to analyzing a no-new-standards case for this product class. TSLs 3, 2, and 1 consist of the remaining efficiency levels for electric pool heaters.

TABLE V.1—TRIAL STANDARD LEVELS FOR CONSUMER POOL HEATERS BY EFFICIENCY LEVEL

Product class	Trial standard level					
	1	2	3	4	5	6
	Efficiency Level and Representative TE_I					
Electric Pool Heaters	1 (387%)	2 (483%)	3 (534%)	4 (551%)	4 (551%)	5 (595%)
Gas-fired Pool Heaters	1 (81.3%)	1 (81.3%)	1 (81.3%)	1 (81.3%)	2 (83.3%)	3 (94.8%)

B. Economic Justification and Energy Savings

1. Economic Impacts on Individual Consumers

DOE analyzed the economic impacts on consumer pool heater consumers by looking at the effects that potential new or amended standards at each TSL would have on the LCC and PBP. DOE also examined the impacts of potential standards on selected consumer subgroups. These analyses are discussed in the following sections.

a. Life-Cycle Cost and Payback Period

In general, higher-efficiency products affect consumers in two ways: (1) Purchase price increases and (2) annual operating costs 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 use, 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.2 through Table V.5 show the LCC and PBP results for the TSLs considered for each product class. In the first of each pair of tables, the simple payback is measured relative to the baseline product. In the second table, impacts are measured relative to the efficiency distribution in the no-new-standards case in the compliance year (see section IV.F.8 of this document). Because some consumers purchase products with higher efficiency in the no-new-standards case, the average savings are less than the difference between the average LCC of the baseline product and the average LCC at each TSL. The savings refer only to consumers who are affected by a standard at a given TSL. Those who already purchase a product with efficiency at or above a given TSL are not affected. Consumers for whom the LCC increases at a given TSL experience a net cost.

TABLE V.2—AVERAGE LCC AND PBP RESULTS FOR ELECTRIC POOL HEATERS

TSL	Representative TE_I (%)	Average costs 2020$				Simple payback (years)	Average lifetime (years)
		Installed cost	First year's operating cost	Lifetime operating cost	LCC		
1	387	3,974	502	4,610	8,584	0.6	11.2
2	483	4,063	419	3,868	7,932	0.6	11.2
3	534	4,140	389	3,601	7,741	0.7	11.2
4,5	551	4,196	380	3,521	7,716	0.7	11.2
6	595 (Max Tech)	4,342	363	3,374	7,716	0.8	11.2

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

TABLE V.3—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR ELECTRIC POOL HEATERS

TSL	Representative TE_I (%)	Life-cycle cost savings	
		Average LCC savings * 2020$	Percent of consumers that experience net cost (%)
1	387	7,995	0.4
2	483	3,695	0.9
3	534	1,123	11.0
4,5	551	1,029	20.9
6	595 (Max Tech)	929	37.8

* The savings represent the average LCC for affected consumers.

TABLE V.4—AVERAGE LCC AND PBP RESULTS FOR GAS-FIRED POOL HEATERS

TSL	Representative TE_I (%)	Average costs (2020$)				Simple payback (years)	Average lifetime (years)
		Installed cost	First year's operating cost	Lifetime operating cost	LCC		
1,2,3,4	81.3	2,881	884	8,374	11,255	0.1	11.2
5	83.3	3,059	871	8,261	11,320	1.5	11.2
6	94.8 (Max Tech).	3,749	798	7,603	11,352	4.4	11.2

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

TABLE V.5—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR GAS-FIRED POOL HEATERS

TSL	Representative TE_I (%)	Life-cycle cost savings	
		Average LCC savings * (2020$)	Percent of consumers that experience net cost (%)
1,2,3,4	81.3	1,085	0.0
5	83.3	43	31.9
6	94.8 (Max Tech)	(15)	70.1

* The savings represent the average LCC for affected consumers.
Parentheses indicate negative (−) values.

b. Consumer Subgroup Analysis

In the consumer subgroup analysis, DOE estimated the impact of the considered TSLs on senior-only households and small businesses. Table V.6 and Table V.7 compare the average LCC savings and PBP at each efficiency level for the consumer subgroup, along with the average LCC savings for the entire consumer sample for electric pool heaters and gas-fired pool heaters, respectively. In most cases, the average LCC savings and PBP for senior-only households and small businesses at the considered efficiency levels are substantially different from the average for all households, since all households includes consumer pool heaters in homes and commercial applications. Chapter 11 of the NOPR TSD presents the complete LCC and PBP results for the subgroup.

TABLE V.6—COMPARISON OF LCC SAVINGS AND PBP FOR CONSUMER SUBGROUPS AND ALL HOUSEHOLDS FOR ELECTRIC POOL HEATERS

TSL	Average life-cycle cost savings (2020$)			Simple payback period (years)		
	Senior-only households	Small business	All households	Senior-only households	Small business	All households
1	2,758	24,716	7,995	1.1	0.3	0.6
2	1,165	25,600	3,695	1.2	0.3	0.6
3	302	16,750	1,123	1.3	0.3	0.7
4,5	251	16,295	1,029	1.4	0.4	0.7
6	140	15,383	929	1.6	0.4	0.8

TABLE V.7—COMPARISON OF LCC SAVINGS AND PBP FOR CONSUMER SUBGROUPS AND ALL HOUSEHOLDS FOR GAS-FIRED POOL HEATERS

TSL	Average life-cycle cost savings (2020$)			Simple payback period (years)		
	Senior-only households	Small business	All households	Senior-only households	Small business	All households
1,2,3,4	1,122	384	1,085	0.1	0.3	0.1
5	(22)	126	43	1.6	2.6	1.5
6	(464)	800	(15)	6.0	3.0	4.4

Parentheses indicate negative (−) values.

c. Rebuttable Presumption Payback

As discussed in section III.E.2, EPCA establishes a rebuttable presumption that an energy conservation standard is economically justified if the increased purchase cost for a product that meets the standard is less than three times the value of the first-year energy savings resulting from the standard. In calculating a rebuttable presumption payback period for each of the considered TSLs, DOE used discrete values, and, as required by EPCA, based the energy use calculation on the DOE test procedure for consumer pool heaters. In contrast, the PBPs presented in section V.B.1.a of this document were calculated using distributions that reflect the range of energy use in the field.

Table V.8 presents the rebuttable-presumption payback periods for the considered TSLs for consumer pool heaters. These results show that, in most cases, the projected payback period will be three years or less with respect to each TSL examined. While DOE examined the rebuttable-presumption criterion, it considered whether the standard levels considered for the NOPR are economically justified through a more detailed analysis of the economic impacts of those levels, pursuant to 42 U.S.C. 6295(o)(2)(B)(i), that considers the full range of impacts to the consumer, manufacturer, Nation, and environment. The results of that analysis serve as the basis for DOE to definitively evaluate the economic justification for a potential standard level, thereby supporting or rebutting the results of any preliminary determination of economic justification.

TABLE V.8—REBUTTABLE-PRESUMPTION PAYBACK PERIODS (YEARS)

TSL	Electric pool heaters	Gas-fired pool heaters
1	2.41	0.11
2	2.52	0.11
3	2.68	0.11
4	2.83	0.11
5	2.83	1.72
6	3.20	5.87

2. Economic Impacts on Manufacturers

DOE performed an MIA to estimate the impact of new and amended energy conservation standards on manufacturers of consumer pool heaters. The following section describes the expected impacts on manufacturers at each considered TSL. Chapter 12 of the NOPR TSD explains the analysis in further detail.

a. Industry Cash Flow Analysis Results

In this section, DOE provides GRIM results from the analysis, which examines changes in the industry that would result from a standard. The following tables illustrate the estimated financial impacts (represented by changes in INPV) of potential new and amended energy conservation standards on manufacturers of consumer pool heaters, as well as the conversion costs that DOE estimates manufacturers of consumer pool heaters would incur at each TSL.

As discussed in section IV.J.2.e of this document, DOE modeled two manufacturer markup scenarios to evaluate a range of cash flow impacts on the consumer pool heater industry: (1) The preservation of gross margin percentage markup scenario and (2) the preservation of operating profit. DOE considered the preservation of gross margin percentage scenario by applying a ''gross margin percentage'' markup for each product class across all efficiency levels. As MPCs increase with efficiency, this scenario implies that the absolute dollar markup will increase. DOE assumed a manufacturer markup of 1.33 for gas-fired pool heaters and 1.28 for electric pool heaters. This manufacturer markup is consistent with the one DOE assumed in the engineering analysis and the no-new-standards case of the GRIM. Because this scenario assumes that a manufacturer's absolute dollar markup would increase as MPCs increase in the standards cases, it represents the upper-bound to industry profitability under potential new and amended energy conservation standards.

The preservation of operating profit scenario reflects manufacturers' concerns about their inability to maintain margins as MPCs increase to reach more-stringent efficiency levels. In this scenario, while manufacturers make the necessary investments required to convert their facilities to produce compliant products, operating profit does not change in absolute dollars and decreases as a percentage of revenue.

Each of the modeled manufacturer markup 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 no-new-standards case and each standards case resulting from the sum of discounted cash-flows from 2021 through 2057. 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 no-new-standards case and the standards case at each TSL in the year before new and amended standards are required.

Table V.9 and Table V.10 show the MIA results for both product classes at each TSL using the manufacturer markup scenarios previously described.

TABLE V.9—MANUFACTURER IMPACT ANALYSIS FOR CONSUMER POOL HEATERS UNDER THE PRESERVATION OF GROSS MARGIN MARKUP SCENARIO

	Units	No-new-standards case	Trial standard level *					
			1	2	3	4	5	6
INPV	2020$ millions.	188.7	186.5	184.2	171.8	171.1	174.2	187.3
Change in INPV.	2020$ millions.		(2.2)	(4.4)	(16.9)	(17.5)	(14.4)	(1.4)
	%		(1.2)	(2.3)	(9.0)	(9.3)	(7.7)	(0.7)
Product Conversion Costs.	2020$ millions.		2.7	6.1	22.9	24.1	32.6	41.5
Capital Conversion Costs.	2020$ millions.			0.6	5.3	5.3	6.2	17.5
Total Investment Requires **.	2020$ millions.		2.7	6.6	28.3	29.4	38.8	59.0

* Numbers in parentheses indicate a negative number. Numbers may not sum exactly due to rounding.

TABLE V.10—MANUFACTURER IMPACT ANALYSIS FOR CONSUMER POOL HEATERS UNDER THE PRESERVATION OF OPERATING PROFIT MARKUP SCENARIO

	Units	No-new-standards case	Trial standard level*					
			1	2	3	4	5	6
INPV	2020$ millions.	188.7	186.1	183.6	170.3	169.0	161.0	135.5
Change in INPV.	2020$ millions.	....	(2.5)	(5.0)	(18.3)	(19.6)	(27.7)	(53.2)
	%	....	(1.3)	(2.7)	(9.7)	(10.4)	(14.7)	(28.2)
Product Conversion Costs.	2020$ millions.	....	2.7	6.1	22.9	24.1	32.6	41.5
Capital Conversion Costs.	2020$ millions.	....	....	0.6	5.3	5.3	6.2	17.5
Total Investment Requires.	2020$ millions.	....	2.7	6.6	28.3	29.4	38.8	59.0

* Numbers in parentheses indicate a negative number. Numbers may not sum exactly due to rounding.

At TSL 1, DOE estimates that impacts on INPV will range from −$2.5 million to −$2.2 million, or a change in INPV of −1.3 to −1.2 percent. At TSL 1, industry free cash-flow is $13.4 million, which is a decrease of approximately $0.9 million compared to the no-new-standards case value of $14.3 million in 2027, the year leading up to the proposed standards.

TSL 1 would set the energy conservation standard for both gas-fired consumer pool heaters and electric consumer pool heaters at EL 1. DOE estimates that 96 percent of gas-fired pool heater shipments and 93 percent of electric pool heater shipments already meet or exceed the efficiency levels analyzed at TSL 1. Gas-fired pool heater manufacturers would likely need to redesign any models with a standing pilot light. DOE assumed this would require approximately two months of engineering time per model, which would cost manufacturers approximately $0.5 million. Electric heat pump pool heater manufacturers would incur approximately $2.2 million in product conversion costs primarily to test all compliant electric pool heater models to demonstrate compliance with standards at TSL 1. DOE estimates pool heater manufacturers will incur minimal to no capital conversion costs at TSL 1.

Furthermore, no electric resistance pool heaters meet or exceed the electric pool heater efficiency level analyzed at TSL 1 or above. DOE estimates manufacturers will not incur conversion costs for electric resistance pool heaters, because of the expectation that these consumer pool heater products will be discontinued, as described in section IV.J.2.c of this document.

At TSL 1, the shipment-weighted average MPC for all consumer pool heaters increases by 0.5 percent relative to the no-new-standards case shipment-weighted average MPC for all consumer pool heaters in 2028. In the preservation of gross margin markup scenario, manufacturers are able to fully pass on this slight cost increase to consumers. The slight increase in shipment-weighted average MPC for consumer pool heaters is slightly outweighed by the $2.7 million in conversion costs, causing a slightly negative change in INPV at TSL 1 under the preservation of gross margin markup scenario.

Under the preservation of operating profit markup scenario, manufacturers earn the same per-unit operating profit as would be earned in the no-new-standards case, but manufacturers do not earn additional profit from their investments. In this scenario, the 0.5 percent shipment-weighted average MPC increase results in a reduction in the manufacturer markup after the analyzed compliance year. This reduction in the manufacturer markup and the $2.7 million in conversion costs incurred by manufacturers cause a slightly negative change in INPV at TSL 1 under the preservation of operating profit markup scenario.

At TSL 2, DOE estimates that impacts on INPV will range from −$5.0 million to −$4.4 million, or a change in INPV of −2.7 percent to −2.3 percent. At TSL 2, industry free cash-flow is $11.9 million, which is a decrease of approximately $2.4 million compared to the no-new-standards case value of $14.3 million in 2027, the year leading up to the proposed standards.

DOE estimates that 96 percent of gas-fired pool heater shipments and 79 percent of electric pool heater shipments already meet or exceed the efficiency levels analyzed at TSL 2. To bring non-compliant electric heat pump pool heaters into compliance and to test all electric heat pump pool heaters to demonstrate compliance with standards at TSL 2, electric heat pump pool heater manufacturers would incur approximately $5.5 million in product conversion costs and $0.6 million in capital conversion costs at TSL 2.

At TSL 2, the shipment-weighted average MPC for all consumer pool heaters increases by 0.9 percent relative to the no-new-standards case shipment-weighted average MPC for all consumer pool heaters in 2028. In the preservation of gross margin markup scenario, the slight increase in shipment-weighted average MPC for consumer pool heaters is slightly outweighed by the $6.6 million in conversion costs, causing a slightly negative change in INPV at TSL 2 under the preservation of gross margin markup scenario.

Under the preservation of operating profit markup scenario, the 0.9 percent shipment-weighted average MPC increase results in a reduction in the manufacturer markup after the analyzed compliance year. This reduction in the manufacturer markup and the $6.6 million in conversion costs incurred by manufacturers cause a slightly negative change in INPV at TSL 2 under the preservation of operating profit markup scenario.

At TSL 3, DOE estimates that impacts on INPV will range from −$18.3 million to −$16.9 million, or a change in INPV of −9.7 percent to −9.0 percent. At TSL 3, industry free cash-flow is $3.8 million, which is a decrease of approximately $10.6 million compared to the no-new-standards case value of $14.3 million in 2027, the year leading up to the proposed standards.

DOE estimates that 96 percent of gas-fired pool heater shipments and 19 percent of electric pool heater shipments already meet or exceed the efficiency levels analyzed at TSL 3. To bring non-compliant electric heat pump pool heaters into compliance and to test all electric heat pump pool heaters to demonstrate compliance with standards at TSL 3, electric heat pump pool heater manufacturers would incur approximately $22.4 million in product conversion costs and $5.3 million in capital conversion costs at TSL 3.

At TSL 3, the shipment-weighted average MPC for all consumer pool heaters increases by 2.1 percent relative to the no-new-standards case shipment-weighted average MPC for all consumer pool heaters in 2028. In the preservation of gross margin markup scenario, the increase in shipment-weighted average MPC for consumer pool heaters is outweighed by the $28.3 million in conversion costs, causing a moderately negative change in INPV at TSL 3 under the preservation of gross margin markup scenario.

Under the preservation of operating profit markup scenario, the 2.1 percent shipment-weighted average MPC increase results in a reduction in the manufacturer markup after the analyzed compliance year. This reduction in the manufacturer markup and the $28.3 million in conversion costs incurred by manufacturers cause a moderately negative change in INPV at TSL 3 under the preservation of operating profit markup scenario.

At TSL 4, DOE estimates that impacts on INPV will range from −$19.6 million to −$17.5 million, or a change in INPV of −10.4 percent to −9.3 percent. At TSL 4, industry free cash-flow is $3.4 million, which is a decrease of approximately $11.0 million compared to the no-new-standards case value of $14.3 million in 2027, the year leading up to the proposed standards.

DOE estimates that 96 percent of gas-fired pool heaters and 10 percent of electric pool heaters meet or exceed the efficiency levels analyzed at TSL 4. To bring non-compliant products into compliance, consumer pool heater manufacturers would incur approximately $24.1 million in product conversion costs for redesign and testing. DOE estimates manufacturers will incur approximately $5.3 million in capital conversion costs associated with TSL 4 to make changes to existing machinery and tooling.

At TSL 4, the shipment-weighted average MPC for all consumer pool heaters increases by 3.1 percent relative to the no-new-standards case shipment-weighted average MPC for all consumer pool heaters in 2028. In the preservation of gross margin markup scenario, the increase in shipment-weighted average MPC for consumer pool heaters is outweighed by the $29.4 million in conversion costs, causing a moderately negative change in INPV at TSL 4 under the preservation of gross margin markup scenario.

Under the preservation of operating profit markup scenario, the 3.1 percent shipment-weighted average MPC increase results in a reduction in the manufacturer markup after the analyzed compliance year. This reduction in the manufacturer markup and the $29.4 million in conversion costs incurred by manufacturers causing a moderately negative change in INPV at TSL 4 under the preservation of operating profit markup scenario.

At TSL 5, DOE estimates that impacts on INPV will range from −$27.7 million to −$14.4 million, or a change in INPV of −14.7 percent to −7.7 percent. At TSL 5, industry free cash-flow is slightly negative (less then −$0.1 million), which is a decrease of approximately $14.4 million compared to the no-new-standards case value of $14.3 million in 2027, the year leading up to the proposed standards.

DOE estimates that 45 percent of gas-fired pool heaters and 10 percent of electric pool heaters meet or exceed the efficiency levels analyzed at TSL 5. To bring non-compliant products into compliance, consumer pool heater manufacturers would incur approximately $32.6 million in product conversion costs for redesign and testing. DOE estimates manufacturers will incur approximately $6.2 million in capital conversion costs associated with TSL 5 to make changes to existing machinery and tooling. The design options analyzed at TSL 5 incorporate a blower for gas-fired pool heaters.

At TSL 5, the shipment-weighted average MPC for all consumer pool heaters increases by 10.2 percent relative to the no-new-standards case shipment-weighted average MPC for all consumer pool heaters in 2028. In the preservation of gross margin markup scenario, the increase in shipment-weighted average MPC for consumer pool heaters is outweighed by the $38.8 million in conversion costs, causing a moderately negative change in INPV at TSL 5 under the preservation of gross margin markup scenario.

Under the preservation of operating profit markup scenario, the 10.2 percent shipment-weighted average MPC increase results in a reduction in the manufacturer markup after the analyzed compliance year. This reduction in manufacturer markup and the $38.8 million in conversion costs incurred by manufacturers cause a moderately negative change in INPV at TSL 5 under the preservation of operating profit markup scenario.

At TSL 6, DOE estimates that impacts on INPV will range from $53.2 million to −$1.4 million, or a change in INPV of −28.2 percent to −0.7 percent. At TSL 6, industry free cash-flow is −$8.3 million, which is a decrease of approximately $22.6 million compared to the no-new-standards case value of $14.3 million in 2027, the year leading up to the proposed standards.

DOE estimates 9 percent of gas-fired pool heaters and less than 1 percent of electric pool heaters meet the efficiency levels analyzed at TSL 6. To bring non-compliant products into compliance, consumer pool heater manufacturers would incur approximately $41.5 million in product conversion costs for redesign and testing. DOE estimates manufacturers will incur approximately $17.5 million in capital conversion costs associated with TSL 6 to make changes to existing machinery and tooling. The design options at TSL 6 analyzed the implementation of condensing technology for gas-fired pool heaters, which requires a significant redesign effort and capital investment.

At TSL 6, the shipment-weighted average MPC for all consumer pool heaters significantly increases by 37.0 percent relative to the no-new-standards case shipment-weighted average MPC for all consumer pool heaters in 2028. In the preservation of gross margin markup scenario, the large increase in shipment-weighted average MPC for consumer pool heaters is still outweighed by the $59.0 million in conversion costs, causing a slightly negative change in INPV at TSL 6 under the preservation of gross margin markup scenario.

Under the preservation of operating profit markup scenario, the 37.0 percent shipment-weighted average MPC increase results in a significant reduction in the manufacturer markup after the analyzed compliance year. This large reduction in manufacturer markup and the significant $59.0 million in conversion costs incurred by manufacturers cause a significantly negative change in INPV at TSL 6 under the preservation of operating profit markup scenario.

b. Direct Impacts on Employment

To quantitatively assess the potential impacts of new and amended energy conservation standards on direct employment in the consumer pool heater industry, DOE used the GRIM to estimate the number of direct production employees and non-production employees in the no-new-standards case, and the standards cases at each TSL.

Production employees are those who are directly involved in fabricating and assembling products within an original equipment manufacturer facility. Workers performing services that are closely associated with production operations, such as materials handling tasks using forklifts, are included as production labor, as well as line supervisors.

DOE used the GRIM to calculate the number of production employees from labor expenditures. DOE used statistical data from the U.S. Census Bureau's 2019 Annual Survey of Manufacturers (''ASM'') and the results of the engineering analysis to calculate industry-wide labor expenditures. Labor expenditures related to product manufacturing depend on the labor intensity of the product, the sales volume, and an assumption that wages remain fixed in real terms over time. The total labor expenditures in the GRIM were then converted to domestic production employment levels by dividing production labor expenditures by the annual payment per production worker.

Non-production employees account for those workers that are not directly engaged in the manufacturing of the covered product. This could include sales, human resources, engineering, and management. DOE estimated non-production employment levels by multiplying the number of consumer pool heater production workers by a scaling factor. The scaling factor is calculated by taking the ratio of the total number of employees, and the total production workers associated with the industry NAICS code 333414, which covers heating equipment (except warm air furnaces) manufacturing.

Using the GRIM, DOE estimates that there would be 857 domestic production workers, and 495 non-production workers for consumer pool heaters in 2028 in the absence of new and amended energy conservation standards. Table V.11 shows the range of the impacts of energy conservation standards on U.S. production on consumer pool heaters.

TABLE V.11—TOTAL NUMBER OF DOMESTIC CONSUMER POOL HEATER PRODUCTION WORKERS IN 2028

	No-new-standards case	Trial standard level					
		1	2	3	4	5	6
Domestic Production Workers in 2028	857	853	853	853	850	852	1,064
Domestic Non-Production Workers in 2028	495	492	492	492	491	492	614
Total Direct Employment in 2028	1,352	1,345	1,345	1,345	1,341	1,344	1,678
Potential Changes in Total Direct Employment in 2028	....	(30)–(7)	(30)–(7)	(30)–(7)	(30)–(11)	(30)–(8)	(356)–326

The direct employment impacts shown in Table V.11 represent the potential changes in direct employment that could result following the compliance date for the consumer pool heaters in this proposal. Employment could increase or decrease due to the labor content of the various products being manufactured domestically or if manufacturers decided to move production facilities abroad because of the new and amended standards. At one end of the range, DOE assumes that all manufacturers continue to manufacture the same scope of the products domestically after new and amended standards. However, since the labor content of consumer pool heaters varies by efficiency level, this can either result in an increase or decrease in domestic employment, even if all domestic product remains in the U.S.[143] The other end of the range assumes that some domestic manufacturing either is eliminated or moves abroad due to the analyzed new and amended standards. DOE assumes that for electric pool heaters, only the electric resistance pool heater employees would be impacted at all TSLs analyzed. DOE estimates there would be approximately 30 domestic production and non-production employees manufacturing electric resistance pool heaters in 2028. Therefore, DOE assumes that for all TSLs analyzed, there would be a reduction in 30 domestic employees due to electric resistance pool heaters no longer being manufactured domestically. For gas pool heaters, DOE assumes there would not be any impact to domestic production until TSL 6, max-tech. At this TSL, DOE assumes that up to half of all domestic gas pool heater production could move abroad due to the new and amended standards at TSL 6. DOE estimated there would be approximately 651 domestic production workers manufacturing gas-fired pool heaters in 2028. Therefore, DOE estimates that if standards were set at TSL 6, max-tech, there could be a loss of up to 356 domestic employees responsible for manufacturing consumer pool heaters.[144] Additional detail on the analysis of direct employment can be found in chapter 12 of the NOPR TSD.

c. Impacts on Manufacturing Capacity

DOE did not identify any significant capacity constraints for the design options being evaluated for this NOPR. The design options evaluated for this NOPR are available as products that are on the market currently, with models meeting all the efficiency levels analyzed as part of this analysis. The materials used to manufacture models at all efficiency levels are widely available on the market. As a result, DOE does not anticipate that the industry will likely experience any capacity constraints directly resulting from energy conservation standards at any of the TSLs considered.

d. Impacts on Subgroups of Manufacturers

As discussed in section IV.J.1 of this document, using average cost

[143] TSL 6 is estimated to have an increase in domestic employment, while TSL 1 through TSL 5, are estimated to have a reduction in domestic employment, assuming all production remains in the U.S.

[144] 326 domestic production employees manufacturing consumer gas-fired pool heaters and 30 domestic production and non-production employees manufacturing consumer electric resistance pool heaters.

assumptions to develop an industry cash-flow estimate may not be adequate for assessing differential impacts among manufacturer subgroups. Small manufacturers, niche manufacturers, and manufacturers exhibiting a cost structure substantially different from the industry average could be affected disproportionately. DOE used the results of the industry characterization to group manufacturers exhibiting similar characteristics. Consequently, DOE identified small business manufacturers as a subgroup for a separate impact analysis.

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. The size standards are codified at 13 CFR part 121. To be categorized as a small business under NAICS code 333414, ''heating equipment (except warm air furnaces) manufacturing,'' a consumer pool heater manufacturer and its affiliates may employ a maximum of 500 employees. The 500-employee threshold includes all employees in a business's parent company and any other subsidiaries. Based on this classification, DOE identified six potential manufacturers that could qualify as domestic small businesses.

All six small businesses manufacture electric pool heaters and none of them manufacture gas-fired pool heaters. Therefore, only new standards set for electric pool heaters would impact any of the small businesses. Five of the six small businesses exclusively manufacture electric heat pump pool heaters, while the other small business exclusively manufacturers electric resistance pool heaters.

The small business subgroup analysis is discussed in more detail in chapter 12 of the NOPR TSD. DOE examines the potential impacts on small business manufacturers in section VI.B of this NOPR.

e. Cumulative Regulatory Burden

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

Some consumer pool heater manufacturers also make other products or equipment that could be subject to energy conservation standards set by DOE. DOE looks at regulations that could affect consumer pool heater manufacturers that will take effect three years before or after the estimated 2028 compliance date. Therefore, this cumulative regulatory burden analysis focuses on DOE regulations taking place between 2025 and 2031. DOE was not able to identify any potential energy conservation standard or test procedure for other products or equipment manufactured by consumer pool heater manufacturer that are scheduled to require compliance between 2025 and 2031.

DOE requests information regarding the impact of cumulative regulatory burden on manufacturers of consumer pool heaters associated with multiple DOE standards or product-specific regulatory actions of other Federal agencies.

3. National Impact Analysis

This section presents DOE's estimates of the NES and the NPV of consumer benefits that would result from each of the TSLs considered as potential amended standards.

a. Significance of Energy Savings

To estimate the energy savings attributable to potential new or amended standards for consumer pool heaters, DOE compared their energy consumption under the no-new-standards case to their anticipated energy consumption under each TSL. The savings are measured over the entire lifetime of products purchased in the 30-year period that begins in the year of anticipated compliance with amended standards (2028–2057). Table V.12 presents DOE's projections of the national energy savings for each TSL considered for consumer pool heaters. The savings were calculated using the approach described in section IV.H of this document.

TABLE V.12—CUMULATIVE NATIONAL ENERGY SAVINGS FOR CONSUMER POOL HEATERS; 30 YEARS OF SHIPMENTS
[2028–2057]

Energy savings	Product class	Trial standard level (quads *)					
		1	2	3	4	5	6
Site energy	Electric Pool Heaters	0.08	0.10	0.13	0.14	0.14	0.16
	Gas-fired Pool Heaters	0.02	0.02	0.02	0.02	0.09	0.80
	Total	0.11	0.12	0.15	0.16	0.23	0.96
Primary energy.	Electric Pool Heaters	0.22	0.27	0.35	0.38	0.38	0.43
	Gas-fired Pool Heaters	0.02	0.02	0.02	0.02	0.09	0.80
	Total	0.25	0.30	0.38	0.40	0.47	1.23
FFC energy	Electric Pool Heaters	0.23	0.28	0.37	0.39	0.39	0.45
	Gas-fired Pool Heaters	0.02	0.02	0.02	0.02	0.10	0.88
	Total	0.26	0.31	0.39	0.42	0.49	1.33

* quads = quadrillion British thermal units.
Note numbers may not add to totals, due to rounding.

OMB Circular A–4 [145] 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 proposed rulemaking, DOE undertook a sensitivity analysis using 9 years, rather than 30 years, of product shipments. The choice of a 9-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.[146] The review timeframe established in EPCA is generally not synchronized with the product lifetime, product manufacturing cycles, or other factors specific to consumer pool heaters. Thus, such results are presented for informational purposes only and are not indicative of any change in DOE's analytical methodology. The NES sensitivity analysis results based on a 9-year analytical period are presented in Table V.13 of this document. The impacts are counted over the lifetime of consumer pool heaters purchased in 2028–2057.

TABLE V.13—CUMULATIVE NATIONAL ENERGY SAVINGS FOR CONSUMER POOL HEATERS; 9 YEARS OF SHIPMENTS
[2028–2036]

Energy savings	Product class	Trial standard level (quads *)					
		1	2	3	4	5	6
Site energy	Electric Pool Heaters	0.03	0.03	0.04	0.04	0.04	0.05
	Gas-fired Pool Heaters	0.01	0.01	0.01	0.01	0.03	0.22
	Total	0.03	0.04	0.05	0.05	0.07	0.26
Primary energy.	Electric Pool Heaters	0.07	0.09	0.11	0.11	0.11	0.13
	Gas-fired Pool Heaters	0.01	0.01	0.01	0.01	0.03	0.22
	Total	0.08	0.09	0.11	0.12	0.14	0.35
FFC energy	Electric Pool Heaters	0.07	0.09	0.11	0.12	0.12	0.13
	Gas-fired Pool Heaters	0.01	0.01	0.01	0.01	0.03	0.24
	Total	0.08	0.10	0.12	0.13	0.15	0.37

* quads = quadrillion British thermal units.
Note numbers may not add to totals, due to rounding.

b. Net Present Value of Consumer Costs and Benefits

DOE estimated the cumulative NPV of the total costs and savings for consumers that would result from the TSLs considered for consumer pool heaters. In accordance with OMB's guidelines on regulatory analysis,[147] DOE calculated NPV using both a 7-percent and a 3-percent real discount rate. Table V.14 shows the consumer NPV results with impacts counted over the lifetime of products purchased in 2028–2057.

TABLE V.14—CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR CONSUMER POOL HEATERS; 30 YEARS OF SHIPMENTS
[2028–2057]

Discount rate	Product class	Trial standard level (billion 2020$)					
		1	2	3	4	5	6
7 percent	Electric Pool Heaters	0.64	0.77	0.94	0.96	0.96	0.95
	Gas-fired Pool Heaters	0.08	0.08	0.08	0.08	(0.01)	(0.18)
	Total	0.72	0.85	1.02	1.04	0.95	0.77
3 percent	Electric Pool Heaters	1.49	1.81	2.25	2.32	2.32	2.36
	Gas-fired Pool Heaters	0.18	0.18	0.18	0.18	0.07	0.37
	Total	1.67	1.99	2.43	2.50	2.39	2.73

Parentheses indicate negative (−) values.
Note numbers may not add to totals, due to rounding.

[145] U.S. Office of Management and Budget. *Circular A–4: Regulatory Analysis.* September 17, 2003. Available at: *www.whitehouse.gov/sites/whitehouse.gov/files/omb/circulars/A4/a-4.pdf* (last accessed April 15, 2021).

[146] Section 325(m) of EPCA requires DOE to review its standards at least once every 6 years, and requires, for certain products, a 3-year period after any new standard is promulgated before compliance is required, except that in no case may any new standards be required within 6 years of the compliance date of the previous standards. While adding a 6-year review to the 3-year compliance period adds up to 9 years, DOE notes that it may undertake reviews at any time within the 6 year period and that the 3-year compliance date may yield to the 6-year backstop. A 9-year analysis period may not be appropriate given the variability that occurs in the timing of standards reviews and the fact that for some products, the compliance period is 5 years rather than 3 years.

[147] U.S. Office of Management and Budget. *Circular A–4: Regulatory Analysis.* September 17, 2003. Available at: *www.whitehouse.gov/sites/whitehouse.gov/files/omb/circulars/A4/a-4.pdf* (last accessed April 15, 2021).

The NPV results based on the aforementioned 9-year analytical period are presented in Table V.15. The impacts are counted over the lifetime of products purchased in 2028–2057. As mentioned previously, such results are presented for informational purposes only and are not indicative of any change in DOE's analytical methodology or decision criteria.

TABLE V.15—CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR CONSUMER POOL HEATERS; 9 YEARS OF SHIPMENTS

[2028–2036]

Discount rate	Product class	Trial standard level (billion 2020$)					
		1	2	3	4	5	6
7 percent	Electric Pool Heaters	0.35	0.42	0.50	0.51	0.51	0.51
	Gas-fired Pool Heaters	0.04	0.04	0.04	0.04	(0.01)	(0.13)
	Total	0.40	0.46	0.54	0.56	0.51	0.37
3 percent	Electric Pool Heaters	0.64	0.76	0.92	0.94	0.94	0.95
	Gas-fired Pool Heaters	0.08	0.08	0.08	0.08	0.02	0.04
	Total	0.71	0.83	0.99	1.02	0.96	0.99

Parentheses indicate negative (−) values.
Note numbers may not add to totals, due to rounding.

The above results reflect the use of a default trend to estimate the change in price for consumer pool heaters over the analysis period (see section IV.H.3 of this document). DOE also conducted a sensitivity analysis that considered one scenario with a larger price decline from the reference case and one scenario with a constant price. The results of these alternative cases are presented in appendix 10C of the NOPR TSD. In the high-price-decline case, the NPV of consumer benefits is higher than in the default case. In the constant-price case, the NPV of consumer benefits is lower than in the default case.

c. Indirect Impacts on Employment

It is estimated that that new or amended energy conservation standards for consumer pool heaters would reduce energy expenditures for consumers of those products, with the resulting net savings being redirected to other forms of economic activity. These expected shifts in spending and economic activity could affect the demand for labor. As described in section IV.N of this document, DOE used an input/output model of the U.S. economy to estimate indirect employment impacts of the TSLs that DOE considered. There are uncertainties involved in projecting employment impacts, especially changes in the later years of the analysis. Therefore, DOE generated results for near-term timeframes (2028–2033), where these uncertainties are reduced.

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

4. Impact on Utility or Performance of Products

As discussed in section IV.C.1.b of this document, DOE has tentatively concluded that the standards proposed in this NOPR would not lessen the utility or performance of the consumer pool heaters under consideration in this rulemaking. Manufacturers of these products currently offer units that meet or exceed the proposed standards.

5. Impact of Any Lessening of Competition

DOE considered any lessening of competition that would be likely to result from new or amended standards. As discussed in section III.E.1.e of this document, the Attorney General determines the impact, if any, of any lessening of competition likely to result from a proposed standard, and transmits such determination in writing to the Secretary, together with an analysis of the nature and extent of such impact. To assist the Attorney General in making this determination, DOE has provided DOJ with copies of this NOPR and the accompanying TSD for review. DOE will consider DOJ's comments on the proposed rule in determining whether to proceed to a final rule. DOE will publish and respond to DOJ's comments in that document. DOE invites comment from the public regarding the competitive impacts that are likely to result from this proposed rule. In addition, stakeholders may also provide comments separately to DOJ regarding these potential impacts. See the **ADDRESSES** section for information on how to send comments to DOJ.

6. Need of the Nation To Conserve Energy

Enhanced energy efficiency, where economically justified, improves the Nation's energy security, strengthens the economy, and reduces the environmental impacts (costs) of energy production. 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. Chapter 15 in the NOPR TSD presents the estimated impacts on electricity generating capacity, relative to the no-new-standards case, for the TSLs that DOE considered in this proposed rulemaking.

Energy conservation resulting from potential new and amended energy conservation standards for consumer pool heaters is expected to yield environmental benefits in the form of reduced emissions of certain air pollutants and greenhouse gases. Table V.16 provides DOE's estimate of cumulative emissions reductions expected to result from the TSLs considered in this rulemaking. The emissions were calculated using the multipliers discussed in section IV.K. of this document. DOE reports annual emissions reductions for each TSL in chapter 13 of the NOPR TSD.

TABLE V.16—CUMULATIVE EMISSIONS REDUCTION FOR CONSUMER POOL HEATERS SHIPPED IN 2028–2057

	Trial standard level					
	1	2	3	4	5	6
Site and Power Sector Emissions						
CO_2 (million metric tons)	8.5	10.1	12.7	13.6	17.2	56.4
SO_2 (thousand tons)	3.2	4.00	5.1	5.5	5.4	6.8
NO_X (thousand tons)	8.4	9.1	10.2	10.5	67.0	74.1
Hg (tons)	0.02	0.02	0.03	0.03	0.03	0.04
CH_4 (thousand tons)	0.6	0.7	0.9	1.0	1.0	2.0
N_2O (thousand tons)	0.08	0.10	0.13	0.14	0.14	0.24
Upstream Emissions						
CO_2 (million metric tons)	0.7	0.8	1.0	1.1	1.5	6.2
SO_2 (thousand tons)	0.04	0.05	0.06	0.07	0.07	0.10
NO_X (thousand tons)	10.5	12.3	15.2	16.2	23.2	95.0
Hg (tons)	0.00	0.00	0.00	0.00	0.00	0.00
CH_4 (thousand tons)	71	83	103	109	160	681
N_2O (thousand tons)	0.00	0.00	0.00	0.01	0.01	0.01
Total FFC Emissions						
CO_2 (million metric tons)	9.2	11.0	13.8	14.7	18.8	62.7
SO_2 (thousand tons)	3.2	4.0	5.2	5.6	5.5	6.9
NO_X (thousand tons)	19	21	25	27	90	169
Hg (tons)	0.02	0.02	0.03	0.03	0.03	0.04
CH_4 (thousand tons)	72	84	104	110	161	683
N_2O (thousand tons)	0.08	0.10	0.13	0.14	0.15	0.26

Note numbers may not add to totals, due to rounding.

As part of the analysis for this proposed rulemaking, DOE estimated monetary benefits likely to result from the reduced emissions of CO_2 that DOE estimated for each of the considered TSLs for consumer pool heaters. Section IV.L of this document discusses the SC–CO_2 values that DOE used. Table V.17 presents the value of CO_2 emissions reduction at each TSL.

TABLE V.17—PRESENT VALUE OF CO_2 EMISSIONS REDUCTION FOR CONSUMER POOL HEATERS SHIPPED IN 2028–2057

TSL	SC–CO_2 case discount rate and statistics (million 2020$)			
	5% (average)	3% (average)	2.5% (average)	3% (95th percentile)
1	79	347	545	1,053
2	94	413	649	1,253
3	117	517	813	1,569
4	125	552	868	1,675
5	158	701	1,103	2,126
6	521	2,319	3,656	7,030

As discussed in section IV.L.1.b of this document, DOE estimated monetary benefits likely to result from the reduced emissions of methane and N_2O that DOE estimated for each of the considered TSLs for consumer pool heaters. Table V.18 presents the value of the CH_4 emissions reduction at each TSL, and Table V.19 presents the value of the N_2O emissions reduction at each TSL.

TABLE V.18—PRESENT VALUE OF METHANE EMISSIONS REDUCTION FOR CONSUMER POOL HEATERS SHIPPED IN 2028–2057

TSL	SC–CH_4 case discount rate and statistics (million 2020$)			
	5% (average)	3% (average)	2.5% (average)	3% (95th percentile)
1	28	86	120	226
2	33	100	141	265
3	40	124	174	326
4	42	131	185	347

TABLE V.18—PRESENT VALUE OF METHANE EMISSIONS REDUCTION FOR CONSUMER POOL HEATERS SHIPPED IN 2028–2057—Continued

TSL	$SC–CH_4$ case discount rate and statistics (million 2020$)			
	5% (average)	3% (average)	2.5% (average)	3% (95th percentile)
5	62	192	270	506
6	258	807	1,139	2,130

TABLE V.19—PRESENT VALUE OF NITROUS OXIDE EMISSIONS REDUCTION FOR CONSUMER POOL HEATERS SHIPPED IN 2028–2057

TSL	$SC–N_2O$ case discount rate and statistics (million 2020$)			
	5% (average)	3% (average)	2.5% (average)	3% (95th percentile)
1	0.27	1.11	1.74	2.96
2	0.33	1.35	2.13	3.62
3	0.42	1.74	2.74	4.65
4	0.45	1.87	2.94	5.00
5	0.47	1.94	3.05	5.19
6	0.82	3.39	5.35	9.09

DOE is well aware that scientific and economic knowledge about the contribution of CO_2 and other 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 reduced GHG emissions in this rulemaking is subject to change. That said, because of omitted damages, DOE agrees with the IWG that these estimates most likely underestimate the climate benefits of greenhouse gas reductions. 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. DOE notes that the proposed standards would be economically justified even without inclusion of monetized benefits of reduced GHG emissions.

DOE also estimated the monetary value of the economic benefits associated with SO_2 emissions reductions anticipated to result from the considered TSLs for consumer pool heaters. The dollar-per-ton values that DOE used are discussed in section IV.L of this document. Table V.20 presents the present value for SO_2 emissions reduction for each TSL calculated using 7-percent and 3-percent discount rates.

TABLE V.20—PRESENT SOCIAL VALUE OF SO_2 EMISSIONS REDUCTION FOR CONSUMER POOL HEATERS SHIPPED IN 2028–2057

TSL	7% Discount rate (million 2020$)	3% Discount rate (million 2020$)
1	28	72
2	35	88
3	44	114
4	47	123
5	47	120
6	58	152

DOE also estimated the monetary value of the economic benefits associated with NO_X emissions reductions anticipated to result from the considered TSLs for consumer pool heaters. The dollar-per-ton values that DOE used are discussed in section IV.L of this document. Table V.21 presents the present value for NO_X emissions reduction for each TSL calculated using 7-percent and 3-percent discount rates.

TABLE V.21—PRESENT SOCIAL VALUE OF NO_X EMISSIONS REDUCTION FOR CONSUMER POOL HEATERS SHIPPED IN 2028–2057

TSL	7% Discount rate (million 2020$)	3% Discount rate (million 2020$)
1	39	93
2	45	109
3	55	133
4	59	142
5	82	202
6	324	819

The benefits of reduced CO2, CH4, and N2O emissions are collectively referred to as climate benefits. The benefits of reduced SO_2 and NO_X emissions are collectively referred to as health benefits. For the time series of estimated monetary values of reduced emissions, see chapter 14 of the NOPR TSD.

7. Other Factors

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

8. Summary of National Economic Impacts

Table V.22 presents the NPV values that result from adding the monetized estimates of the potential economic, climate, and health benefits resulting from reduced GHG, SO_2, and NO_X emissions to the NPV of consumer benefits calculated for each TSL considered in this rulemaking. The consumer benefits are domestic U.S. monetary savings that occur as a result of purchasing the covered pool heaters and are measured for the lifetime of products shipped in 2028–2057. The climate benefits associated with reduced GHG emissions resulting from the adopted standards are global benefits and are also calculated based on the lifetime of pool heaters shipped in 2028–2057. The climate benefits associated with four SC–GHG estimates are shown. DOE does not have a single central SC–GHG point estimate and it emphasizes the importance and value of considering the benefits calculated using all four SC–GHG estimates.

TABLE V.22—NPV OF CONSUMER BENEFITS COMBINED WITH MONETIZED CLIMATE AND HEALTH BENEFITS FROM EMISSIONS REDUCTIONS

Category	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5	TSL 6
3% discount rate for NPV of Consumer and Health Benefits (billion 2020$)						
5% d.r., Average SC–GHG case	1.9	2.3	2.8	2.9	2.9	4.5
3% d.r., Average SC–GHG case	2.3	2.7	3.3	3.5	3.6	6.8
2.5% d.r., Average SC–GHG case	2.5	3.0	3.7	3.8	4.1	8.5
3% d.r., 95th percentile SC–GHG case	3.1	3.7	4.6	4.8	5.3	12.9
7% discount rate for NPV of Consumer and Health Benefits (billion 2020$)						
5% d.r., Average SC–GHG case	0.9	1.1	1.3	1.3	1.3	1.9
3% d.r., Average SC–GHG case	1.2	1.4	1.8	1.8	2.0	4.3
2.5% d.r., Average SC–GHG case	1.5	1.7	2.1	2.2	2.5	6.0
3% d.r., 95th percentile SC–GHG case	2.1	2.5	3.0	3.2	3.7	10.3

The national operating cost savings are domestic U.S. monetary savings that occur as a result of purchasing the covered products and are measured for the lifetime of products shipped in 2028–2057. The benefits associated with reduced GHG emissions achieved as a result of the adopted standards are also calculated based on the lifetime of consumer pool heaters shipped in 2028–2057.

C. Conclusion

When considering new or amended energy conservation standards, the standards that DOE adopts for any type (or class) of covered product must be designed to achieve the maximum improvement in energy efficiency that the Secretary determines is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A)) In determining whether a standard is economically justified, the Secretary must determine whether the benefits of the standard exceed its burdens by, to the greatest extent practicable, considering the seven statutory factors discussed previously. (42 U.S.C. 6295(o)(2)(B)(i)) The new or amended standard must also result in significant conservation of energy. (42 U.S.C. 6295(o)(3)(B))

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

To aid the reader as DOE discusses the benefits and/or burdens of each TSL, tables in this section present a summary of the results of DOE's quantitative analysis for each TSL. 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 consumers who may be disproportionately affected by a national standard and impacts on employment.

DOE also notes that the economics literature provides a wide-ranging discussion of how consumers trade off upfront costs and energy savings in the absence of government intervention. Much of this literature attempts to explain why consumers appear to undervalue energy efficiency improvements. There is evidence that consumers undervalue future energy savings as a result of (1) a lack of information, (2) a lack of sufficient salience of the long-term or aggregate benefits, (3) a lack of sufficient savings to warrant delaying or altering purchases, (4) excessive focus on the short term, in the form of inconsistent weighting of future energy cost savings relative to available returns on other investments, (5) computational or other difficulties associated with the evaluation of relevant tradeoffs, and (6) a divergence in incentives (for example, between renters and owners, or builders and purchasers). Having less than perfect foresight and a high degree of uncertainty about the future, consumers may trade off these types of investments at a higher than expected rate between current consumption and uncertain future energy cost savings.

In DOE's current regulatory analysis, potential changes in the benefits and costs of a regulation due to changes in consumer purchase decisions are included in two ways. First, if consumers forego the purchase of a product in the standards case, this decreases sales for product manufacturers, and the impact on manufacturers attributed to lost revenue is included in the MIA. Second, DOE accounts for energy savings attributable only to products actually used by consumers in the standards case; if a standard decreases the number of products purchased by consumers, this decreases the potential energy savings from an energy conservation standard. DOE provides estimates of shipments and changes in the volume of product purchases in chapter 9 of the NOPR TSD. However, DOE's current analysis does not explicitly control for heterogeneity in consumer preferences, preferences across subcategories of products or specific features, or consumer price sensitivity variation according to household income.[148]

While DOE is not prepared at present to provide a fuller quantifiable framework for estimating the benefits and costs of changes in consumer purchase decisions due to an energy conservation standard, DOE is committed to developing a framework

[148] P.C. Reiss and M.W. White. Household Electricity Demand, Revisited. *Review of Economic Studies.* 2005. 72(3): pp. 853–883. doi: *10.1111/0034-6527.00354.*

that can support empirical quantitative tools for improved assessment of the consumer welfare impacts of appliance standards. DOE has posted a paper that discusses the issue of consumer welfare impacts of appliance energy conservation standards, and potential enhancements to the methodology by which these impacts are defined and estimated in the regulatory process.[149] DOE welcomes comments on how to more fully assess the potential impact of energy conservation standards on consumer choice and how to quantify this impact in its regulatory analysis in future rulemakings.

1. Benefits and Burdens of TSLs Considered for Consumer Pool Heater Standards

Table V.23 and Table V.24 summarize the quantitative impacts estimated for each TSL for consumer pool heaters. The national impacts are measured over the lifetime of consumer pool heaters purchased in the 30-year period that begins in the anticipated year of compliance with amended standards (2028–2057). The energy savings, emissions reductions, and value of emissions reductions refer to full-fuel-cycle results. DOE exercises its own judgment in presenting monetized climate benefits as recommended in applicable Executive Orders and DOE would reach the same conclusion presented in this notice in the absence of the social cost of greenhouse gases, including the February 2021 Interim Estimates presented by the Interagency Working Group on the Social Cost of Greenhouse Gases. The efficiency levels contained in each TSL are described in section V.A of this document.

TABLE V.23—SUMMARY OF ANALYTICAL RESULTS FOR CONSUMER POOL HEATERS TSLs: NATIONAL IMPACTS

Category	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5	TSL 6
Cumulative FFC National Energy Savings (quads)						
Quads	0.26	0.31	0.39	0.42	0.49	1.33
Cumulative FFC Emissions Reduction (Total FFC Emissions)						
CO_2 *(million metric tons)*	9	11	14	15	19	63
SO_2 *(thousand tons)*	3.2	4.0	5.2	5.6	5.5	6.9
NO_X *(thousand tons)*	19	21	25	27	90	169
Hg *(tons)*	0.02	0.02	0.03	0.03	0.03	0.04
CH_4 *(thousand tons)*	72	84	104	110	161	683
N_2O *(thousand tons)*	0.08	0.10	0.13	0.14	0.15	0.26
Present Value of Monetized Benefits and Costs (3% discount rate, billion 2020$)						
Consumer Operating Cost Savings	1.73	2.10	2.68	2.87	3.20	7.16
Climate Benefits *	0.43	0.51	0.64	0.69	0.89	3.13
Health Benefits **	0.16	0.20	0.25	0.26	0.32	0.97
Total Benefits †	2.33	2.81	3.57	3.82	4.42	11.26
Consumer Incremental Product Costs ‡	0.07	0.11	0.25	0.37	0.81	4.43
Consumer Net Benefits	1.67	1.99	2.43	2.50	2.39	2.73
Total Net Benefits	2.27	2.70	3.32	3.45	3.61	6.83
Present Value of Monetized Benefits and Costs (7% discount rate, billions 2020$)						
Consumer Operating Cost Savings	0.75	0.90	1.15	1.23	1.36	2.98
Climate Benefits *	0.43	0.51	0.64	0.69	0.89	3.13
Health Benefits *	0.07	0.08	0.10	0.11	0.13	0.38
Total Benefits †	1.25	1.50	1.89	2.02	2.38	6.49
Consumer Incremental Product Costs ‡	0.03	0.06	0.13	0.19	0.40	2.21
Consumer Net Benefits	0.72	0.85	1.02	1.04	0.95	0.77
Total Net Benefits	1.22	1.44	1.76	1.83	1.98	4.28

Note: This table presents the costs and benefits associated with consumer pool heaters shipped in 2028–2057. These results include benefits to consumers which accrue after 2057 from the products shipped in 2028–2057.

* Climate benefits are calculated using four different estimates of the social cost of carbon (SC–CO2), methane (SC–CH4), and nitrous oxide (SC–N2O) (model average at 2.5 percent, 3 percent, and 5 percent discount rates; 95th percentile at 3 percent discount rate), as shown in Table V.17 through Table V.19. Together these represent the global social cost of greenhouse gases (SC–GHG). For presentational purposes of this table, the climate benefits associated with the average SC–GHG at a 3 percent discount rate are shown, but the Department does not have a single central SC–GHG point estimate. See section. IV.L of this document for more details.

** Health benefits are calculated using benefit-per-ton values for NO_X and SO_2. DOE is currently only monetizing $PM_{2.5}$ and (for NO_X) ozone precursor health benefits, but will continue to assess the ability to monetize other effects such as health benefits from reductions in direct $PM_{2.5}$ emissions. The health benefits are presented at real discount rates of 3 and 7 percent. See section IV.L of this document for more details.

† Total and net benefits include consumer, climate, and health benefits. For presentation purposes, total and net benefits for both the 3-percent and 7-percent cases are presented using the average SC–GHG with 3-percent discount rate, but the Department does not have a single central SC–GHG point estimate. DOE emphasizes the importance and value of considering the benefits calculated using all four SC–GHG estimates. See Table V.22 for net benefits using all four SC–GHG estimates. On March 16, 2022, the Fifth Circuit Court of Appeals (No. 22–30087) granted the federal government's emergency motion for stay pending appeal of the February 11, 2022, preliminary injunction issued in *Louisiana* v. *Biden,* No. 21–cv–1074–JDC–KK (W.D. La.). As a result of the Fifth Circuit's order, the preliminary injunction is no longer in effect, pending resolution of the federal government's appeal of that injunction or a further court order. Among other things, the preliminary injunction enjoined the defendants in that case from ''adopting, employing, treating as binding, or relying upon'' the interim estimates of the social cost of greenhouse gases—which were issued by the Interagency Working Group on the Social Cost of Greenhouse Gases on February 26, 2021—to monetize the benefits of reducing greenhouse gas emissions. In the absence of further intervening court orders, DOE will revert to its approach prior to the injunction and present monetized benefits where appropriate and permissible under law.

[149] Sanstad, A. H. *Notes on the Economics of Household Energy Consumption and Technology Choice.* 2010. Lawrence Berkeley National Laboratory. Available at: *www1.eere.energy.gov/buildings/appliance_standards/pdfs/consumer_ee_theory.pdf* (last accessed April 15, 2021).

‡ Costs include incremental equipment costs as well as installation costs.

TABLE V.24—SUMMARY OF ANALYTICAL RESULTS FOR CONSUMER POOL HEATERS TSLS: MANUFACTURER AND CONSUMER IMPACTS

Category	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5	TSL 6
Manufacturer Impacts						
Industry NPV (*million 2020$*) (No-new-standards case INPV = 188.7)	186.1–186.5	183.6–184.2	170.3–171.8	169.0–171.1	161.0–174.2	135.5–187.3
Industry NPV (*% change*)	(1.3)–(1.2)	(2.7)–(2.3)	(9.7)–(9.0)	(10.4)–(9.3)	(14.7)–(7.7)	(28.2)–(0.7)
Consumer Average LCC Savings (2020$)						
Electric Pool Heaters	7,995	3,695	1,123	1,029	1,029	929
Gas-fired Pool Heaters	1,085	1,085	1,085	1,085	43	(15)
Shipment-Weighted Average *	7,995	3,695	1,123	1,121	677	465
Consumer Simple PBP (years)						
Electric Pool Heaters	0.6	0.6	0.7	0.7	0.7	0.8
Gas-fired Pool Heaters	0.1	0.1	0.1	0.1	1.5	4.4
Shipment-Weighted Average *	0.6	0.6	0.7	0.3	1.3	3.3
Percent of Consumers that Experience a Net Cost (%)						
Electric Pool Heaters	0.4	0.9	11.0	20.9	20.9	37.8
Gas-fired Pool Heaters	0.0	0.0	0.0	0.0	31.9	70.1
Shipment-Weighted Average *	0.1	0.3	3.3	3.3	28.6	60.3

Parentheses indicate negative (−) values.
* Weighted by shares of each product class in total projected shipments in 2028.

DOE first considered TSL 6, which represents the max-tech efficiency levels. TSL 6 would save an estimated 1.33 quads of energy, an amount DOE considers significant. Under TSL 6, the NPV of consumer benefit would be $0.77 billion using a discount rate of 7 percent, and $2.73 billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 6 are 63 Mt of CO_2, 6.9 thousand tons of SO_2, 169 thousand tons of NO_X, 0.04 tons of Hg, 683 thousand tons of CH_4, and 0.26 thousand tons of N_2O. The estimated monetary value of the climate benefits from reduced GHG emissions (associated with the average SC–GHG at a 3-percent discount rate) at TSL 6 is $3.13 billion. The estimated monetary value of the health benefits from reduced SO_2 and NO_X emissions at TSL 6 is $0.38 billion using a 7-percent discount rate and $0.97 billion using a 3-percent discount rate.

Using a 7-percent discount rate for consumer benefits and costs and health benefits from reduced SO_2 and NO_X emissions, and the 3-percent discount rate case for climate benefits from reduced GHG emissions, the estimated total monetized NPV at TSL 6 is $4.28 billion. Using a 3-percent discount rate for all benefits and costs, the estimated total monetized NPV at TSL 6 is $6.83 billion. The estimated total monetized NPV is provided for additional information, however DOE gives considerable weight to the NPV of consumer benefits and the percentage of consumers experiencing a net cost when determining whether a proposed standard level is economically justified.

At TSL 6, the average LCC impact is a savings of $929 for electric pool heaters and an average LCC loss of $15 for gas-fired pool heaters. The simple payback period is 0.8 years for electric pool heaters and 4.4 years for gas-fired pool heaters. The fraction of consumers experiencing a net LCC cost is 37.8 percent for electric pool heaters and 70.1 percent for gas-fired pool heaters.

At TSL 6, the projected change in INPV ranges from a decrease of $53.2 million to a decrease of $1.4 million, which corresponds to decreases of 28.2 percent and 0.7 percent, respectively. DOE estimates that industry must invest $59.0 million to comply with standards set at TSL 6. DOE estimates that approximately nine percent of gas-fired pool heater shipments and less than one percent of electric pool heater shipments would meet the efficiency levels analyzed at TSL 6. There are 18 pool heater manufacturers that manufacture electric pool heaters covered by this rulemaking. Only one of the 18 electric pool heater manufacturers offers electric pool heater models that meet the efficiency level required at TSL 6 for electric pool heaters. All other electric pool heater manufacturers do not offer any models that would meet the efficiency level required at TSL 6 for electric pool heaters covered by this rulemaking. If these manufacturers decide to leave the electric pool heater market, there would be only one manufacturer of electric pool heaters, which could raise concerns related to anti-competitive market forces. There are four pool heater manufacturers that manufacture gas-fired pool heaters covered by this rulemaking. Only one of the four gas-fired pool heater manufacturers offers gas-fired pool heater models that meet the efficiency level required at TSL 6 for gas-fired pool heaters. All other gas-fired pool heater manufacturers do not offer any models that would meet the efficiency level required at TSL 6 for gas-fired pool heaters covered by this rulemaking. At TSL 6, most manufacturers would be required to redesign every pool heater model covered by this rulemaking. It is unclear if most manufacturers would have the engineering capacity to complete the necessary redesigns within the 5-year compliance period. If manufacturers require more than 5 years to redesign all their covered pool heater models, they will likely prioritize redesigns based on sales volume. There is risk that some pool heater models will become either temporarily or permanently unavailable after the compliance date.

The Secretary tentatively concludes that at TSL 6 for consumer pool heaters, the benefits of energy savings, positive NPV of consumer benefits, emission reductions, and the estimated monetary value of the climate and health benefits would be outweighed by the economic burden on many consumers, and the impacts on manufacturers, including the large conversion costs, profit margin impacts that could result in a large reduction in INPV, and the lack of manufacturers currently offering products meeting the efficiency levels required at this TSL, including most small businesses. A majority of gas-fired pool heater consumers (70.1 percent) would experience a net cost and the average LCC savings would be negative. The potential reduction in INPV could be as high as 28.2 percent. Additionally, only one pool heater manufacturer offers models that meet the efficiency level required at TSL 6 for electric pool heaters covered by this rulemaking and only one pool heater manufacturer offers models that meet the efficiency level required at TSL 6 for gas-fired pool heaters covered by this rulemaking. Due to limited amount of engineering resources each manufacturer has, it is unclear if most manufacturers will be able to redesign their entire product offerings of pool heaters covered by this rulemaking in the 5-year compliance period. Lastly, only one small business offers pool heater models that meet the efficiency levels required at TSL 6. No other small businesses offer any pool heater models that meet the efficiency levels required at TSL 6. Consequently, the Secretary has tentatively concluded that TSL 6 is not economically justified.

DOE then considered TSL 5, which represents efficiency level 4 for electric pool heaters and efficiency level 2 for gas-fired pool heaters. TSL 5 would save an estimated 0.49 quads of energy, an amount DOE considers significant. Under TSL 5, the NPV of consumer benefit would be $0.95 billion using a discount rate of 7 percent, and $2.39 billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 5 are 19 Mt of CO_2, 5.5 thousand tons of SO_2, 90 thousand tons of NO_X, 0.03 tons of Hg, 161 thousand tons of CH_4, and 0.15 thousand tons of N_2O. The estimated monetary value of the climate benefits from reduced GHG emissions (associated with the average SC–GHG at a 3-percent discount rate) at TSL 5 is $0.89 billion. The estimated monetary value of the health benefits from reduced SO_2 and NO_X emissions at TSL 5 is $0.13 billion using a 7-percent discount rate and $0.32 billion using a 3-percent discount rate.

Using a 7-percent discount rate for consumer benefits and costs and health benefits from reduced SO_2 and NO_X emissions, and the 3-percent discount rate case for climate benefits from reduced GHG emissions, the estimated total monetized NPV at TSL 5 is $1.98 billion. Using a 3-percent discount rate for all benefits and costs, the estimated total monetized NPV at TSL 5 is $3.61 billion. The estimated total NPV is provided for additional information, however DOE gives considerable weight to the NPV of consumer benefits and the percentage of consumers experiencing a net cost when determining whether a proposed standard level is economically justified.

At TSL 5, the average LCC impact is a savings of $1,029 for electric pool heaters and $43 for gas-fired pool heaters. The simple payback period is 0.7 years for electric pool heaters and 1.5 years for gas-fired pool heaters. The fraction of consumers experiencing a net LCC cost is 20.9 percent for electric pool heaters and 31.9 percent for gas-fired pool heaters.

At TSL 5, the projected change in INPV ranges from a decrease of $27.7 million to a decrease of $14.4 million, which correspond to decreases of 14.7 percent and 7.7 percent, respectively. DOE estimates that industry must invest $38.8 million to comply with standards set at TSL 5. DOE estimates that approximately 45 percent of gas-fired pool heater shipments and ten percent of electric pool heater shipments would meet the efficiency levels analyzed at TSL 5. All gas-fired pool heater manufacturers and eight of the 18 electric pool heater manufacturers offer products that meet or exceed the efficiency levels required at TSL 5.

After considering the analysis and weighing the benefits and burdens, the Secretary has tentatively concluded that at a standard set at TSL 5 for consumer pool heaters would be economically justified. At this TSL, the average LCC savings for both electric and gas-fired pool heater consumers is positive. An estimated 20.9 percent of electric pool heater consumers and 31.9 percent of gas-fired pool heater consumers experience a net cost. The FFC national energy savings are significant and the NPV of consumer benefits is positive using both a 3-percent and 7-percent discount rate. Notably, the benefits to consumers vastly outweigh the cost to manufacturers. At TSL 5, the NPV of consumer benefits, even measured at the more conservative discount rate of 7 percent is over 34 times higher than the maximum estimated manufacturers' loss in INPV. The positive LCC savings—a different way of quantifying consumer benefits—reinforces this conclusion. The standard levels at TSL 5 are economically justified even without weighing the estimated monetary value of emissions reductions. When those monetized climate benefits from GHG emissions reductions and health benefits from SO_2 and NO_X emissions reductions are included—representing $0.89 billion in climate benefits (associated with the average SC–GHG at a 3-percent discount rate) and $0.32 billion (using a 3-percent discount rate) or $0.13 billion (using a 7-percent discount rate) in health benefits—the rationale becomes stronger still.

As stated, DOE conducts a ''walk-down'' analysis to determine the TSL that represents the maximum improvement in energy efficiency that is technologically feasible and economically justified as required under EPCA. The walk-down is not a comparative analysis, as a comparative analysis would result in the maximization of net benefits instead of energy savings that are technologically feasible and economically justified and would be contrary to the statute. 86 FR 70892, 70908. Although DOE has not conducted a comparative analysis to select the proposed energy conservation standards, DOE notes that as compared to TSL 6, TSL 5 has higher average LCC savings, smaller percentages of consumer experiencing a net cost, a lower maximum decrease in INPV, and lower manufacturer conversion costs.

Accordingly, the Secretary has tentatively concluded that TSL 5 would offer the maximum improvement in efficiency that is technologically feasible and economically justified and would result in the significant conservation of energy. Although results are presented here in terms of TSLs, DOE analyzes and evaluates all possible ELs for each product class in its analysis. For both gas-fired pool heaters and electric pool heaters, TSL 5 is comprised of the highest efficiency level below max-tech. For gas-fired pool heaters, the max-tech efficiency level results in negative average LCC savings and a large percentage of consumers that experience a net LCC cost, in addition to significant manufacturer impacts. For electric pool heaters the max-tech efficiency level can only be achieved by a single manufacturer, resulting in large expected conversion costs and significant reductions in INPV. The ELs one level below max-tech, representing the proposed standard levels, result in positive LCC savings for both classes, significantly reduce the number of consumers experiencing a net cost, and reduce the decrease in INPV and conversion costs to the point where DOE has tentatively concluded they are economically justified, as discussed for TSL 5 in the preceding paragraphs.

Therefore, based on the previous considerations, DOE proposes to adopt the energy conservation standards for consumer pool heaters at TSL 5. The proposed amended energy conservation standards for pool heaters, which are expressed as TE_I, are shown in Table V.25.

Table V.25 Proposed Amended Energy Conservation Standards for Consumer Pool Heaters

Product Class	Integrated Thermal Efficiency TE_I† (*percent*)
Electric Pool Heater	$\frac{600PE}{PE + 1{,}619}$
Gas-Fired Pool Heater	$\frac{84(Q_{IN} + 491)}{Q_{IN} + 2{,}536}$

†PE is the active electrical power for consumer pool heaters and Q_{IN} is the input capacity as determined in accordance with the DOE test procedure in appendix P.

2. Annualized Benefits and Costs of the Proposed Standards

The benefits and costs of the proposed standards can also be expressed in terms of annualized values. The annualized net benefit is (1) the annualized national economic value (expressed in 2020$) of the benefits from operating products that meet the proposed standards (consisting primarily of operating cost savings from using less energy, minus increases in product purchase costs, and (2) the annualized monetary value of the benefits of GHGs, SO_2, and NO_X emission reductions.

Table V.26 shows the annualized values for consumer pool heaters under TSL 5, expressed in 2020$. The results under the primary estimate are as follows.

Using a 7-percent discount rate for consumer benefits and costs and health benefits from reduced SO_2 and NO_X emissions, and the 3-percent discount rate case for climate benefits from reduced GHG emissions, the estimated cost of the standards proposed in this rule is $49.0 million per year in increased equipment costs, while the estimated annual benefits are $164 million in reduced equipment operating costs, $54.5 million in climate benefits, and $15.6 million in monetized health benefits. In this case, the net monetized benefit would amount to $185 million per year.

Using a 3-percent discount rate for all benefits and costs, the estimated cost of the proposed standards is $49.3 million per year in increased equipment costs, while the estimated annual benefits are $195 million in reduced operating costs, $54.5 million in climate benefits, and $19.6 million in monetized health benefits. In this case, the net monetized benefit would amount to $220 million per year.

TABLE V.26—ANNUALIZED MONETIZED BENEFITS AND COSTS OF PROPOSED ENERGY CONSERVATION STANDARDS FOR CONSUMER POOL HEATERS

[TSL 5]

	Million 2020$/year		
	Primary estimate	Low-net-benefits estimate	High-net-benefits estimate
3% discount rate			
Consumer Operating Cost Savings	194.9	179.0	212.8
Climate Benefits *	54.5	52.4	56.6
Health Benefits **	19.6	18.9	20.4
Total Benefits †	269	250	290
Consumer Incremental Product Costs ‡	49.3	51.4	49.4
Net Benefits	220	199	240
7% discount rate			
Consumer Operating Cost Savings	164.2	152.7	177.7
Climate Benefits *	54.5	52.4	56.6
Health Benefits **	15.6	15.0	16.1
Total Benefits †	234	220	250
Consumer Incremental Product Costs ‡	49.0	50.7	49.2
Net Benefits	185	169	201

Note: This table presents the costs and benefits associated with consumer pool heaters shipped in 2028–2057. These results include benefits to consumers which accrue after 2057 from the products shipped in 2028–2057.

* Climate benefits are calculated using four different estimates of the social cost of carbon (SC–CO2), methane (SC–CH4), and nitrous oxide (SC–N2O) (model average at 2.5 percent, 3 percent, and 5 percent discount rates; 95th percentile at 3 percent discount rate). Together these represent the global social cost of greenhouse gases (SC–GHG). For presentational purposes of this table, the climate benefits associated with the average SC–GHG at a 3 percent discount rate are shown, but the Department does not have a single central SC–GHG point estimate, and it emphasizes the importance and value of considering the benefits calculated using all four SC–GHG estimates. See section. IV.L of this document for more details.

* Health benefits are calculated using benefit-per-ton values for NO_X and SO_2. DOE is currently only monetizing $PM_{2.5}$ and (for NO_X) ozone precursor health benefits, but will continue to assess the ability to monetize other effects such as health benefits from reductions in direct $PM_{2.5}$ emissions. The health benefits are presented at real discount rates of 3 and 7 percent. See section IV.L of this document for more details.

† Total and net benefits include consumer, climate, and health benefits. For presentation purposes, total and net benefits for both the 3-percent and 7-percent cases are presented using the average SC–GHG with 3-percent discount rate, but the Department does not have a single central SC–GHG point estimate. DOE emphasizes the importance and value of considering the benefits calculated using all four SC–GHG estimates. On March 16, 2022, the Fifth Circuit Court of Appeals (No. 22–30087) granted the federal government's emergency motion for stay pending appeal of the February 11, 2022, preliminary injunction issued in *Louisiana* v. *Biden,* No. 21–cv–1074–JDC–KK (W.D. La.). As a result of the Fifth Circuit's order, the preliminary injunction is no longer in effect, pending resolution of the federal government's appeal of that injunction or a further court order. Among other things, the preliminary injunction enjoined the defendants in that case from ''adopting, employing, treating as binding, or relying upon'' the interim estimates of the social cost of greenhouse gases—which were issued by the Interagency Working Group on the Social Cost of Greenhouse Gases on February 26, 2021—to monetize the benefits of reducing greenhouse gas emissions. In the absence of further intervening court orders, DOE will revert to its approach prior to the injunction and present monetized benefits where appropriate and permissible under law.

VI. Procedural Issues and Regulatory Review

A. Review Under Executive Orders 12866 and 13563

Section 1(b)(1) of Executive Order (''E.O.'')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 set forth in this NOPR are intended to address are as follows:

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

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

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

The Administrator of the Office of Information and Regulatory Affairs (''OIRA'') in the OMB has determined that the proposed regulatory action is a significant regulatory action under section (3)(f) of Executive Order 12866. Accordingly, pursuant to section 6(a)(3)(B) of the Order, DOE has provided to OIRA:

(i) The text of the draft regulatory action, together with a reasonably detailed description of the need for the regulatory action and an explanation of how the regulatory action will meet that need; and

(ii) An assessment of the potential costs and benefits of the regulatory action, including an explanation of the manner in which the regulatory action is consistent with a statutory mandate. DOE has included these documents in the rulemaking record. A summary of the potential costs and benefits of the regulatory action is presented in Table VI.1.

TABLE VI.1—ANNUALIZED BENEFITS, COSTS, AND NET BENEFITS OF PROPOSED STANDARDS

Category	Million 2020$/year	
	3% Discount rate	7% Discount rate
Consumer Operating Cost Savings	194.9	164.2
Climate Benefits *	54.5	54.5
Health Benefits **	19.6	15.6
Total Benefits †	269	234
Costs ‡	49.3	49.0
Net Benefits	220	185

Note: This table presents the costs and benefits associated with consumer pool heaters shipped in 2028–2057. These results include benefits to consumers which accrue after 2057 from the products shipped in 2028–2057.

* Climate benefits are calculated using four different estimates of the social cost of carbon (SC–CO2), methane (SC–CH4), and nitrous oxide (SC–N2O) (model average at 2.5 percent, 3 percent, and 5 percent discount rates; 95th percentile at 3 percent discount rate). Together these represent the global social cost of greenhouse gases (SC–GHG). For presentational purposes of this table, the climate benefits associated with the average SC–GHG at a 3 percent discount rate are shown, but the Department does not have a single central SC–GHG point estimate, and it emphasizes the importance and value of considering the benefits calculated using all four SC–GHG estimates.

** Health benefits are calculated using benefit-per-ton values for NO_X and SO_2. DOE is currently only monetizing $PM_{2.5}$ and (for NO_X) ozone precursor health benefits, but will continue to assess the ability to monetize other effects such as health benefits from reductions in direct $PM_{2.5}$ emissions. The health benefits are presented at real discount rates of 3 and 7 percent.

† Total and net benefits include consumer, climate, and health benefits. For presentation purposes, total and net benefits for both the 3-percent and 7-percent cases are presented using the average SC–GHG with 3-percent discount rate, but the Department does not have a single central SC–GHG point estimate. DOE emphasizes the importance and value of considering the benefits calculated using all four SC–GHG estimates. On March 16, 2022, the Fifth Circuit Court of Appeals (No. 22–30087) granted the federal government's emergency motion for stay pending appeal of the February 11, 2022, preliminary injunction issued in *Louisiana* v. *Biden,* No. 21–cv–1074–JDC–KK (W.D. La.). As a result of the Fifth Circuit's order, the preliminary injunction is no longer in effect, pending resolution of the federal government's appeal of that injunction or a further court order. Among other things, the preliminary injunction enjoined the defendants in that case from ''adopting, employing, treating as binding, or relying upon'' the interim estimates of the social cost of greenhouse gases—which were issued by the Interagency Working Group on the Social Cost of Greenhouse Gases on February 26, 2021—to monetize the benefits of reducing greenhouse gas emissions. In the absence of further intervening court orders, DOE will revert to its approach prior to the injunction and present monetized benefits where appropriate and permissible under law.

‡ Costs include incremental equipment costs as well as installation costs.

In addition, the Administrator of OIRA has determined that the proposed regulatory action is an ''economically'' significant regulatory action under section (3)(f)(1) of E.O. 12866. Accordingly, pursuant to section 6(a)(3)(C) of the Order, DOE has provided to OIRA an assessment, including the underlying analysis, of benefits and costs anticipated from the regulatory action, together with, to the extent feasible, a quantification of those costs; and an assessment, including the underlying analysis, of costs and benefits of potentially effective and reasonably feasible alternatives to the planned regulation, and an explanation why the planned regulatory action is preferable to the identified potential alternatives. These assessments are summarized in this preamble and further detail can be found in the technical support document for this rulemaking.

DOE has also reviewed this proposed regulation pursuant to E.O. 13563, issued on January 18, 2011. 76 FR 3281 (Jan. 21, 2011). E.O. 13563 is supplemental to and explicitly reaffirms the principles, structures, and definitions governing regulatory review established in E.O. 12866. To the extent permitted by law, agencies are required by E.O. 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 E.O. 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, 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 E.O. 13272, ''Proper Consideration of Small Entities in Agency Rulemaking,'' 67 FR 53461 (Aug. 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: *www.energy.gov/gc/office-general-counsel.* DOE reviewed this proposed rule under the provisions of the Regulatory Flexibility Act and the policies and procedures published on February 19, 2003. DOE has prepared the following IRFA for the products that are the subject of this rulemaking.

For manufacturers of consumer pool heaters, the 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. *See* 13 CFR part 121. The size standards are listed by North American Industry Classification System (''NAICS'') code and industry description and are available at *www.sba.gov/document/support--table-size-standards.* Manufacturing of consumer pool heaters is classified under NAICS 333414, ''heating equipment (except warm air furnaces) manufacturing.'' The SBA sets a threshold of 500 employees or fewer for an entity to be considered as a small business for this category.

1. Description of Reasons Why Action Is Being Considered

DOE has undertaken this rulemaking pursuant to 42 U.S.C. 6295(e)(4)(B), which requires DOE to conduct a second round of amended standards rulemaking for consumer pool heaters. The Energy Policy and Conservation Act, as amended (EPCA), also requires that not later than six years after issuance of any final rule establishing or amending a standard, DOE must publish either a notice of the determination that standards for the product do not need to be amended, or a notice of proposed rulemaking including new proposed energy conservation standards. (42 U.S.C. 6295(m)(1)) This rulemaking is in accordance with DOE's obligations under EPCA.

2. Objectives of, and Legal Basis for, Rule

As discussed previously in section II, Title III, Part B of EPCA, sets forth a variety of provisions designed to improve energy efficiency and established the Energy Conservation Program for Consumer Products Other Than Automobiles, a program covering most major household appliances and certain industrial and commercial equipment. The National Appliance Energy Conservation Act of 1987 (NAECA), Public Law 100–12, amended EPCA to establish energy conservation standards for residential pool heaters and set requirements to conduct two cycles of rulemaking to determine whether these standards should be amended. (42 U.S.C. 6295(e)(2) and (4)) The first of these two rulemakings, which amended standards for gas-fired pool heaters, concluded with the promulgation of a final rule on April 16, 2010. 75 FR 20112. (Codified at 10 CFR 430.32(k)). This rulemaking satisfies the statutory requirements under EPCA to conduct a second round of review of the pool heaters standard. (42 U.S.C. 6295(e)(4)(B)) This proposed rulemaking is also in accordance the six-year review required under 42 U.S.C. 6295(m)(1).

3. Description on Estimated Number of Small Entities Regulated

For manufacturers of consumer pool heaters, the 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 this proposed rule. *See* 13 CFR part 121. The size standards are listed by NAICS code and industry description and are available at *www.sba.gov/document/support--table-size-standards.*

Manufacturing of consumer pool heaters is classified under NAICS code 333414, ''heating equipment (except warm air furnaces) manufacturing.'' The SBA sets a threshold of 500 employees or fewer 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. During its market survey, DOE used publicly available 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.,* D&B Hoover's reports) to create a list of companies that manufacture consumer pool heaters. DOE also asked stakeholders and industry representatives if they were aware of any additional small manufacturers during manufacturer interviews. DOE reviewed publicly available data and contacted various companies on its complete list of manufacturers 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 identified 21 companies manufacturing consumer pool heaters covered by this rulemaking. Of these manufacturers, DOE identified six as domestic small businesses. All six domestic small businesses only manufacture electric pool heaters. DOE did not identify any domestic small businesses that manufacture gas-fired pool heaters.

DOE was able to reach and discuss potential standards with two of the six small businesses. Additionally, DOE requested information about small businesses and potential impacts on small businesses while interviewing large manufacturers.

Gas-fired pool heaters account for most of the consumer pool heater market, with approximately 70 percent of all consumer pool heater units shipped annually. Within the electric pool heater market, over 90 percent of shipments are heat pump pool heaters and only a small fraction of the shipments are electric resistance pool heaters. (See chapter 9 of the NOPR TSD for more information on the shipments analysis conducted for this rulemaking.) Although the electric pool heater market is smaller than the gas-fired pool heater market, it is also more fragmented. Whereas DOE identified five manufacturers of gas-fired pool heaters, DOE identified 20 manufacturers of electric pool heaters (four of the companies make both gas-fired and electric pool heaters).

Four major players dominate the market for electric pool heaters, three are large manufacturers and one is a small business. The rest of the market is served by a combination of large and small businesses with market shares estimated to be in the single digits. Of the six small businesses identified, five only manufacture electric heat pump pool heaters and one only manufactures electric resistance pool heaters.

4. Description and Estimate of Compliance Requirements Including Differences in Cost, if Any, for Different Groups of Small Entities

As stated previously, DOE identified six small manufacturers of electric pool heaters and no small manufacturers of gas-fired pool heaters. Accordingly, this analysis of small business impacts focuses exclusively on the electric pool heater industry. Within the electric pool heater industry, this analysis focuses only on products impacted by this rulemaking (*i.e.,* electric heat pump pool heaters and electric resistance pool heaters with capacities greater than 11 kW, as discussed in section III.A of this document).

This NOPR proposes minimum energy conservation standards for electric pool heaters at efficiency levels above those achieved by electric resistance pool heaters. Given that the designs of electric heat pump pool heaters and electric resistance pool heaters use different types of technology, DOE assumes manufacturers of electric resistance pool heaters with capacities greater than 11 kW would discontinue those product lines rather than redesign them as electric heat pump pool heaters. As a result, expected impacts on manufacturers vary based on the type of electric pool heaters they manufacture.

As described in section IV.J.2.c of this document, there are two types of conversion costs that small businesses could incur due to the proposed standards for electric pool heaters: Product conversion costs and capital conversion costs. Product conversion costs are investments in R&D, testing, marketing, and other non-capitalized costs necessary to make product designs comply with new and amended energy conservation standards. Capital conversion costs are investments in property, plant, and equipment necessary to adapt or change existing production facilities such that new compliant product designs can be fabricated and assembled. Manufacturers would only need to make these investments if they have products that do not meet the adopted energy conservation standards. Testing costs are costs manufacturers must make to test their electric pool heaters in accordance with DOE's test procedure to demonstrate compliance with adopted energy conservation standards. Manufacturers must do this for all compliant electric pool heaters that are in the scope of this rulemaking.

DOE estimates there are three small businesses that do not have any electric heat pump pool heater models that would meet the proposed standards. DOE applied the conversion cost methodology described in section IV.J.2.c of this document to calculate small business product and capital conversion costs. To calculate product conversion costs DOE estimated it would take six months of engineering time to redesign a single electric heat pump pool heater model to meet the proposed standards. DOE estimates that there are approximately 101 electric heat pump pool heaters manufactured by small businesses that may need to be redesigned to comply with the proposed energy conservation standards for electric pool heaters, if adopted. To calculate capital conversion costs DOE estimates that most small businesses would need to make minor investments in tooling to accommodate electric heat pump pool heater models with a larger evaporator. Small business conversion costs are presented in Table VI.2. of this document.

The five small businesses that manufacture electric heat pump pool heaters would incur testing costs to demonstrate compliance of electric pool heaters with adopted energy conservation standards in accordance with DOE's test procedure. Electric pool heaters are currently not subject to DOE energy conservation standards. This NOPR proposes to establish new energy conservation standards for electric pool heaters. Manufacturers, including small businesses, would have to test all electric pool heaters that are subject to this rulemaking after the compliance date. DOE estimates that small businesses manufacture approximately 131 electric heat pump pool models that would be included in the scope of this rulemaking. All 118 electric heat pump pool heater models would need to be tested after the compliance date. DOE estimates a per model testing cost for these electric heat pump pool heater models. Small business conversion and testing costs are presented in Table VI.2.

TABLE VI.2—SMALL BUSINESS COSTS

	Small business costs (2020$)	Average cost per small business (2020$)
Product Conversion Costs	6.34 million	1.27 million
Capital Conversion Costs	0.23 million	0.05 million
Testing Costs for Compliance	0.66 million	0.13 million
Total Small Business Costs	7.23 million	1.45 million

DOE estimates the average small business would incur approximately $1.45 million per small business. DOE assumes that all consumer pool heater manufacturers would spread these costs over the five-year compliance timeframe, as standards are expected to require compliance approximately five years after the publication of a Final Rule. Therefore, DOE assumes that the average consumer pool heater small business would incur on average $290,000 annually in the five years leading up to the compliance date for consumer pool heaters. Using publicly available data, DOE estimated the average annual revenue of the five small businesses that manufacturer electric heat pump pool heaters to be $4.89 million. Table VI.3 compares these average small business costs to average annual revenue of small businesses.

Additionally, these manufacturers could choose to discontinue their least efficient models and ramp up production of existing, compliant models rather than redesign each of their noncompliant models. Therefore, actual conversion costs could be lower than estimates developed under the conservative assumption that manufacturers would redesign all noncompliant models.

TABLE VI.3—AVERAGE SMALL BUSINESS COSTS COMPARED TO ANNUAL REVENUE

Units	Estimated compliance costs (2020$)	Annual revenue (2020$)	Compliance costs as a percent of annual revenue (%)	5 Years of revenue (2020$)	Compliance costs as a percent of 5 years of revenue (%)
Average Small Business	1.45 million	4.89 million	29.5	24.47 million	5.9

Lastly, for the one small business that manufactures only electric resistance pool heaters, based on public company literature, this small business manufactures 72 electric resistance pool heaters with capacities greater than 11 kW. This small business also manufactures electric resistance pool heaters with capacities less than or equal to 11 kW and a small selection of other heating products that would still be allowed to be sold, even if this proposal is adopted in a final rule. If the proposed standards were adopted, this manufacturer's business and competitive position in the electric pool heater market (for electric resistance pool heaters with capacities greater than 11 kW) would be negatively impacted, since the proposed standards result in a minimum efficiency level that is not feasible for electric resistance pool heaters to achieve. This small business does not offer any compliant consumer pool heater products that could serve as a replacement product for the non-compliant electric resistance pool heaters. However, this small business would still be able to sell electric resistance pool heaters with capacities less than or equal to 11 kW and would still be able to export electric resistance pool heaters with capacities greater than 11 kW to other countries, including into Canada.

DOE requests comment on its findings that there are six domestic small businesses that manufacture consumer pool heaters and its estimate of the potential impacts on these small businesses.

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

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

6. Significant Alternatives to the Rule

The discussion in the previous section analyzes impacts on small businesses that would result from DOE's proposed rule, represented by TSL 5. In reviewing alternatives to the proposed rule, DOE examined energy conservation standards set at lower efficiency levels. While TSL 1, TSL 2, and TSL 3 would reduce the impacts on small business manufacturers, it would come at the expense of a reduction in energy savings and, for some TSLs, a reduction in NPV benefits to consumers.[150] TSL 1 achieves 47 percent lower energy savings and 24 percent less NPV benefits discounted at 7 percent to consumers compared to the energy savings and NPV benefits at TSL 5. TSL 2 achieves 37 percent lower energy savings and 11 percent less NPV benefits discounted at 7 percent to consumers compared to the energy savings and NPV benefits at TSL 5. TSL 3 achieves 20 percent lower energy savings compared to the energy savings at TSL 5.

DOE tentatively concludes that establishing standards at TSL 5 balances the benefits of the energy savings with the potential burdens placed on consumer pool heater manufacturers, including small business manufacturers. Accordingly, DOE does not propose one of the other TSLs considered in the analysis, or the other policy alternatives examined as part of the regulatory impact analysis and included in chapter 17 of the NOPR TSD.

Additional compliance flexibilities may be available through other means. EPCA provides that a manufacturer whose annual gross revenue from all of its operations does not exceed $8 million may apply for an exemption from all or part of an energy conservation standard for a period not longer than 24 months after the effective date of a final rule establishing the standard. (42 U.S.C. 6295(t)). Additionally, manufacturers subject to DOE's energy efficiency standards may apply to DOE's Office of Hearings and Appeals for exception relief under certain circumstances. Manufacturers should refer to 10 CFR part 430, subpart E, and 10 CFR part 1003 for additional details.

C. Review Under the Paperwork Reduction Act

Manufacturers of consumer pool heaters currently subject to energy conservation standards 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 consumer pool heaters, 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 consumer pool heaters. 76 FR 12422 (Mar. 7, 2011); 80 FR 5099 (Jan. 30, 2015). 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 35 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.

DOE is proposing to amend energy conservation standards for gas-fired consumer pool heaters and proposing to establish energy conservation standards for electric consumer pool heaters. DOE is not proposing to amend the existing reporting requirements or establish new DOE reporting requirements. Were DOE to establish amended and new energy conservation standards as proposed in this NOPR, DOE would consider associated reporting and certification requirements in a future rulemaking. Therefore, DOE has tentatively concluded that amended energy conservation standards for gas-fired consumer pool heaters and new energy conservation standards for electric consumer pool heaters would not impose additional costs for manufacturers related to reporting and certification.

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

DOE is analyzing this proposed regulation in accordance with the National Environmental Policy Act of 1969 (''NEPA'') and DOE's NEPA implementing regulations (10 CFR part 1021). DOE's regulations include a categorical exclusion for rulemakings that establish energy conservation standards for consumer products or industrial equipment. 10 CFR part 1021, subpart D, appendix B5.1. DOE anticipates that this rulemaking qualifies for categorical exclusion B5.1 because it is a rulemaking that establishes energy conservation standards for consumer products or industrial equipment, none of the exceptions identified in categorical exclusion B5.1(b) apply, no extraordinary circumstances exist that require further environmental analysis, and it otherwise meets the requirements for application of a categorical exclusion. See 10 CFR 1021.410. DOE will complete its NEPA review before issuing the final rule.

E. Review Under Executive Order 13132

E.O. 13132, ''Federalism,'' 64 FR 43255 (Aug. 10, 1999), imposes certain requirements on Federal agencies formulating and implementing policies or regulations that preempt State law or that have federalism implications. The Executive order requires agencies to examine the constitutional and statutory authority supporting any action that would limit the policymaking discretion of the States and to carefully assess the necessity for such actions. The Executive order also requires agencies to have an accountable process to ensure meaningful and timely input by State and local officials in the development of regulatory policies that have federalism implications. On March 14, 2000, DOE published a statement of policy describing the intergovernmental consultation process it will follow in the development of such regulations. 65 FR 13735. DOE has examined this proposed rule and has tentatively determined that it would not have a substantial direct effect on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. EPCA governs and prescribes Federal preemption of State regulations as to energy conservation for the products that are the subject of this 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) Therefore, 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 E.O. 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, (3) provide a clear legal standard for affected conduct rather than a general standard, and (4) promote simplification and burden reduction. 61 FR 4729 (Feb. 7, 1996). Regarding the review required by section 3(a), section 3(b) of E.O. 12988 specifically requires that executive

[150] TSL 4 would have an identical impact on electric pool heater manufacturers as TSL 5 since the standards for electric pool heaters are identical at TSL 4 and TSL 5. Both TSL 4 and TSL 5 require the same EL for electric pool heaters, EL 4. All small businesses only manufacture electric pool heaters. No small businesses manufacture gas-fired pool heaters. Therefore, the impacts on small businesses are identical at TSL 4 and TSL 5.

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 E.O. 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. Public Law 104–4, section 201 (codified at 2 U.S.C. 1531). For a proposed regulatory action likely to result in a rule that may cause the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector of $100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish a written statement that estimates the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a), (b)) The UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal governments on a proposed ''significant intergovernmental mandate,'' and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect them. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. 62 FR 12820. DOE's policy statement is also available at *www.energy.gov/sites/prod/files/gcprod/documents/umra_97.pdf.*

This proposed rule does not contain a Federal intergovernmental mandate, nor is it expected to require expenditures of $100 million or more in any one year by the private sector. As a result, the analytical requirements of UMRA do not apply.

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 proposed rule would not have any impact on the autonomy or integrity of the family as an institution. Accordingly, DOE has concluded that it is not necessary to prepare a Family Policymaking Assessment.

I. Review Under Executive Order 12630

Pursuant to E.O. 12630, ''Governmental Actions and Interference with Constitutionally Protected Property Rights,'' 53 FR 8859 (Mar. 15, 1988), DOE has determined that this proposed rule, if finalized, would not result in any takings that might require compensation under the Fifth Amendment to the U.S. Constitution.

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

Section 515 of the Treasury and General Government Appropriations Act, 2001 (44 U.S.C. 3516 note) provides for Federal agencies to review most disseminations of information to the public under information quality guidelines established by each agency pursuant to general guidelines issued by OMB. OMB's guidelines were published at 67 FR 8452 (Feb. 22, 2002), and DOE's guidelines were published at 67 FR 62446 (Oct. 7, 2002). Pursuant to OMB Memorandum M–19–15, Improving Implementation of the Information Quality Act (April 24, 2019), DOE published updated guidelines which are available at *www.energy.gov/sites/prod/files/2019/12/f70/DOE%20Final%20Updated%20IQA%20Guidelines%20Dec%202019.pdf.* DOE has reviewed this 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

E.O. 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 new and amended energy conservation standards for consumer pool heaters, 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 this proposed rule.

L. Information Quality

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 2664, 2667.

In response to OMB's Bulletin, DOE conducted formal peer reviews of the energy conservation standards development process and the analyses that are typically used and has prepared a report describing that peer review.[151] Generation of this report involved a rigorous, formal, and documented

[151] The 2007 ''Energy Conservation Standards Rulemaking Peer Review Report'' is available at the following website: *https://energy.gov/eere/buildings/downloads/energy-conservation-standards-rulemaking-peer-review-report-0.*

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. DOE has determined that the peer-reviewed analytical process continues to reflect current practice, and the Department followed that process for developing energy conservation standards in the case of the present proposed rulemaking.

M. Description of Materials Incorporated by Reference

In this NOPR, DOE proposes to maintain the following material previously approved for incorporation by reference in appendix P: The test standard published by American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., titled ''Method of Testing and Rating Pool Heaters'', approved February 2, 2011, ASHRAE 146; and the test standard published by American National Standards Institute, titled ''Standard for Gas-Fired Pool Heaters'', approved December 13. 2005. ANSI Z21.56.

ASHRAE 146 is an industry standard for testing and rating pool heaters. Appendix P references ASHRAE 146 to establish the active mode equilibrium condition for fossil fuel-fired pool heaters and the active mode test method, measurements, and calculations for electric resistance and electric heat pump pool heaters. The proposed amendments to appendix P include additional references to ASHRAE 146 to clarify the calculations of average annual electrical energy consumption and for electric pool heaters, output capacity. Copies of ASHRAE 146 can be obtained from American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Publication Sales, 1791 Tullie Circle NE, Atlanta, GA 30329, 800–527–4723 or 404–636–8400, or go to *www.ashrae.org.*

ANSI Z21.56 is an industry standard for testing gas-fired pool heaters. Appendix P references ANSI Z21.56 to establish the active mode test method, test conditions, measurements, and calculations for fossil fuel-fired pool heaters. The proposed amendments to appendix P include additional references to ANSI Z21.56 to clarify the calculations of input capacity and active electrical power for fossil fuel-fired pool heaters. Copies of ANSI Z21.56 can be obtained from, American National Standards Institute, 25 W. 43rd Street, 4th Floor, New York, NY 10036, 212–642–4900, or go to *www.ansi.org.*

VII. Public Participation

A. Participation in the Webinar

The time and date of the webinar meeting are listed in the **DATES** section at the beginning of this document. Webinar registration information, participant instructions, and information about the capabilities available to webinar participants will be published on DOE's website: *www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=44&action=viewcurrent.* 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 an interest in the topics addressed in this NOPR, or who is representative of a group or class of persons that has an interest in these issues, may request an opportunity to make an oral presentation at the webinar. Such persons may submit requests to speak by email to: *ApplianceStandardsQuestions@ee.doe.gov.* Persons who wish to speak should include with their request a computer file in WordPerfect, Microsoft Word, PDF, or text (ASCII) file format that briefly describes the nature of their interest in this rulemaking and the topics they wish to discuss. Such persons should also provide a daytime telephone number where they can be reached.

Persons requesting to speak should briefly describe the nature of their interest in this proposed rulemaking and provide a telephone number for contact. DOE requests persons selected to make an oral presentation to submit an advance copy of their statements at least two weeks before the webinar. At its discretion, DOE may permit persons who cannot supply an advance copy of their statement to participate, if those persons have made advance alternative arrangements with the Building Technologies Office. As necessary, requests to give an oral presentation should ask for such alternative arrangements.

C. Conduct of the Webinar

DOE will designate a DOE official to preside at the webinar 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 webinar. There shall not be discussion of proprietary information, costs or prices, market share, or other commercial matters regulated by U.S. anti-trust laws. After the webinar and until the end of the comment period, interested parties may submit further comments on the proceedings and any aspect of the rulemaking.

The webinar will be conducted in an informal, conference style. DOE will present summaries of comments received before the webinar, allow time for prepared general statements by participants, and encourage all interested parties to share their views on issues affecting this proposed 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 permit, 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. 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 proposed rulemaking. The official conducting the webinar 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 webinar.

A transcript of the webinar will be included in the docket, which can be viewed as described in the *Docket* section at the beginning of this NOPR. 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 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 www.regulations.gov. The *www.regulations.gov* web page will require you to provide your name and contact information. Your contact information will be viewable to DOE Building Technologies staff only. Your contact information will not be publicly viewable except for your first and last names, organization name (if any), and submitter representative name (if any). If your comment is not processed properly because of technical difficulties, DOE will use this information to contact you. If DOE cannot read your comment due to technical difficulties and cannot contact you for clarification, DOE may not be able to consider your comment.

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

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

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

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

Include contact information each time you submit comments, data, documents, and other information to DOE. No telefacsimiles (''faxes'') will be accepted.

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

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

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

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 requests comment on the proposal to add to its enforcement provisions to use a ±2 percent threshold on the certified value of input capacity or active electrical power (as applicable) when determining the applicable energy conservation standard for the basic model.

(2) DOE requests comment on its assumption that electric pool heaters that have both heating and cooling capabilities do not suffer diminished efficiency performance in heating mode.

(3) DOE requests comment on the product classes analyzed for this rulemaking.

(4) DOE requests comment on the proposed definitions for electric pool heater, electric spa heater, gas-fired pool heater, oil-fired pool heater, and portable electric spa.

(5) DOE requests comment on its proposed definition for output capacity, as well as its proposed calculations for determining the output capacity of electric pool heaters.

(6) DOE requests comment on the efficiency improvement expected from replacing a PSC fan motor with a BPM fan motor in heat pump pool heater.

(7) DOE seeks comment from interested parties regarding the efficiency levels selected for the NOPR analysis.

(8) DOE seeks comment from interested parties regarding the typical technological changes associated with each efficiency level.

(9) DOE requests comment on its assumption that the fraction of shipments which utilize cupronickel heat exchangers would not change as a result of amended standards.

(10) DOE requests comment on whether the distribution channels described above are appropriate for consumer pool heaters and are sufficient to describe the distribution markets. In addition, DOE seeks input on the percentage of products being distributed through the different distribution channels, and whether the share of products through each channel varies based on product class, capacity, or other features.

(11) DOE requests comment on the data sources used to establish the markups for the parties involved with the distribution of covered products.

(12) DOE requests comment on the data sources and methodology used to establish pool heater consumer samples.

(13) DOE requests comment on the overall methodology for determining consumer pool heater energy use.

(14) DOE requests comment on the data sources and methodology for determining consumer pool heater hours of operation as well as swimming pool and spa hours of operation.

(15) DOE requests comment on the methodology used for determining heat pump pool heater energy use.

(16) DOE requests comment on the methodology used for determining standby and off mode energy use.

(17) DOE requests comments on its assumption that gas-fired pool heaters installed in California, Utah, or Texas would have a low-NO_X burner and the fraction of installations outside these three regions that would have a low-NO_X burner.

(18) DOE requests comments on its assumption and methodology for

determining equipment price trends. DOE also requests data that would allow for use of different price trend projections for electric resistance and heat pump pool heaters.

(19) DOE seeks comment regarding the fraction of electric pool heater installations that are located in a space-constrained area that could increase the cost of installing a heat pump pool heater.

(20) DOE requests comments on its assumption, methodology, and sources for determining installation costs for consumer pool heaters.

(21) DOE requests comments on its approach for determining the rebound effect.

(22) DOE requests comments on its approach for developing gas, LPG, and electricity prices.

(23) DOE requests comments on its approach for calculating maintenance and repair costs.

(24) DOE welcomes additional comments and data regarding lifetime estimates, particularly in relation to differences between electric resistance pool heaters, heat pump pool heaters, and gas-fired pool heaters.

(25) DOE welcomes additional comments and data regarding estimates for energy efficiency distribution for 2020 and future distribution in 2028.

(26) DOE requests comment on DOE's methodology and data sources used for projecting the future shipments of consumer pool heaters in the absence of amended energy conservation standards.

(27) To estimate the impact on shipments of the price increase for the considered efficiency levels, DOE used a relative price elasticity approach. DOE welcomes stakeholder input on the effect of amended standards on future consumer pool heater shipments.

(28) DOE seeks additional information on industry capital and product conversion costs of compliance associated with the analyzed energy conservation standards for consumer pool heaters evaluated in this NOPR.

(29) DOE requests comment on the estimated stranded assets for both electric resistance pool heaters and gas-fired pool heaters.

(30) DOE welcomes any additional comments on the approach for conducting the emissions analysis for pool heaters.

(31) DOE requests information regarding the impact of cumulative regulatory burden on manufacturers of consumer pool heaters associated with multiple DOE standards or product-specific regulatory actions of other Federal agencies.

(32) DOE requests comment on its findings that there are six domestic small businesses that manufacture consumer pool heaters and its estimate of the potential impacts on these small businesses.

Additionally, DOE welcomes comments on other issues relevant to the conduct of this rulemaking that may not specifically be identified in this document.

VIII. Approval of the Office of the Secretary

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

List of Subjects

10 CFR Part 429

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

10 CFR Part 430

Administrative practice and procedure, Confidential business information, Energy conservation, Household appliances, Imports, Incorporation by reference, Intergovernmental relations, Small businesses.

Signing Authority

This document of the Department of Energy was signed on March 28, 2022, by Kelly J. Speakes-Backman, Principal Deputy Assistant Secretary for Energy Efficiency and Renewable Energy, pursuant to delegated authority from the Secretary of Energy. That document with the original signature and date is maintained by DOE. For administrative purposes only, and in compliance with requirements of the Office of the Federal Register, the undersigned DOE Federal Register Liaison Officer has been authorized to sign and submit the document in electronic format for publication, as an official document of the Department of Energy. This administrative process in no way alters the legal effect of this document upon publication in the **Federal Register**.

Signed in Washington, DC, on March 31, 2022.

Treena V. Garrett,

Federal Register Liaison Officer, U.S. Department of Energy.

For the reasons set forth in the preamble, DOE proposes to amend 10 CFR parts 429 and 430 as set forth below:

PART 429—CERTIFICATION, COMPLIANCE, AND ENFORCEMENT FOR CONSUMER PRODUCTS AND COMMERCIAL AND INDUSTRIAL EQUIPMENT

■ 1. The authority citation for part 429 continues to read as follows:

Authority: 42 U.S.C. 6291–6317; 28 U.S.C. 2461 note.

■ 2. Section 429.134 is amended by adding paragraph (s) to read as follows:

§ 429.134 Product-specific enforcement provisions.

* * * * *

(s) *Pool heaters.* Beginning on [DATE 5 YEARS AFTER PUBLICATION OF FINAL RULE]:

(1) *Verification of input capacity for gas-fired pool heaters.* The input capacity of each tested unit will be measured pursuant to the test requirements of § 430.23(p). The results of the measurement(s) will be compared to the represented value of input capacity certified by the manufacturer for the basic model. The certified input capacity will be considered valid only if the measurement(s) (either the measured input capacity for a single unit sample or the average of the measured input capacity for a multiple unit sample) is within two percent of the certified input capacity.

(i) If the representative value of input capacity is found to be valid, the certified input capacity will serve as the basis for determination of the applicable standard and the mean measured input capacity will be used as the basis for calculation of the integrated thermal efficiency standard for the basic model.

(ii) If the representative value of input capacity is not within two percent of the certified input capacity, DOE will first attempt to increase or decrease the gas pressure within the range specified in manufacturer's installation and operation manual shipped with the gas-fired pool heater being tested to achieve the certified input capacity (within two percent). If the input capacity is still not within two percent of the certified input capacity, DOE will attempt to modify the gas inlet orifice. If the input capacity still is not within two percent of the certified input capacity, the mean measured input capacity (either for a single unit sample or the average for a multiple unit sample) determined from the tested units will serve as the basis for calculation of the integrated thermal efficiency standard for the basic model.

(2) *Verification of active electrical power for pool heaters.* The active electrical power of each tested unit will be measured pursuant to the test

requirements of § 430.23. The results of the measurement(s) will be compared to the represented value of active electrical power city certified by the manufacturer for the basic model. The certified active electrical power will be considered valid only if the measurement(s) (either the measured active electrical power for a single unit sample or the average of the measured active electrical power for a multiple unit sample) is within two percent of the certified active electrical power.

(i) If the representative value of active electrical power is found to be valid, the certified active electrical power will serve as the basis for determination of the applicable standard and the mean measured active electrical power will be used as the basis for calculation of the integrated thermal efficiency standard for the basic model.

(ii) If the representative value of input capacity is not within two percent of the certified input capacity, the mean measured active electrical power (either for a single unit sample or the average for a multiple unit sample) determined from the tested units will serve as the basis for calculation of the integrated thermal efficiency standard for the basic model.

PART 430—ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS

■ 3. The authority citation for part 430 continues to read as follows:

Authority: 42 U.S.C. 6291–6309; 28 U.S.C. 2461 note.

■ 4. Section 430.2 is amended by adding in alphabetical order definitions for ''Electric pool heater'', ''Electric spa heater'', ''Gas-fired pool heater'', ''Oil-fired pool heater'', and ''Portable electric spa'' to read as follows:

§ 430.2 Definitions.

* * * * *

Electric pool heater means a pool heater other than an electric spa heater that uses electricity as its primary energy source.

Electric spa heater means a pool heater that—

(1) Uses electricity as its primary energy source;

(2) Has an output capacity (as measured according to appendix P to subpart B of part 430) of 11 kW or less; and

(3) Is designed to be installed within a portable electric spa.

* * * * *

Gas-fired pool heater means a pool heater that uses gas as its primary energy source.

* * * * *

Oil-fired pool heater means a pool heater that uses oil as its primary energy source.

* * * * *

Portable electric spa means a self-contained, factory-built spa or hot tub in which all control, water heating and water circulating equipment is an integral part of the product. Self-contained spas may be permanently wired or cord connected.

* * * * *

■ 5. Appendix P of subpart B of part 430 is amended by:

■ a. Revising the introductory note.

■ b. Revising sections 1., 5.2, and 5.3; and

■ c. Adding sections 5.5, 5.5.1, and 5.5.2;

The revisions and additions read as follows:

Appendix P to Subpart B of Part 430—Uniform Test Method for Measuring the Energy Consumption of Pool Heaters

Note: On and after [*Date 180 days after publication of final rule*], any representations made with respect to the energy use or efficiency of all pool heaters must be made in accordance with the results of testing pursuant to this appendix. Until [*Date 180 Days After Publication of Final Rule*], manufacturers must test gas-fired pool heaters in accordance with this appendix, or appendix P as it appeared at 10 CFR part 430, subpart B revised as of January 1, 2021. Prior to [*Date 180 days after publication of final rule*], if a manufacturer makes representations of standby mode and off mode energy consumption, then testing must also include the provisions of this appendix, or appendix P as it appeared at 10 CFR part 430, subpart B revised as of January 1, 2021, related to standby mode and off mode energy consumption.

1. Definitions

Active electrical power means the maximum electrical power consumption in active mode for an electric pool heater.

Active mode means the condition during the pool heating season in which the pool heater is connected to the power source, and the main burner, electric resistance element, or heat pump is activated to heat pool water.

Coefficient of performance (COP), as applied to heat pump pool heaters, means the ratio of heat output in kW to the total power input in kW.

Electric heat pump pool heater means an appliance designed for heating nonpotable water and employing a compressor, water-cooled condenser, and outdoor air coil.

Electric resistance pool heater means an appliance designed for heating nonpotable water and employing electric resistance heating elements.

Fossil fuel-fired pool heater means an appliance designed for heating nonpotable water and employing gas or oil burners.

Hybrid pool heater means an appliance designed for heating nonpotable water and employing both a heat pump (compressor, water-cooled condenser, and outdoor air coil) and a fossil fueled burner as heating sources.

Input capacity means the maximum fuel input rate for a fossil fuel-fired pool heater.

Off mode means the condition during the pool non-heating season in which the pool heater is connected to the power source, and neither the main burner, nor the electric resistance elements, nor the heat pump is activated, and the seasonal off switch, if present, is in the ''off'' position.

Output capacity for an electric pool or spa heater means the maximum rate at which energy is transferred to the water.

Seasonal off switch means a switch that results in different energy consumption in off mode as compared to standby mode.

Standby mode means the condition during the pool heating season in which the pool heater is connected to the power source, and neither the main burner, nor the electric resistance elements, nor the heat pump is activated.

* * * * *

5.2 *Average annual fossil fuel energy for pool heaters.* For electric resistance and electric heat pump pool heaters, the average annual fuel energy for pool heaters, $E_F = 0$.

For fossil fuel-fired pool heaters, the average annual fuel energy for pool heaters, E_F, is defined as:

$$E_F = BOH\ Q_{IN} + (POH - BOH)\ Q_{PR} + (8760 - POH)\ Q_{off,R}$$

where:

BOH = average number of burner operating hours = 104 h,

POH = average number of pool operating hours = 4,464 h,

Q_{IN} = input capacity, in Btu/h, calculated as the quantity $CF \times Q \times H$ in the equation for thermal efficiency in Section 2.10.1 of ANSI Z21.56 (incorporated by reference; see § 430.3) and divided by 0.5 h (For electric resistance and electric heat pump pool heaters, $Q_{IN} = 0$.),

Q_{PR} = average energy consumption rate of continuously operating pilot light, if employed, = (Q_P/1 h),

Q_P = energy consumption of continuously operating pilot light, if employed, as measured in section 4.2 of this appendix, in Btu,

8760 = number of hours in one year,

$Q_{off,R}$ = average off mode fossil fuel energy consumption rate = Q_{off}/(1 h), and

Q_{off} = off mode energy consumption as defined in section 4.3 of this appendix.

5.3 *Average annual electrical energy consumption for pool heaters.* The average annual electrical energy consumption for pool heaters, E_{AE}, is expressed in Btu and defined as:

(1) $E_{AE} = E_{AE,active} + E_{AE,standby,off}$
(2) $E_{AE,active} = BOH * PE$
(3) $E_{AE,standby,off} = (POH - BOH) P_{W,SB}(Btu/h) + (8760 - POH) P_{W,OFF}(Btu/h)$

where:

$E_{AE,active}$ = electrical consumption in the active mode,
$E_{AE,standby,off}$ = auxiliary electrical consumption in the standby mode and off mode,
PE = active electrical power, calculated as:
= $2E_c$, for fossil fuel-fired heaters tested according to sSection 2.10.1 of ANSI Z21.56 and for electric resistance pool heaters, in Btu/h,
= 3.412 $PE_{aux,rated}$, for fossil fuel-fired heaters tested according to Section 2.10.2 of ANSI Z21.56, in Btu/h,
= $E_{c,HP} * (60/t_{HP})$, for electric heat pump pool heaters, in Btu/h.
E_c = electrical consumption in Btu per 30 min. This includes the electrical consumption (converted to Btus) of the pool heater and, if present, a recirculating pump during the 30-minute thermal efficiency test. The 30-minute thermal efficiency test is defined in section 2.10.1 of ANSI Z21.56 for fossil fuel-fired pool heaters and Section 9.1.4 of ASHRAE 146 (incorporated by reference; see § 430.3) for electric resistance pool heaters.
2 = conversion factor to convert unit from per 30 min. to per h.
$PE_{aux,rated}$ = nameplate rating of auxiliary electrical equipment of heater, in Watts
$E_{c,HP}$ = electrical consumption of the electric heat pump pool heater (converted to equivalent unit of Btu), including the electrical energy to the recirculating pump if used, during the thermal efficiency test, as defined in Section 9.1 of ASHRAE 146, in Btu. t_{HP} = elapsed time of data recording during the thermal efficiency test on electric heat pump pool heater, as defined in Section 9.1 of ASHRAE 146, in minutes.
BOH = as defined in section 5.2 of this appendix,
POH = as defined in section 5.2 of this appendix,
$P_{W,SB}(Btu/h)$ = electrical energy consumption rate during standby mode expressed in Btu/h = 3.412 $P_{W,SB}$, Btu/h,
$P_{W,SB}$ = as defined in section 4.2 of this appendix,
$P_{W,OFF}(Btu/h)$ = electrical energy consumption rate during off mode expressed in Btu/h = 3.412 $P_{W,OFF}$, Btu/h, and
$P_{W,OFF}$ = as defined in section 4.3 of this appendix.

* * * * *

5.5 *Output capacity for electric pool heaters.*

5.5.1 Calculate the output capacity of an electric heat pump pool heater as:

$$Q_{OUT,HP} = k * W * (T_{ohp} - T_{ihp}) * (60/t_{HP})$$

where k is the specific heat of water, W is the mass of water collected during the test, T_{ohp} is the average outlet water temperature during the standard rating test, T_{ihp} is the average inlet water temperature during the standard rating test, all as defined in Section 11.2 of ASHRAE 146, and t_{HP} is the elapsed time in minutes of data recording during the thermal efficiency test on electric heat pump pool heater, as defined in Section 9.1 of ASHRAE 146.

5.5.2 Calculate the output capacity of an electric resistance pool heater as:

$$Q_{OUT,ER} = k * W * (T_{mo} - T_{mi}) * (60/30)$$

where k is the specific heat of water, W is the mass of water collected during the test, T_{mo} is the average outlet water temperature recorded during the primary test, and T_{mi} is the average inlet water temperature record during the primary test, all as defined in Section 11.1 of ASHRAE 146, and 60/30 is the conversion factor to convert unit from per 30 minutes to per hour.

■ 6. Section 430.32 is amended by revising paragraph (k) to read as follows:

§ 430.32 Energy and water conservation standards and their compliance dates.

* * * * *

(k) *Pool heaters.* (1) Gas-fired pool heaters manufactured on and after April 16, 2013 and before [DATE 5 YEARS AFTER PUBLICATION OF FINAL RULE], shall have a thermal efficiency not less than 82%.

(2) Gas-fired pool heaters and electric pool heaters manufactured on and after [DATE 5 YEARS AFTER PUBLICATION OF FINAL RULE], shall have an integrated thermal efficiency not less than the following:

Product Class	Integrated Thermal Efficiency (percent)[1]
(i) Gas-fired Pool Heater	$\frac{84(Q_{IN} + 491)}{Q_{IN} + 2,536}$
(ii) Electric Pool Heater	$\frac{600\ PE}{PE + 1,619}$

[1] Q_{IN} is the certified input capacity of a gas-fired pool heater basic model, in Btu/h, and PE is the certified active electrical power of an electric pool heater, in Btu/h.

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