This document, concerning Dedicated Purpose Pool Pump Motors is an action issued by the U.S. Department of Energy (DOE). Though it is not intended or expected, should any discrepancy occur between the document posted here and the document published in the Federal Register, the Federal Register publication controls.

The text of this rule is subject to correction based on the identification of errors as defined in 10 CFR 430.5 before publication in the Federal Register. Readers are requested to notify DOE by email at ErrorCorrectionInfo@EE.DOE.Gov of any typographical or other errors, as described in such regulations, by no later than midnight on September 11, 2023, in order that DOE may make any necessary corrections in the regulatory text submitted to the Office of the Federal Register for publication

[6450-01-P]

DEPARTMENT OF ENERGY

10 CFR Parts 429 and 431

[EERE-2017-BT-STD-0048]

RIN 1904-AF27

Energy Conservation Program: Energy Conservation Standards for Dedicated Purpose Pool Pump Motors

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

ACTION: Final rule.

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 dedicated purpose pool pump motors. When DOE is considering adopting energy conservation standards, EPCA requires that the standards be designed to achieve the maximum improvement in energy efficiency, which DOE determines is technologically feasible and economically justified. In this final rule, DOE is adopting amended energy conservation standards for dedicated purpose pool pump motors. It has determined that the new energy conservation standards for these products would result in significant conservation of energy, and are technologically feasible and economically justified.

DATES: The effective date of this rule is **[INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]**. Compliance with the new standards established for dedicated purpose pool pump motors with motor total horsepower < 0.5 THP in this final rule is required on and after [**INSERT DATE 2**

YEARS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]. Compliance with the new standards established for dedicated purpose pool pump motors with motor total horsepower ≥0.5 THP and <1.15 THP in this final rule is required on and after [**INSERT DATE 4 YEARS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER***]. Finally, compliance with the new standards established for dedicated purpose pool pump motors with motor total horsepower ≥1.15 THP and ≤5 THP in this final rule is required on and after [**INSERT DATE 2 YEARS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER***]. The incorporation of refence of certain material listed in this rule is approved by the Director of the Federal Register on [**INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER***].

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

The docket webpage can be found *www.regulations.gov/docket/EERE-2017-BT-STD-0048*. The docket webpage contains instructions on how to access all documents, including public comments, in the docket.

For further information on how to review the docket, contact the Appliance and Equipment Standards Program staff at (202) 287-1445 or by email: *ApplianceStandardsQuestions@ee.doe.gov*.

FOR FURTHER INFORMATION CONTACT:

Mr. Jeremy Dommu, 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. Email: *ApplianceStandardsQuestions@ee.doe.gov*.

Ms. Amelia Whiting, U.S. Department of Energy, Office of the General Counsel, GC-33, 1000 Independence Avenue, SW., Washington, DC, 20585-0121. Telephone: (202) 586-2588. Email: *amelia.whiting@hq.doe.gov*.

SUPPLEMENTARY INFORMATION:

DOE incorporates by reference the following standard into parts 429 and 431:

UL 1004–10, *Standard for Safety for Pool Pump Motors*, Revised First Edition, Dated March 24, 2022 ("UL 1004-10:2022).

Copies of UL 1004-10:2022 can be obtained from: Underwriters Laboratories ("UL"), 333 Pfingsten Road, Northbrook, IL 60062, (841) 272–8800, or go to *www.ul.com*.

For a further discussion of this standard, *see* section VI.N of this document.

Table of Contents

I. Synopsis of the Final Rule

The Energy Policy and Conservation Act, Pub. L. 94-163, as amended ("EPCA"),[1] authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment. (42 U.S.C. 6291–6317) Title III, Part C of the Energy Policy and Conservation Act, as amended (EPCA)[2] established the Energy

[1] All references to EPCA in this document refer to the statute as amended through the Energy Act of 2020, Pub. L. 116-260 (Dec. 27, 2020), which reflect the last statutory amendments that impact Parts A and A-1 of EPCA.
[2] For editorial reasons, upon codification in the U.S. Code, Part C was re-designated Part A-1.

Conservation Program for Certain Industrial Equipment. (42 U.S.C. 6311-6317) Such equipment includes electric motors, which include dedicated-purpose pool pump motors ("DPPP motors" or "DPPPMs" or "pool pump motors"), the subject of this rulemaking. (42 U.S.C. 6311(1)(A)). This rulemaking does not concern standards for dedicated-purpose pool pumps ("DPPPs"), which are being addressed in a separate rulemaking.[3]

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. 6316(a); 42 U.S.C. 6295(o)(2)(A)) Furthermore, the new or amended standard must result in significant conservation of energy. (42 U.S.C. 6295(o)(3)(B))

In accordance with these and other statutory provisions discussed in this document, DOE is adopting new energy conservation standards for DPPP motors. The adopted standards, which are expressed in full-load efficiency and design requirements, are shown in Table I.1. DOE is finalizing standards that apply to all products listed in Table I.1 and manufactured in, or imported into, the United States starting on the dates provided in the table.

[3] Docket No. EERE-2022-BT-STD-0001, which is maintained at *www.regulations.gov/docket/EERE-2022-BT-STD-0001*.

Table I.1 Energy Conservation Standards for DPPP Motors (TSL 7)

Motor Total Horsepower (THP)	Performance Standard: Full-load efficiency (%)	Design Requirement: Speed Capability	Design Requirement: Freeze Protection	Compliance Date
THP <0.5	69%	None	None	**[INSERT DATE 2 YEARS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]**
0.5≤ THP <1.15	-	Variable speed control*	Only for DPPP motors with freeze protection controls**	**[INSERT DATE 4 YEARS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]**
1.15≤ THP ≤5	-	Variable speed control*	Only for DPPP motors with freeze protection controls**	**[INSERT DATE 2 YEARS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]**

* A variable speed motor is a DPPP motor that meets the definition of "variable-speed control dedicated-purpose pool pump motor" as defined by UL 1004-10:2022.
** DPPP motors with freeze protection controls are to be shipped with the freeze protection feature disabled, or with the following default, user-adjustable settings: (a) the default dry-bulb air temperature setting shall be no greater than 40 °F; (b) the default run time setting shall be no greater than 1 hour (before the temperature is rechecked); and (c) the default motor speed in freeze protection mode shall not be more than half of the maximum operating speed.

A. Benefits and Costs to Consumers

Table I.2 summarizes DOE's evaluation of the economic impacts of the adopted standards on consumers of DPPP motors, as measured by the average life-cycle cost ("LCC") savings and the simple payback period ("PBP").[4] The average LCC savings are positive for each equipment class, and the PBP is less than the average lifetime of DPPP motors, which is estimated to be 4.5 years (*see* section IV.F of this document).

[4] The average LCC savings refer to consumers that are affected by a standard and are measured relative to the distribution of purchased DPPP motors, and their associated energy 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 document). The simple PBP, which is designed to compare specific efficiency levels, is measured relative to the baseline product (*see* section IV.C of this document).

Table I.2 Impacts of Adopted Energy Conservation Standards on Consumers of DPPP Motors

DPPP Motors Equipment Class	Average LCC Savings *2022$*	Simple Payback Period *years*
Extra-small-size (THP <0.5)	$3	0.9
Small-size (0.5 ≤ THP <1.15)	$4	3.4
Standard-size (1.15 ≤ THP ≤ 5)	$236	1.3

DOE's analysis of the impacts of the adopted 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, which align with the industry profits from producing DPPP motors, from the base year through the end of the analysis period (2024–2055).[5] Using a real discount rate of 7.2 percent, DOE estimates that the INPV for manufacturers of DPPP motors in the case without new standards is $661 million in 2022$. Under the adopted standards, DOE estimates the change in INPV to range from -32.4 percent to 12.0 percent, which is approximately -$214.2 million to $79.0 million change in profits. In order to bring products into compliance with new standards, it is estimated that industry will incur total conversion costs of $56.2 million.[6]

DOE's analysis of the impacts of the adopted standards on manufacturers is described in sections IV.J and V.B.2 of this document.

[5] This time period captures manufacturers' profits starting with the years leading up to the compliance date, at which time they are making investments to comply with standards, and throughout the 30-year analysis period after the compliance date.
[6] Conversion costs are included in the INPV calculation.

C. National Benefits and Costs[7]

DOE's analyses indicate that the adopted energy conservation standards for DPPP motors would save a significant amount of energy. Relative to the case without new standards, the lifetime energy savings for DPPP motors purchased in the 30-year period that begins in the anticipated first full year of compliance with the new standards (2026–2055),[8] amount to 1.56 quadrillion British thermal units ("Btu"), or quads.[9] This represents a savings of 27.5 percent relative to the energy use of these products in the case without new standards (referred to as the "no-new-standards case").

The cumulative net present value ("NPV") of total consumer benefits of the standards for DPPP motors ranges from $5.4 billion (at a 7-percent discount rate) to $10.2 billion (at a 3-percent discount rate). This NPV expresses the estimated total value of future operating-cost savings minus the estimated increased equipment and installation costs for DPPP motors purchased in 2026–2055 relative to the no-new-standards case.[10]

In addition, the adopted standards for DPPP motors are projected to yield significant environmental benefits. DOE estimates that the standards will result in cumulative emission reductions (over the same period as for energy savings) of 31.2 million metric tons (Mt)[11] of carbon dioxide (CO_2), 9.8 thousand tons of sulfur dioxide

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[7] All monetary values in this document are expressed in 2021 dollars and, where appropriate, are discounted to 2024 unless explicitly stated otherwise.
[8]DOE conducted the analysis over a 30-year period starting in 2026 (2026–2055). As discussed in section III.A of this document, for all TSLs DOE considered a 2-year lead time resulting in a first full year of compliance of 2026, except for small-size DPPP motors at TSL 7 where DOE uses a 4-year compliance lead time, resulting in a compliance year of 2028. In this case, DOE considered 28 years of shipments (2028–2055)
[9] 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.
[10] For small size DPPP motors, as noted previously, DOE considered 28 years of shipments (2028–2055)
[11] A metric ton is equivalent to 1.1 short tons. Results for emissions other than CO_2 are presented in short tons.

(SO_2), 56.4 thousand tons of nitrogen oxides (NO_X), 247.2 thousand tons of methane (CH_4), 0.32 thousand tons of nitrous oxide (N_2O), and 0.07 tons of mercury (Hg).[12]

DOE estimates the value of climate benefits from a reduction in greenhouse gases (GHG) 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 GHG (SC-GHG). DOE used interim SC-GHG values developed by an Interagency Working Group on the Social Cost of Greenhouse Gases (IWG).[13] 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 over the period of analysis are estimated to be $2.0 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 sets of SC-GHG estimates.

DOE estimated the monetary health benefits of SO_2 and NO_X emissions reductions, using benefit per ton estimates from the Environmental Protection Agency,[14] as discussed in section IV.L of this document. DOE estimated the present value of the health benefits would be $2.0 billion using a 7-percent discount rate, and $3.9 billion

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[12] DOE calculated emissions reductions relative to the no-new-standards-case, which reflects key assumptions in the *Annual Energy Outlook 2023* (*AEO2023*). *AEO2023* represents current federal and state legislation and final implementation of regulations as of the time of its preparation. See section IV.K of this document for further discussion of *AEO2023* assumptions that effect air pollutant emissions.

[13] To monetize the benefits of reducing GHG emissions this analysis uses the interim 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 IWG. ("February 2021 SC-GHG TSD"). *www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf.*

[14] U.S. EPA. Estimating the Benefit per Ton of Reducing Directly Emitted PM2.5, PM2.5 Precursors and Ozone Precursors from 21 Sectors. Available at *www.epa.gov/benmap/estimating-benefit-ton-reducing-pm25-precursors-21-sectors.*

using a 3-percent discount rate. DOE is currently only monetizing health benefits from changes in ambient fine particulate matter ($PM_{2.5}$) concentrations from two precursors (SO_2 and (for NO_X) and from changes in ambient ozone from one precursor (NO_X), but will continue to assess the ability to monetize other effects such as health benefits from reductions in direct $PM_{2.5}$ emissions.

Table I.3 summarizes the monetized benefits and costs expected to result from the amended standards for DPPP motors. There are other important unquantified effects, including certain unquantified climate benefits, unquantified public health benefits from the reduction of toxic air pollutants and other emissions, unquantified energy security benefits, and distributional effects, among others.

Table I.3 Present Value in 2024 of Monetized Benefits and Costs of Adopted Energy Conservation Standards for DPPP Motors

	Billion 2022$
3% discount rate	
Consumer Operating Cost Savings	14.0
Climate Benefits*	2.0
Health Benefits**	3.9
Total Monetized Benefits†	19.9
Consumer Incremental Equipment Costs‡	3.9
Net Monetized Benefits	16.0
Change in Producer Cashflow (INPV††)	(0.21) - 0.08
7% discount rate	
Consumer Operating Cost Savings	7.9
Climate Benefits* (3% discount rate)	2.0
Health Benefits**	2.0
Total Monetized Benefits†	11.9
Consumer Incremental Equipment Costs‡	2.6
Net Monetized Benefits	9.3
Change in Producer Cashflow (INPV††)	(0.21) - 0.08

Note: This table presents the present value of the monetized costs and benefits associated with product name shipped in 2026−2055, except for small-size DPPP motors where shipments in 2028-2055 are considered. These results include consumer, climate, and health benefits which accrue after 2055 from the products shipped in 2026−2055 (or 2028-2055).
* Climate benefits are calculated using four different estimates of the social cost of carbon (SC-CO_2), methane (SC-CH_4), and nitrous oxide (SC-N_2O) (model average at 2.5-percent, 3-percent, and 5-percent discount rates; 95th percentile at 3-percent discount rate) (*see* section IV.L of this document). Together these represent the global 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 DOE does not have a single central SC-GHG point estimate. To monetize the benefits of reducing greenhouse gas emissions this analysis uses the interim 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).
** Health benefits are calculated using benefit-per-ton values for NO_X and SO_2. 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. *See* section IV.L of this document for more details.
† Total and net benefits include those consumer, climate, and health benefits that can be quantified and monetized. 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 DOE does not have a single central SC-GHG point estimate. DOE emphasizes the importance and value of considering the benefits calculated using all four sets of SC-GHG estimates.
‡ Costs include incremental equipment costs as well as installation costs.
†† Operating Cost Savings are calculated based on the life cycle costs analysis and national impact analysis as discussed in detail below. *See* sections IV.F and IV.H of this document. DOE's NIA includes all impacts (both costs and benefits) along the distribution chain beginning with the increased costs to the manufacturer to manufacture the equipment and ending with the increase in price experienced by the consumer. DOE also separately conducts a detailed analysis on the impacts on manufacturers (the MIA). *See* section IV.J of this document. In the detailed MIA, DOE models manufacturers' pricing decisions based on assumptions regarding investments, conversion costs, cashflow, and margins. The MIA produces a range of impacts, which is the rule's expected impact on the INPV. The change in INPV is the present

value of all changes in industry cash flow, including changes in production costs, capital expenditures, and manufacturer profit margins. Change in INPV is calculated using the industry weighted average cost of capital value of 7.2% that is estimated in the MIA (see chapter 12 of the Final Rule TSD for a complete description of the industry weighted average cost of capital). For DPPP motors, those values are -$214 million and $79 million. DOE accounts for that range of likely impacts in analyzing whether a TSL is economically justified. See section V.C of this document. DOE is presenting the range of impacts to the INPV under two markup scenarios: the Preservation of Gross Margin scenario, which is the manufacturer markup scenario used in the calculation of Consumer Operating Cost Savings in this table, and the Preservation of Operating Profit Markup scenario, where DOE assumed manufacturers would not be able to increase per-unit operating profit in proportion to increases in manufacturer production costs. DOE includes the range of estimated INPV in the above table, drawing on the MIA explained further in Section IV.J of this document, to provide additional context for assessing the estimated impacts of this rule to society, including potential changes in production and consumption, which is consistent with OMB's Circular A-4 and E.O. 12866. If DOE were to include the INPV into the net benefit calculation for this final rule, the net benefits would range from $15.79 billion to $16.08 billion at 3-percent discount rate and range from $9.09 billion to $9.38 billion at 7-percent discount rate.

The benefits and costs of the standards 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 monetized value of climate and health benefits of emission reductions, all annualized.[15]

The national operating cost 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 DPPP motors shipped in (2026–2055).[16] The benefits associated with reduced emissions achieved as a result of the adopted standards are also calculated based on the lifetime of DPPP motors shipped in (2026–2055).[16] Total benefits for both the 3-percent and 7-percent cases are presented using the average GHG social costs with 3-percent

[15] To convert the time-series of costs and benefits into annualized values, DOE calculated a present value in 2024, 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 or 2040), and then discounted the present value from each year to 2024. 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.

[16] For small size DPPP motors, as noted previously, DOE considered 28 years of shipments (2028–2055).

discount rate. Estimates of SC-GHG values are presented for all four discount rates in section V.B.6 of this document.

Table I.4 presents the total estimated monetized benefits and costs associated with the standard, expressed in terms of annualized values. 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 NO_X and SO_2 emissions, and the 3-percent discount rate case for climate benefits from reduced GHG emissions, the estimated monetized cost of the standards adopted in this rule is $221 million per year in increased equipment costs, while the estimated annual benefits are $684 million in reduced equipment operating costs, $103 million in monetized climate benefits, and $173 million in monetized health benefits. In this case, the monetized net benefit would amount to $739 million per year.

Using a 3-percent discount rate for all benefits and costs, the estimated monetized cost of the standards is $204 million per year in increased equipment costs, while the estimated annual monetized benefits are $738 million in reduced operating costs, $103 million in monetized climate benefits, and $205 million in monetized health benefits. In this case, the monetized net benefit would amount to $841 million per year.

Table I.4 Annualized Monetized Benefits and Costs of Adopted Standards for DPPP Motors

	Million 2022$/year		
	Primary Estimate	**Low-Net-Benefits Estimate**	**High-Net-Benefits Estimate**
3% discount rate			
Consumer Operating Cost Savings	738	721	760
Climate Benefits*	103	103	103
Health Benefits**	205	205	205
Total Monetized Benefits†	1,046	1029	1,068
Consumer Incremental Equipment Costs‡	204	235	173
Monetized Net Benefits	841	793	895
Change in Producer Cashflow (INPV††)	(17) - 6	(17) - 6	(17) - 6
7% discount rate			
Consumer Operating Cost Savings	684	671	703
Climate Benefits* (3% discount rate)	103	103	103
Health Benefits**	173	173	173
Total Monetized Benefits†	960	947	979
Consumer Incremental Equipment Costs‡	221	250	190
Monetized Net Benefits	739	696	790
Change in Producer Cashflow (INPV††)	(17) - 6	(17) - 6	(17) - 6

Note: This table presents the costs and benefits associated with DPPP motors shipped in 2026−2055, except for small-size DPPP motors where shipments in 2028-2055 are considered. These results include consumer, climate, and health benefits which accrue after 2055 from the products shipped in 2026−2055 (or 2028-2055). The Primary, Low Net Benefits, and High Net Benefits Estimates utilize projections of energy prices from the *AEO2023* Reference case, Low Economic Growth case, and High Economic Growth case, respectively. In addition, incremental equipment costs reflect a medium decline rate in the Primary Estimate, an increasing rate in the Low Net Benefits Estimate, and a high decline rate in the High Net Benefits Estimate. The methods used to derive projected price trends are explained in sections IV.F.1 and IV.H.3 of this document. Note that the Benefits and Costs may not sum to the Net Benefits due to rounding.

* Climate benefits are calculated using four different estimates of the global SC-GHG (*see* section IV.L of this document). For presentational purposes of this table, the climate benefits associated with the average SC-GHG at a 3 percent discount rate are shown, but 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 sets of SC-GHG estimates. To monetize the benefits of reducing greenhouse gas emissions this analysis uses the interim 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).

** Health benefits are calculated using benefit-per-ton values for NO_X and SO_2. 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. *See* section IV.L of this document for more details.

† Total benefits for both the 3-percent and 7-percent cases are presented using the average SC-GHG with 3-percent discount rate, but DOE does not have a single central SC-GHG point estimate.

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

†† Operating Cost Savings are calculated based on the life cycle costs analysis and national impact analysis as discussed in detail below. *See* sections IV.F and IV.H of this document. DOE's NIA includes all

impacts (both costs and benefits) along the distribution chain beginning with the increased costs to the manufacturer to manufacture the equipment and ending with the increase in price experienced by the consumer. DOE also separately conducts a detailed analysis on the impacts on manufacturers (the MIA). *See* section IV.J of this document. In the detailed MIA, DOE models manufacturers' pricing decisions based on assumptions regarding investments, conversion costs, cashflow, and margins. The MIA produces a range of impacts, which is the rule's expected impact on the INPV. The change in INPV is the present value of all changes in industry cash flow, including changes in production costs, capital expenditures, and manufacturer profit margins. Annualized change in INPV is calculated using the industry weighted average cost of capital value of 7.2% that is estimated in the MIA (see chapter 12 of the Final Rule TSD for a complete description of the industry weighted average cost of capital). For DPPP motors, those values are -$17 million and $6 million. DOE accounts for that range of likely impacts in analyzing whether a TSL is economically justified. *See* section V.C of this document. DOE is presenting the range of impacts to the INPV under two markup scenarios: the Preservation of Gross Margin scenario, which is the manufacturer markup scenario used in the calculation of Consumer Operating Cost Savings in this table, and the Preservation of Operating Profit Markup scenario, where DOE assumed manufacturers would not be able to increase per-unit operating profit in proportion to increases in manufacturer production costs. DOE includes the range of estimated annualized change in INPV in the above table, drawing on the MIA explained further in section IV.J of this document, to provide additional context for assessing the estimated impacts of this rule to society, including potential changes in production and consumption, which is consistent with OMB's Circular A-4 and E.O. 12866. If DOE were to include the INPV into the annualized net benefit calculation for this final rule, the annualized net benefits would range from $824 million to $847 million at 3-percent discount rate and range from $722 million to $745 million at 7-percent discount rate.

DOE's analysis of the national impacts of the adopted standards is described in sections IV.G.2, IV.K, and IV.L of this document.

D. Conclusion

DOE concludes that the standards adopted in this final rule represent the maximum improvement in energy efficiency that is technologically feasible and economically justified, and would result in the significant conservation of energy. Specifically, equipment are able to achieve these standard levels using technology options currently available in the DPPPM market. As for economic justification, DOE's analysis shows that the benefits of the standards exceed the burdens of the standards.

Using a 7-percent discount rate for consumer benefits and costs and NO_X and SO_2 reduction benefits, and a 3-percent discount rate case for GHG social costs, the estimated monetized cost of the standards for DPPP motors is $221 million per year in increased equipment costs, while the estimated annual monetized benefits are $684 million in reduced equipment operating costs, $103 million in monetized climate benefits, and $173 million in monetized ambient air pollutant health benefits. The monetized net benefit amounts to $739 million per year.

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.[17] For example, 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. Accordingly, DOE evaluates the significance of energy savings on a case-by-case basis.

As previously mentioned, the standards are projected to result in estimated national energy savings[18] of 1.56 quads FFC, the equivalent of the primary annual energy use of 16.8 million homes. In addition, they are projected to reduce CO_2 emissions by 31.2 Mt. Based on these findings, DOE has determined the energy savings from the standard levels adopted in this final rule are "significant" within the meaning of 42 U.S.C. 6295(o)(3)(B). A more detailed discussion of the basis for these conclusions is contained in the remainder of this document and the accompanying TSD.

[17] Procedures, Interpretations, and Policies for Consideration in New or Revised Energy Conservation Standards and Test Procedures for Consumer Products and Commercial/Industrial Equipment, 86 FR 70892, 70901 (Dec. 13, 2021).
[18] Associated with DPPP motors shipped in 2026–2055, except for small-size DPPP motors where shipments in 2028-2055 are considered.

II. Introduction

The following section briefly discusses the statutory authority underlying this final rule, as well as some of the relevant historical background related to the establishment of standards for DPPP motors.

A. Authority

EPCA authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment. Title III, Part C of EPCA, added by Pub. L. 95-619, Title IV, section 441(a) (42 U.S.C. 6311-6317, as codified), established the Energy Conservation Program for Certain Industrial Equipment, which sets forth a variety of provisions designed to improve energy efficiency. This equipment includes those electric motors that are DPPP motors, the subject of this document. (42 U.S.C. 6311(1)(A))

The energy conservation program 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 include definitions (42 U.S.C. 6311), test procedures (42 U.S.C. 6314), labeling provisions (42 U.S.C. 6315), energy conservation standards (42 U.S.C. 6316 (a); 42 U.S.C. 6295), and the authority to require information and reports from manufacturers (42 U.S.C. 6316).

Federal energy efficiency requirements for covered equipment established under EPCA generally supersede State laws and regulations concerning energy conservation testing, labeling, and standards. (42 U.S.C. 6316(a); 42 U.S.C. 6297) There are currently no Federal energy conservation standards for DPPP motors. DOE noted in the July 2021 Final Rule that efforts by States to set energy conservation standards, test procedures, or labeling requirements for DPPP motors—or any other electric motor—are preempted as a matter of law. 86 FR 40765, 40767.

Upon further consideration, however, DOE is clarifying here that none of the provisions in 42 U.S.C. 6313 apply to DPPP motors because, although they are a category of electric motor, DPPPP motors are not among the category of electric motors for which Congress established standards and a rulemaking schedule in 42 U.S.C. 6313(b). Thus, state DPPP motor standards are not already preempted as a matter of law. EPCA outlines rules of preemption for state energy conservation standards before a federal standard promulgated becomes effective. 42 U.S.C. 6316(a); 42 U.S.C. 6297(b). Specifically, it provides that no state regulation concerning energy efficiency or energy use of covered equipment shall be effective with respect to the covered equipment – in the absence of a federal regulation – unless the state regulation is a regulation regulating electric motors other than those to which 42 U.S.C. 6313 is applicable. 42 U.S.C. 6316(a)(7); 42 U.S.C. 6297(b)(4). As discussed in section III.A. of this document, DPPPM are a category of electric motor, but are excepted from the requirements of 42 U.S.C. 6313(b). *See* 42 U.S.C. 6313(b)(1). Further, there are no other provisions in 42 U.S.C. 6313 that would apply to DPPP motors. Therefore, any state regulations establishing or amending standards for DPPPM are not currently preempted.

Instead, under 42 U.S.C. 6297(c), upon the compliance date for the Federal standards in this final rule, the Federal standards will supersede the CEC standards requirements for replacement dedicated-purpose pool pump motors (“RDPPPM”) for the first time. For extra-small-size and standard-size DPPP motors, the CEC standards will be superseded on the compliance date applicable to these DPPP motors, which is 2 years after the publication of this final rule. For small-size DPPP motors, which have an additional two-year lead time, the CEC standards would be superseded on the compliance date applicable to small-size DPPP motors, which is 4 years after the publication of this final rule. DOE may, however, grant waivers of Federal preemption in limited instances for particular State laws or regulations, in accordance with the procedures and other provisions set forth under EPCA. (*See* 42 U.S.C. 6316(a) (applying the preemption waiver provisions of 42 U.S.C. 6297))

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. (*See* 42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(3)(A) and (r)) Manufacturers of covered equipment must use the Federal test procedures as the basis for: (1) certifying to DOE that their equipment complies with the applicable energy conservation standards adopted pursuant to EPCA (42 U.S.C. 6316(a); 42 U.S.C. 6295(s)), and (2) making representations about the efficiency of that equipment (42 U.S.C. 6314(d)). Similarly, DOE must use these test procedures to determine whether the equipment complies with relevant standards promulgated under EPCA. (42 U.S.C. 6316(a); 42 U.S.C. 6295(s)) The DOE test procedures for DPPP motors appear at title 10 of the Code of Federal Regulations ("CFR") §431.484.

DOE must follow specific statutory criteria for prescribing new or amended standards for covered equipment, including DPPP motors. 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 ("Secretary") determines is technologically feasible and economically justified. (42 U.S.C. 6316(a); 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. 6316(a); 42 U.S.C. 6295(o)(3)) Moreover, DOE may not prescribe a standard (1) for certain products, including DPPP motors, 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. 6316(a); 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. 6316(a); 42 U.S.C. 6295(o)(3)(A)-(B)) 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 considers relevant.

(42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(2)(B)(i)(I)-(VII))

Further, EPCA, as codified, 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. 6316(a); 42 U.S.C. 6295(o)(2)(B)(iii))

DOE must also periodically evaluate the energy conservation standards for certain covered equipment, including electric motors, and publish either a notification of determination that the standards do not need to be amended, or a notice of proposed rulemaking ("NOPR") that includes new proposed energy conservation standards (proceeding to a final rule, as appropriate). *See* 42 U.S.C. 6316(a) and 42 U.S.C. 6295(m)(1).

EPCA, as codified, also contains what is known as an "anti-backsliding" provision, which prevents the Secretary from prescribing any amended standard that either increases the maximum allowable energy use or decreases the minimum required energy efficiency of a covered product. (42 U.S.C. 6316(a); 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. 6316(a); 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 products 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. 6316(a); 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 such a 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. 6316(a); 42 U.S.C. 6295(q)(2))

B. Background

1. Current Standards

DPPP motors are electric motors, which are defined as machines that convert electrical power into rotational mechanical power. 10 CFR 431.12. DOE has established test procedures, labeling requirements, and energy conservation standards for certain electric motors (10 CFR part 431, subpart B), but those requirements do not apply to DPPP motors. DOE has separately established a test procedure for DPPP motors in 10

CFR 431.484. The scope of the DPPP motor definition includes DPPP motors regardless of how the equipment is sold; *i.e.*, incorporated in a DPPP or sold separately.

Currently, DPPP motors that would be subject to the energy conservation standards are not subject to any Federal energy conservation standards or labeling requirements because they do not fall within any of the specific classes of electric motors that are currently regulated by DOE.[19] However, DPPP motors are electric motors and, therefore, are and have been among the types of industrial equipment for which Congress has authorized DOE to establish applicable regulations under EPCA without the need for DOE to undertake any additional prior administrative action. (42 U.S.C. 6311(1)(A))

2. History of Standards Rulemaking for DPPP Motors

On January 18, 2017, DOE published a direct final rule establishing energy conservation standards for DPPPs. 82 FR 5650 (the "January 2017 Direct Final Rule").[20]

In comments submitted in response to the direct final rule, several interested parties discussed the issue of the efficiency of electric motors used in DPPPs. Comments were received from a broad range of interested parties, including manufacturers, trade associations, and energy efficiency advocacy organizations suggesting that energy

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[19] The current energy conservation standards at 10 CFR 431.25 apply to electric motors that satisfy nine criteria listed at 10 CFR 431.25(g), subject to the exemptions listed at 10 CFR 431.25(l). The nine criteria are as follows: (1) are single-speed, induction motors; (2) are rated for continuous duty (MG1) operation or for duty type S1 (IEC); (3) contain a squirrel-cage (MG1) or cage (IEC) rotor; (4) operate on polyphase alternating current 60-hertz sinusoidal line power; (5) are rated 600 volts or less; (6) have a 2-, 4-, 6-, or 8-pole configuration; (7) are built in a 3-digit or 4-digit NEMA frame size (or IEC metric equivalent), including those designs between two consecutive NEMA frame sizes (or IEC metric equivalent), or an enclosed 56 NEMA frame size (or IEC metric equivalent); (8) produce at least 1 horsepower (0.746 kW) but not greater than 500 horsepower (373 kW), and; (9) meet all of the performance requirements of one of the following motor types: A NEMA Design A, B, or C motor or an IEC Design N or H motor. The exemptions listed at 10 CFR 431.25(l) are: (1) air-over electric motors; (2) component sets of an electric motor; (3) liquid-cooled electric motors; (4) submersible electric motors; and (5) inverter-only electric motors.

[20] DOE confirmed the adoption of the standards and the effective date and compliance date in a notice published on May 26, 2017. 82 FR 24218. DOE also established a test procedure for DPPPs. 82 FR 36858 (August 7, 2017).

conservation standards were also needed for motors used in pool pumps. Commenters wanted to ensure that consumers who purchased pool pumps compliant with the new standards at 10 CFR 431.465(f), who subsequently needed to replace their motor, would do so with a motor of equal or greater efficiency. All comments received that discussed DPPP motors supported further rulemaking to address these motors. (Docket No. EERE-2015-BT-STD-0008; Regal Beloit Corporation ("Regal Beloit"), No. 122 at p. 1; Hayward Industries, Inc. ("Hayward"), No. 125 at p. 1; Pentair Water Pool and Spa, Inc. ("Pentair"), No. 132 at pp. 1-2; Zodiac Pool Systems ("Zodiac"), No. 134 at pp. 1-2; Association of Pool and Spa Professionals ("APSP"), No. 127 at p. 2; Appliance Standards Awareness Project ("ASAP"), No. 133 at pp. 4-5; Natural Resource Defense Council ("NRDC"), No. 121 at p. 4; California Investor Owned Utilities ("CA IOUs"), No. 130 at p. 2)

Acknowledging comments received in response to the direct final rule in support of regulating DPPP motors that would serve as replacement motors to the regulated pool pumps, DOE published a notice of public meeting on July 3, 2017 and held a public meeting on August 10, 2017 to consider potential scope, definitions, equipment characteristics, and metrics for pool pump motors. 82 FR 30845. DOE also requested comment on potential requirements for DPPP motors in a request for information ("RFI") pertaining to test procedures for small electric motors and electric motors. 82 FR 35468 (July 31, 2017). On August 14, 2018, DOE received a petition submitted by a variety of entities (collectively, the "Joint Petitioners")[21] requesting that DOE issue a direct final

[21] The Joint Petitioners are: the Association of Pool & Spa Professionals, Alliance to Save Energy, American Council for an Energy-Efficient Economy, Appliance Standards Awareness Project, Arizona Public Service, California Energy Commission, California Investor Owned Utilities, Consumer Federation

rule to establish prescriptive standards and a labeling requirement for DPPP motors ("Joint Petition").[22] The Joint Petitioners stated that the motor on a pool pump will often fail before the pump itself needs to be replaced, and motor-only replacements are common. (Joint Petition, No. 14 at p. 2) They added that without a complementary standard for DPPP motors, upon replacing a pool pump motor, consumers may install replacement motors that are less efficient than the motor with which the DPPP was originally equipped. (*Id.*) To address this concern, the Joint Petitioners asked DOE to establish a direct final rule establishing prescriptive standards and a labeling requirement for DPPP motors. (Joint Petition, No. 14 at pp. 6-9) The Joint Petitioners sought a compliance date of July 19, 2021, to align with the standards compliance date for DPPPs. (*Id.*) *See also* 82 FR 24218 (May 26, 2017). DOE published a notice of the Joint Petition and sought comment on whether to proceed with the proposal, as well as any data or information that could be used in DOE's determination of whether to issue a direct final rule. 83 FR 45851 (Sept. 11, 2018).[23]

On December 12, 2018, representatives from the Association of Pool & Spa Professionals ("APSP"), the National Electrical Manufacturers Association ("NEMA"), Nidec Motors, Regal Beloit, and Zodiac met with DOE to reiterate the need for implementation of the Joint Petition. (December 2018 *Ex Parte* Meeting, No. 42 at p.

of America, Florida Consumer Action Network, Hayward Industries, National Electrical Manufacturers Association, Natural Resources Defense Council, Nidec Motor Corporation, Northwest Power and Conservation Council, Pentair Water Pool and Spa, Regal Beloit Corporation, Speck Pumps, Texas ROSE (Ratepayers' Organization to Save Energy), Waterway Plastics, WEG Commercial Motors, and Zodiac Pool Systems.

[22] The Joint Petition is available at www.regulations.gov/document?D=EERE-2017-BT-STD-0048-0014.

[23] Docket No. EERE-2017-BT-STD-0048, available at *www.regulations.gov/docket?D=EERE-2017-BT-STD-0048*.

1)[24] On February 5, 2019, APSP, NEMA, Hayward, Pentair, Nidec Motors, Regal Beloit, WEG Commercial Motors, and Zodiac Pool Systems met with DOE to present an alternative approach to the Joint Petition, suggesting DOE propose a labeling requirement for DPPP motors. (February 2019 *Ex Parte* Meeting, No. 43 at p. 1)[25] These interested parties specifically requested that DOE base the labeling requirement on a newly available industry standard for pool pump motors published on July 1, 2019 (UL 1004-10:2019, "Pool Pump Motors"), a design standard that incorporates some of the proposals contained in the Joint Petition. (February 2019 *Ex Parte* Slides, No. 43 at pp. 9–10) A follow-up memorandum was submitted to DOE on March 1, 2019, providing additional information related to UL 1004-10:2019. (March 2019 *Ex Parte* Memo, No. 44) The interested parties noted the timelines and costs that would be involved in applying a label to the affected pool pump motors and the impacts flowing from past labeling efforts. (*See generally Id*. at 1–3.)

On April 7, 2020, the California Energy Commission ("CEC") adopted new regulations for RDPPPMs, with an effective date of July 19, 2021. The adopted standards included nominal efficiency at full-load and maximum operating speed requirements, in

[24] With respect to each of the *ex parte* communications noted in this document, DOE posted a memorandum submitted by the interested party/parties that summarized the issues discussed in the relevant meeting as well as its date and attendees, in compliance with DOE's Guidance on *Ex Parte* Communications. 74 FR 52795-52796 (Oct. 14, 2009). The memorandum of the meeting as well as any documents given to DOE employees during the meeting were added to the docket as specified in that guidance. *See Id*. at 74 FR 52796.

[25] The parenthetical reference provides a reference for information located in the docket of DOE's rulemaking to develop the test procedure and labeling requirements for DPPP motors. (Docket No. EERE-2017-BT-STD-0048, which is maintained at *www.regulations.gov/docket/EERE-2017-BT-STD-0048*). The references are arranged as follows: (commenter, comment docket ID number, page of that document).

addition to a requirement that RDPPPMs with a total horsepower ("THP") greater than or equal to 0.5 THP manufactured on or after July 19, 2021, must be variable-speed.[26]

On October 5, 2020, in response to the Joint Petition and the alternative recommendation presented by several of the Joint Petitioners following submission of the Joint Petition, DOE published a NOPR proposing to establish a test procedure and an accompanying labeling requirement for DPPP motors. 85 FR 62816 ("October 2020 NOPR"). Specifically, DOE proposed to incorporate by reference UL Standard 1004-10:2019 "Outline of Investigation for Pool Pump Motors" ("UL 1004-10:2019") pertaining to DPPP motor definitions and marking requirements; require the use of Canadian Standards Association ("CSA") C747-09 (R2014), "Energy Efficiency Test Methods for Small Motors" ("CSA C747-09") for testing the energy efficiency of DPPP motors; require the nameplate of a subject DPPP motor (1) to include the full-load efficiency of the motor as determined under the proposed test procedure, and (2) if the DPPP motor is certified to UL-1004-10:2019, to include the statement, "Certified to UL 1004-10:2019"; require that catalogs and marketing materials include the full-load efficiency of the motor; require manufacturers to notify DOE of the subject DPPP motor models in current production (according to the manufacturer's model number) and whether the motor model is certified to UL 1004-10:2019; and require manufacturers to report to DOE the full-load efficiency of the subject DPPP motor models as determined pursuant to the proposed test procedure. 85 FR 62816, 62820. Additionally, if a DPPP motor model is certified to UL 1004-10:2019, DOE proposed to require manufacturers to

[26] See Docket # 19-AAER-02 at www.energy.ca.gov/rules-and-regulations/appliance-efficiency-regulations-title-20/appliance-efficiency-proceedings-2.

report the THP and speed configuration of the motor model as provided on the nameplate pursuant to the UL certification. *Id.*

On July 29, 2021, DOE published a final rule adopting a test procedure for DPPP motors. 86 FR 40765. ("July 2021 Final Rule"). Specifically, the test procedure requires use of CSA C747-09 (R2014), "Energy Efficiency Test Methods for Small Motors" ("CSA C747-09") for testing the full-load efficiency of DPPP motors and incorporates by reference UL 1004-10:2020 "Standard for Pool Pump Motors" ("UL 1004-10:2020") pertaining to definitions and scope. The new test procedure is currently located at 10 CFR 431.484. 86 FR 40765, 40768. DOE did not establish a labeling requirement and stated that it intends to address any such labeling and/or energy conservation standards requirement in a separate notification. *Id.*

On June 21, 2022, DOE published a NOPR proposing energy conservation standards for DPPP motors. 87 FR 37122. ("June 2022 NOPR"). DOE proposed a performance standard for a class of DPPP motors and design requirements for certain classes of DPPP motors. Specifically, DOE proposed to require that DPPP motors less than 0.5 THP must have a full-load efficiency of 69 percent, and DPPP motors greater than or equal to 0.5 THP must be variable speed control DPPP motors. In addition, for DPPP motors greater than or equal to 0.5 THP, DOE also proposed to implement freeze-protection requirements. 87 FR 37122, 37123-37124. On July 26, 2022, DOE presented the proposed standards and accompanying analysis in a public meeting.

DOE received comments in response to the June 2022 NOPR from the interested parties listed in Table II.1.

Table II.1 June 2022 NOPR Written Comments

Commenter(s)	Abbreviation	Comment No. in the Docket	Commenter Type
Anonymous	Anonymous	89	--
Appliance Standards Awareness Project (ASAP), American Council for an Energy-Efficient Economy (ACEEE), National Consumer Law Center, on behalf of its low-income clients (NCLC), Natural Resources Defense Council (NRDC), and Northwest Energy Efficiency Alliance (NEEA)	Joint Advocates	97	Efficiency Organizations
California Energy Commission and New York State Energy Research and Development Authority	CEC and NYSERDA	94	State Agencies
Center for Climate and Energy Solutions, Institute for Policy Integrity at New York University School of Law, Natural Resources Defense Council, Sierra Club, Union of Concerned Scientists	Joint SC-GHG Commenters	95	Efficiency Organizations and Legal Institute
Fluidra	Fluidra	91, 101	Pool Pump Manufacturer
Hayward Industries, Inc.	Hayward	93	Pool Pump Manufacturer
Northwest Energy Efficiency Alliance	NEEA	99	Efficiency Organization
Pacific Gas and Electric Company (PG&E), San Diego Gas and Electric (SDG&E), and Southern California Edison (SCE)	CA IOUs	96	Utilities
Pentair Water Pool and Spa, Inc.	Pentair	90	Pool Pump Manufacturer
The Pool & Hot Tub Alliance and National Electrical Manufacturers Association	PHTA and NEMA	92	Trade Associations
The Pool & Hot Tub Alliance	PHTA	100	Trade Association
Regal Rexnord	Regal	98	Motor Manufacturer

A parenthetical reference at the end of a comment quotation or paraphrase provides the location of the item in the public record.[27] To the extent that interested parties have provided written comments that are substantively consistent with any oral comments provided during the July 26, 2022 public meeting, DOE cites the written comments throughout this final rule. Any oral comments provided during the webinar that are not substantively addressed by written comments are summarized and cited separately throughout this final rule.

III. General Discussion

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

A. General Comments

This section summarizes general comments received from interested parties regarding rulemaking timing and process.

In the June 2022 NOPR, DOE proposed a performance standard (*i.e.*, full-load efficiency) and design requirements (*i.e.*, speed capability) based on DPPP motor THP. Specifically, for motors <0.5 THP, DOE proposed DPPP motors to meet a full-load efficiency of 69 percent. For motors ≥0.5 THP, DOE proposed variable speed control design requirements, and freeze protection control requirements for DPPP motors with freeze protection controls. 87 FR 37122, 37124.

[27] The parenthetical reference provides a reference for information located in the docket of DOE's rulemaking to develop energy conservation standards for DPPP motors. (Docket No. EERE-2017-BT-STD-0048, which is maintained at *www.regulations.gov*). The references are arranged as follows: (commenter name, comment docket ID number, page of that document).

Waterway Plastics commented that the proposal does not align with CEC scope because that scope is only for replacement DPPP motors and requested clarity on the scope of the June 2022 NOPR. (Waterway Plastics, Public Meeting, No. 88 at p. 6) The scope of the final rule includes DPPP motors regardless of how the equipment is sold *i.e.*, incorporated in a DPPP or sold separately (*i.e.*, as a replacement motor).

One anonymous commenter stated that the proposed standard for DPPP motors is more stringent than the standard for DPPPs that went into effect in 2021 and would make the DPPP rule obsolete. Specifically, the anonymous commenter stated that with the DPPP standard, a 1 hp single-speed pump would still meet the weighted energy factor ("WEF") requirement, but this does not seem to be the case in the proposed DPPP motor rule. In addition, the anonymous commenter stated that the WEF DPPP standard was less stringent for non-self-priming pumps, whereas the proposed DPPP motor level does not separate non-self-priming pumps motors. The anonymous commenter stated that typically rules for subcomponents (motors) would have less stringent or equal requirements to the fully assembled product (*i.e.,* pumps), otherwise the standard for pool pumps would be obsolete due to the more stringent motor rule. (Anonymous, No. 89 at p. 1) Waterway Plastics commented that the proposal could affect the DPPPs that are being manufactured in the United States, and that they had concerns that the June 2022 NOPR proposal does not align with the DPPP standards. (Waterway Plastics, Public Meeting, No. 88 at p. 6)

In addition to setting freeze protection requirements, the standard for DPPPs at 10 CFR 431.465(f) would likely require DPPP motors sold in DPPPs to be variable speed for standard-size self priming pool pumps (using DPPP motors greater than or equal to

1.15 THP)[28] and to have a higher efficiency for small-size self priming pumps, non-self priming pumps, and PCBPs.[29] The DPPP standards apply to DPPPs only and do not apply to DPPP motors sold alone as replacement motors. As stated previously, motor-only replacements are common and comments were received from a broad range of interested parties, including manufacturers, trade associations, and energy efficiency advocacy organizations suggesting that energy conservation standards were also needed for motors used in pool pumps to ensure that consumers who purchased pool pumps compliant with the new standards at 10 CFR 431.465(f), who subsequently needed to replace their motor, would do so with a motor of equal or greater efficiency. In contrast, the CEC standards apply to replacement DPPP motors only and would require variable speed replacement DPPP motors at or above 0.5 THP, and also sets requirements for nominal efficiency at full-load and maximum operating speed.[30] In this final rule, DOE establishes DPPP motor standard for both motors sold in DPPPs and sold alone for replacement purposes. While the motor improvements realized by this DPPP motor final rule could be enough to improve a DPPP such that the DPPP would meet the DPPP standard, DOE notes that the DPPP energy conservation standards and the DPPP motor standards are complementary to help ensure a harmonized approach to DPPP and DPPP motors that are replacements. The DPPP standards includes the hydraulic efficiency of the pump, the motor efficiency, and the efficiency of the associated controls and drives

[28] The 0.711 hhp threshold in the DPPP standards for self-priming pool filter pumps aligns with a 1.15 THP motor threshold (1.15 THP is roughly equivalent to 0.711 hhp). *See* section IV.A.3 of this document.

[29] The DPPP standard at 10 CFR 431.465(f) would likely require DPPP motors sold in DPPPs to meet the requirements equivalent to TSL 6, while this DFR establishes standards at TSL 8 for DPPP motors, regardless of how they are sold (*i.e.*, incorporated in a DPPP or sold separately). *See* section V.A of this document.

[30] See Docket # 19-AAER-02 at www.energy.ca.gov/rules-and-regulations/appliance-efficiency-regulations-title-20/appliance-efficiency-proceedings-2.

supporting the DPPP. By contrast, the DPPP motor standard focuses on just the motor aspect and is meant to complement the DPPP standard by ensuring the replacement motors are at least as efficient as originally intended by the DPPP manufacturer in the DPPP design. Therefore, DOE does not agree with the commenter that these two standards are overlapping. Instead, DOE believes it is addressing complementary but different equipment regulations to help ensure the efficiencies that consumers expect when purchasing their DPPPs are maintained when replacing the motor. Since the regulations apply to both domestically produced equipment and imported equipment and are intended to be complementary by design, DOE does not agree with Waterway Plastics that domestic manufacturers will be disadvantaged.

Regarding pressure cleaner booster pumps ("PCBP"), Fluidra recommended separating PCBP into their own equipment class, requiring 69-percent efficiency for motors less than 1.15 THP, and implementing further review of energy use, efficiency, and cost effectiveness for the motors at 1.15 to 5 THP. (Fluidra, No. 91 at p. 2). PHTA and NEMA recommended that if DOE confirms that a variable speed requirement is not cost-effective for PCBP, DOE should not require variable speed for PCBP motors below 1.15 THP. (PHTA and NEMA, No. 92 at p. 5)

On the other hand, CEC and NYSERDA supported DOE's proposed standards, specifically the proposal to require variable-speed motors, and encouraged that DOE finalize the rule as soon as possible. CEC and NYSERDA stated that the proposed standards will extend the 2017 DPPP final rule energy efficiency benefits to replacement DPPP motors, which currently are unregulated on the Federal level, and provide additional energy efficiency improvements to new DPPPs. CEC and NYSERDA also stated that some of the energy savings in this NOPR are already being realized in California through that State's Replacement DPPP Motor Regulations, which went into effect July 19, 2021, and which are projected to provide 451 GWh in annual electricity savings and $82 million in annual savings to California businesses and individuals. (CEC and NYSERDA, No. 94 at p. 2) Further, CEC and NYSERDA commented that variable-speed motors are extremely beneficial to consumers, as DPPPs have different operational modes with different speed requirements, and because real-world pool design complicates the size selection of DPPP motors. Further, CEC and NYSERDA stated that the benefit of variable-speed motors for PCBP applications, which is the ability to adjust motor speed, will eliminate the need to use pressure discs or pressure relief valves. (CEC and NYSERDA, No. 94 at p. 3)

The Joint Advocates commented that they support the proposed standards for DPPP motors, which generally align with the existing California standards for replacement DPPP motors, and would ensure that all DPPP motors greater than or equal to 0.5 THP are variable-speed. The Joint Advocates also supported the proposed freeze protection control requirements. (Joint Advocates, No. 97 at p. 1)

The CA IOUs supported DOE's proposal to adopt TSL 7 for DPPP motors. The CA IOUs commented that they surveyed the CEC certifications database and the DOE Compliance Certification Management System ("CCMS") database and noted that small-size DPPP motors represent motors in PCBPs, small self-priming pool filter pumps, and small non-self-priming pool filter pumps. The CA IOUs agreed that the 0.5 THP to 1.15 THP threshold is an appropriate range for the DOE analysis and standard. Further, the CA IOUs commented that the standard-sized DPPP motor range, between 1.15 to 5.0

THP, represents motors mostly found in standard-size self-priming pool filter pump applications. (CA IOUs, No. 96 at pp. 1-2) The CA IOUs commented that the proposed standard for a small-size DPPP motor will provide technically feasible and cost-effective consumer savings through variable speed motor technology, allowing consumers to choose the lowest speed that meets their pool maintenance needs and reducing pressure head losses through the pump affinity laws. The CA IOUs noted that this energy savings strategy is consistent with the industry standard American National Standards Institute/Pool and Hot Tub Alliance/International Code Council (ANSI/PHTA/ICC)-15:2021, which recommends that "for maximum energy efficiency, pool filtration should be operated at the lowest possible flowrate for a time period that provides sufficient water turnover for clarity and sanitation." (CA IOUs, No. 96 at p. 2) Further, the CA IOUs supported DOE's proposal to adopt freeze protection setting requirements, which aligns with the requirements of the DPPP rule and provides essential energy savings by ensuring that products shopped with freeze protection have the appropriate settings to protect equipment from freezing while not using excessive energy. (CA IOUs, No. 96 at p. 2)

Regal commented that they generally support DOE moving forward with the DPPPM energy conservation standards rule. Regal commented that they believe the proposed rule will enable the achievement of significant energy savings, if careful consideration is given to the rule's underlying technical analysis and the timeline for implementation. (Regal, No. 98 at p.1) ASAP commented in support of DOE's proposed standards for DPPP motors and noted that these generally align with the existing standards in California. (ASAP, Public Meeting, No.88 at p.5) As part of this final rule, DOE considered comments received regarding the technical analysis and made any needed updates, as discussed in section IV of this document. DOE also updated the market data information to match the current market of DPPP motors available, as discussed in section IV.A.2 of this document. Finally, DOE notes that DOE conducted DPPP motor manufacturer interviews as part of the June 2022 NOPR, as discussed in the manufacturer impact analysis, and incorporated feedback to estimate the manufacturer impacts of setting variable-speed requirements as standards. 87 FR 37122, 37154.

In regard to creating an equipment class for DPPP motors used in PCBP applications, DOE generally does not consider end-use applications (for DPPP motors, end-use would be DPPPs) when analyzing equipment classes for covered equipment. *See* further discussion in IV.A.3 of this document. DOE also notes that, assuming the same motor output power, there are no technological features that distinguish a DPPP motor used in a PCBP from a DPPP motor used in a self-priming or non-self-priming application. As such, DOE continues to base the analysis in this final rule only on DPPP motor equipment classes determined only by motor THP, as defined in Table III.1 of this document.

DOE reviewed the cost-effectiveness of the trial standard levels considered with the updates for this final rule and continues to conclude that the proposal from the June 2022 NOPR is technologically feasible and economically justified. *See* section V of this document for analytical results. Section IV provides further details on the analysis conducted, the analysis inputs, and responses to any analysis-specific comments that were received regarding the June 2022 NOPR.

In the June 2022 NOPR, DOE proposed that new standards would apply to DPPP motors manufactured two years after the date on which any new or amended standard is published.[31] DOE estimated the publication of a final rule in the second half of 2023. Therefore, in the June 2022 NOPR, for purposes of its analysis, DOE used 2026 as the first full year of compliance with any new standards for DPPP motors. 87 FR 37122, 37144.

Several commenters recommended that DOE consider a two-step approach to allow for further analysis and data collection and coordinate between DPPP and DPPP motors. As a first step, PHTA, NEMA, and Hayward recommended that DOE adopt a final rule as soon as possible that would adopt and require a DPPP motor listing to UL 1004-10:2022 "Standard for Pool Pump Motors" ("UL 1004-10:2022") in its entirety, which would provide alignment with the current DPPP rule and a means for certification and labeling that will provide for easier enforcement. Further, PHTA, NEMA, and Hayward noted that manufacturers anticipated compliance with UL 1004-10, which was established in the 2018–2020 efforts to obtain a corresponding DPPP motor rule. Therefore, PHTA, NEMA, and Hayward stated that manufacturers are ready and able to provide compliant product 12 months after a final rule effective date. As a second step, PHTA, NEMA, and Hayward commented that DOE should set up a negotiation working group on both DPPP and DPPP motor rules to dig deeper into the concerns highlighted in their comment submission and ensure performance and timing alignments long term. PHTA, NEMA, and Hayward commented that they are committed to initiating step two as soon as possible and stated that if a two-step approach is unfeasible, that prior to issuing a final DPPP motor rule, the cost-effective concerns laid out in their comments should be further analyzed and manufacturer interviews conducted. PHTA, NEMA, and

[31] In the June 2022 NOPR, DOE followed the same 2-year lead time. *See* 87 FR 37122, 37144 at FN67.

Hayward stated that although this approach will slow down obtaining a final rule, the current NOPR deviates from the Joint Petition and the commenters have provided multiple concerns that require attention. (PHTA and NEMA, No. 92 at p. 9; Hayward, No. 93 at pp. 2–3)

In response, Fluidra requested a 5-year transition period to implement compliance with the DPPP motor regulation proposal. Fluidra noted that this transition period would give manufacturers adequate time to develop, test, certify, launch, and transition product lines, as well as educate distributors, pool builders, and consumers on this product transition. (Fluidra, No. 91 at p. 2) Hayward, PHTA, and NEMA requested a compliance date of at least 5 years following the effective date if DOE decides against the implementation of UL 1004-10 based rule. Hayward, PHTA, and NEMA noted that more time is required to: address the limited product that currently exists in the small fractional motor category; find solutions to the design of other products impacted by a DPPP motor rule; and provide better alignment with any coming revisions to the current DPPP rule. (Hayward, No. 93 at pp. 2-3; PHTA and NEMA, No. 92 at p. 9) PHTA stated that any final DPPPM rule compliance date should be extended a minimum of 5 years to allow manufacturers to recover investments made to comply with the pump rule. (PHTA, No. 100 at p. 3) In addition, Hayward recommended the alignment of the DPPP and DPPP motor implementation dates. (Hayward, No. 93 at p. 2) Regal recommended that DOE endeavor to better align both the performance requirements and compliance deadlines between the DPPP and DPPP motor rules. Regal commented that this will allow for maximizing energy savings, while avoiding unintended market disruptions and significant fiscal impacts to industry and consumers. (Regal, No. 98 at p. 1) Specifically, PHTA and NEMA commented that they were concerned the different implementation dates of the DPPP and DPPP motor rules will cause confusion and difficulties for manufacturers and risk the potential to undercut savings by unaligned implementation of the two rules. (PHTA and NEMA, No. 92 at pp. 2)

DOE notes that PHTA and NEMA's original recommendation to DOE was to adopt UL 1004-10:2022 in its entirety (PHTA and NEMA, No. 92 at p. 9, 10), which includes the requirement that DPPP motors rated greater or equal to 1.15 THP shall not be marked for single-speed, two-speed, or multi-speed (*i.e.*, shall instead be marked for variable-speed). (section 7.1(b) of UL 1004-10:2022). Further, PHTA and NEMA stated that manufacturers were ready and able to provide products compliant with UL 1004-10:2022 12 months after a final rule effective date. (PHTA and NEMA, No. 92 at p. 9) Finally, PHTA and NEMA suggested that DOE require compliance with the entire UL 1004-10 standard and not just the scope and definitions sections because doing so would better align and provide consistency with the DPPP rule. They also stated that doing so would provide an easier enforcement tool for DOE by requiring nameplate markings on those motors captured in the scope of the NOPR and in UL 1004-10, and would also ensure products not within the scope, such as rigid electric spa motors, be labelled for that intended use only. (PHTA and NEMA, No. 92 at p. 10) This is an energy conservation standard and not a labeling rulemaking. In this final rule, DOE is requiring variable speed control for standard-size DPPP motors (*i.e.*, $1.15 \leq \text{THP} \leq 5$), consistent with UL 1004-10:2022. However, DOE is also requiring variable-speed control for small-size DPPP motors (*i.e.*, $0.5 \leq \text{THP} < 1.15$), which is more stringent than UL 1004-10:2022. In this final rule, DOE has concluded that the proposal from the June 2022

NOPR is technologically feasible and economically justified. *See* section V for analytical results.

As noted previously, PHTA, NEMA, and Hayward recommended a two-step approach. In addition, most if not all comments to the June 2022 NOPR concerned the transition to variable-speed for the small-size equipment class.[32] DOE reviewed the compliance dates proposed in the June 2022 NOPR with specific concern for the compliance dates applicable to that class. In the June 2022 NOPR, DOE provided a two-year compliance timeline for DPPP motors based on the statutorily mandated rulemaking schedule provided in section 6313. *See* 87 FR 37122, 37144 at FN 67, and 37186. Upon further review, DOE has determined that the rulemaking schedule provided in 42 U.S.C. 6313(b) does not apply to DPPPM. As discussed in section II.A. of this document, DPPPM are a type of electric motor, but not among the types of electric motor for which Congress established standards and a rulemaking schedule in 42 U.S.C. 6313(b). DPPPM are definite purpose motors. *See* 42 U.S.C. 6311(13)(C). As such, they are excepted from the requirements of 42 U.S.C. 6313(b), including the compliance deadlines provided in that section. Because 42 U.S.C. 6316(a) applies certain requirements of section 6295(l)-(s) of EPCA to certain equipment, including electric motors, DOE considered whether the compliance deadlines of section 6295(m)(4) applied to DPPPM. Section 6295(m)(4)(A) defines compliance deadlines for specific products. But electric motors and DPPPMs are not listed, nor does section 6316 apply a cross reference on how to apply these paragraphs to electric motors or DPPPMs. Accordingly, DOE determined that these

[32] *See:* (Anonymous, No. 89 at p. 1), (Pentair, No. 90 at p. 1, 3), (Fluidra, No. 91 at p. 2), (Hayward, No. 93 at p. 2), (CA IOUs, No. 96 at p. 1-2), (Joint Advocates, No. 97 at p. 1), (PHTA and NEMA, No. 92 at p. 10), (PHTA, No. 100 at p. 3)

compliance deadlines do not apply to DPPPM. Additionally, DOE reviewed section 6296(m)(4)(B), which states that DOE cannot apply new standards to a product with respect to which other new standards have been required in the prior 6-year period. As this is the first time DOE is establishing standards for this product, this paragraph also does not apply. As such, DOE has determined that it has discretion to establish compliance deadlines for DPPPM.

DOE notes CEC's standards for RDPPM, which include standards for the small-size equipment class, require compliance beginning July of 2021. Docket # 19-AAER-02. The CEC standards set a variable speed motor requirement for motors at or above 0.5 THP as well as minimum motor full-load efficiency requirements. 20 CA ADC 1605.3(g)(6)(B). DOE's final rule matches the stringency of the California standards (requiring variable speed controls for all motors over 0.5 THP) for replacement DPPP motors but DOE's proposal extends the variable speed requirement to all DPPP motors, regardless of whether they are sold with a DPPP or on their own. DOE believes manufacturers are already producing standard-size and extra-small DPPPMs that will have to comply with DOE's standards in this final rule. In addition, some manufacturers already produce small-size DPPPMs that align with CEC's variable speed RDPPM standards.[33] However, DOE understands that some manufacturers may need additional time to scale up their manufacturing lines, especially for the small-size DPPP motors.[34] Therefore, DOE is adopting two different compliance dates in this final rule depending

[33] *https://www.regalrexnord.com/products/electric-motors/ac-motors-nema/pump-motors/pool-pump-motors/pool-pump-motor-01-85-hp-1-ph-60-hz-115-v-3600-rpm-48y-frame-tefc-elv08tb.*

[34] DOE included the capital and product conversion costs necessary for these DPPP motor manufacturers to introduce variable-speed DPPP motor models for the small-size equipment class. See section III.J of this document.

on the total horsepower of the motor. Doing so will allow DOE to begin the transition to a Federal standard for DPPP motors quickly, which will help alleviate any circumvention and unintended consequences that may be occurring because of the DPPP Federal standard, while balancing the needs of industry to have additional time to increase manufacturing scale of the small DPPP motors. Based on the comments received, DOE has concluded that the need for additional time is particularly relevant for small-size equipment. Accordingly, DOE is extending the compliance timeline to 4 years, instead of the proposed two years, for the small-size equipment class as DOE believes this provides industry sufficient time to scale up their manufacturing lines.

For the extra-small-size and standard-size equipment classes, DOE is maintaining the two-year compliance timelines as proposed. For the extra-small-size and standard-size equipment classes, the adopted TSL (TSL7) aligns with the requirements in UL 1004-10:2022 and as noted by PHTA and NEMA, manufacturers are ready and able to provide products compliant with UL 1004-10:2022 12 months after a final rule effective date. Therefore, for the extra-small-size and standard-size equipment classes DOE has determined that two years provides sufficient lead time.

The CA IOUs recommended that DOE update the DPPP ECS to align with the proposed DPPP motor standards. The CA IOUs commented that the proposed standard requires variable speed capability for small and standard size DPPP motors, which will impact the motors installed in DPPPs. The CA IOUs added that the non-self-priming pool filter pump and PCBP WEF standards allow performance levels achievable by single-speed, dual-speed, and variable-speed motors. (CA IOUs, No. 96 at p. 6) DOE appreciates CA IOUs comments. However, because this rulemaking is concerning DPPP motors only and not DPPPs, DOE may consider coordinating compliance timelines as part of any upcoming DPPP rulemakings.

Finally, Pentair stated that after the DPPP rule, it saw a large increase in internet activity selling illegal pumps and motors that do not meet DOE requirements. (Pentair, No. 90 at pp. 1–2) Fluidra commented that American manufacturers may also be negatively impacted by imports of non-compliant DPPPs and DPPP motors from foreign manufacturers who unknowingly or knowingly disregard enforcement of this regulation. (Fluidra, No. 91 at p. 2) Based on input from five manufacturers, PHTA and NEMA commented that they estimate approximately 5 percent of the current market to be made up of inexpensive imported pumps sold through online retailers that likely do not comply with DOE's current energy conservation standard. PHTA and NEMA commented that these manufacturers have indicated that the current value (5 percent) is approximately double what it was prior to the compliance date for the DPPP standard. PHTA and NEMA commented that the manufacturers also estimate that a DPPP motor standard, established as currently proposed by DOE, will double the percentage of the market made up of non-compliant DPPPs, increasing it to 10 percent. (PHTA and NEMA, No. 92 at pp. 7-8) PHTA and NEMA also stated that the misalignment of the compliance dates for the DPPP energy conservation standards and the proposed DPPP motor standards could cause confusion for manufacturers and importers, potentially leading to more non-compliant DPPP motors being imported. PHTA and NEMA reiterated NEMA's concerns about port of entry enforcement that they have separately commented on numerous times. (PHTA and NEMA, No. 92 at p. 8) Nidec commented that they were concerned that because of the disconnect of the proposal to the current DPPP regulations (DPPPMs between 0.5 to 1.15 THP), there may be issues with enforcement of pumps assembled offshore and coming into the U.S. with non-compliant DPPPMs. Nidec commented that because of the rulemaking, there is a high risk that DPPPs may not get assembled anymore in the U.S. and instead will be done offshore unless there is proper enforcement that brings the DPPP regulations and the proposed DPPPM regulations into harmony. (Nidec, Public Meeting, No. 88, at pp. 45-46) DOE currently does not have any energy conservation standards for DPPP motors. This final rule will finalize standards for DPPP motors and product-specific enforcement requirements at §429.134. Any enforcement-related issues, particularly compliance dates, regarding DPPPs will be addressed as part of the DPPP rulemaking, or through a separate avenue.

Nidec requested comment on whether there are any other examples where an end-product rule defines a lower threshold for compliance versus a component threshold and how DOE has successfully managed that. They stated that in their experience, the end-product generally overrides the component standard, and for the DPPPM proposal, it would not be the case. (Nidec, Public Meeting, No. 88 at p. 47) EPCA authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment. This equipment includes those electric motors that are DPPP motors, the subject of this document, and also pumps (42 U.S.C. 6311(1)(A)) Accordingly, DOE has the authority to regulate both a component (DPPPM) and the end-product (DPPPs). Given the current misalignment amongst the Federal DPPP standards and the CA DPPP replacement motor standards along with DOE's authority for electric motors, DOE is taking an approach to facilitate harmonization of the standards at the Federal level and ensure a complimentary regulatory approach for DPPPs and replacement DPPP motors which will help ensure energy savings are realized in the field. Scope of Coverage

This document covers equipment meeting the definition of a DPPP motor as defined in §431.483 and the scope specified in 10 CFR 431.481(b). Specifically, the scope covers DPPP motors with a total THP of less than or equal to 5, but does not apply to: (i) DPPP motors that are polyphase motors capable of operating without a drive and distributed in commerce without a drive that converts single-phase power to polyphase power; (ii) waterfall pump motors; (iii) rigid electric spa pump motors, (iv) storable electric spa pump motors; (v) integral cartridge-filter pool pump motors; and (vi) integral sand-filter pool pump motors.[35]

When evaluating and establishing energy conservation standards, DOE divides covered equipment into equipment classes by the type of energy used or by capacity or other performance-related features, which other products within such type (or class) do not have, that justify differing standards. In making a determination 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. 6316(a); 42 U.S.C. 6295(q))

DOE is establishing equipment classes for DPPP motors based on THP. DOE is proposing an extra-small-size equipment class corresponding to motors with a THP less than 0.5 THP, a small-size equipment class corresponding to motors with a total

[35] These terms are defined in UL 1004-10:2020, which is incorporated by reference in DOE's test procedure at 10 CFR 431.484. In this final rule, DOE is incorporating by reference the latest version of the UL standard, UL 1004-10:2022; *see* discussion in section III.A.1 of this document.

horsepower rating greater than or equal to 0.5 THP but less than 1.15 THP, and a standard-size equipment class corresponding to a motor with a THP greater than or equal to 1.15 THP and less than or equal to 5 THP. Table III.1 provides a summary of the equipment classes. *See* section IV.A.3 for further details on the reasoning as to why DOE determined these equipment classes are appropriate and justify having separate standards.

Table III.1 Equipment Classes for DPPP motors

Equipment Class	**Motor Total Horsepower** ***Hp***
Extra-small-size	THP <0.5
Small-size	0.5≤ THP <1.15
Standard-size	1.15≤ THP ≤5

See section IV.A.1 of this document for discussion of the equipment classes analyzed in this final rule.

B. Test Procedure

EPCA sets forth generally applicable criteria and procedures for DOE's adoption and amendment of test procedures. (42 U.S.C. 6314(a)) 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. (42 U.S.C. 6314(d)(1); 42 U.S.C. 6316(a), 42 U.S.C. 6295(s))

The test procedure references UL 1004-10:2020 “Standard for Safety for Pool Pump Motors” for the definitions (10 CFR 431.483) and references CSA C747–09 as the energy efficiency test method for DPPP motors (10 CFR 431.484(b)). The test procedure establishes full-load efficiency as the metric for DPPP motors. 10 CFR 431.484(b). In this final rule, DOE is incorporating by reference the latest version of the UL standard, UL 1004-10:2022; further discussion on this topic and any comments received are provided in section IV.A.1 of this document. In addition, DOE is also finalizing product-specific enforcement requirements at 10 CFR 429.134 that require DPPP motors to be tested in accordance with UL 1004-10:2022 to verify variable-speed capability and applicable freeze protection design requirements.

C. Technological Feasibility

1. General

In each energy conservation standards rulemaking, DOE conducts a screening analysis based on information gathered on all current technology options and prototype designs that could improve the efficiency of the products or equipment that are the subject of the rulemaking. As the first step in such an analysis, DOE develops a list of technology options for consideration in consultation with manufacturers, design engineers, and other interested parties. DOE then determines which of those means for improving efficiency are technologically feasible. DOE considers technologies incorporated in commercially available products or in working prototypes to be technologically feasible. 10 CFR 431.4; sections 6(b)(3)(i) and 7(b)(1) of appendix A to 10 CFR part 430 subpart C ("appendix A").

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. 10 CFR 431.4; section 7(b)(2)-(5) of appendix A. Section IV.B of this document discusses the results of the screening analysis for DPPP motors, 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 final rule technical support document ("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. 6316(a); 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 DPPP motors, 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 of this final rule and in chapter 5 of the final rule TSD.

D. Energy Savings

1. Determination of Savings

For each trial standard level ("TSL"), DOE projected energy savings from application of the TSL to DPPP motors purchased in the 30-year period that begins in the first full year of compliance with the standards (2026–2055).[36] The savings are measured over the entire lifetime of equipment purchased in the 30-year analysis 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-

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

standards case represents a projection of energy consumption that reflects how the market for a product would likely evolve in the absence of energy conservation standards.

DOE used its national impact analysis ("NIA") spreadsheet models to estimate national energy savings ("NES") from standards for DPPP motors. The NIA spreadsheet model (described in section IV.G.2 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 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.[37] 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.2 of this document.

2. Significance of Savings

To adopt any new or amended 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))

The significance of energy savings offered by a new or amended energy conservation standard cannot be determined without knowledge of the specific

[37] 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).

circumstances surrounding a given rulemaking.[38] For example, 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. Accordingly, DOE evaluates the significance of energy savings on a case-by-case basis, taking into account the significance of cumulative FFC national energy savings, the cumulative FFC emissions reductions, and the need to confront the global climate crisis, among other factors.

As stated, the standard levels adopted in this final rule are projected to result in national energy savings of 1.56 quads FFC, the equivalent of the electricity use of 16.8 million homes in one year. Based on the amount of FFC savings, the corresponding reduction in emissions, and the need to confront the global climate crisis, DOE has determined the energy savings from the standard levels adopted in this final rule are "significant" within the meaning of 42 U.S.C. 6316(a); 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. 6316(a); 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.

[38] Procedures, Interpretations, and Policies for Consideration in New or Revised Energy Conservation Standards and Test Procedures for Consumer Products and Commercial/Industrial Equipment, 86 FR 70892, 70901 (Dec. 13, 2021).

a. Economic Impact on Manufacturers and Consumers

In determining the impacts of potential amended standards on manufacturers, DOE conducts an 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 payback period ("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. 6316(a); 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 cost (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 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. 6316(a); 42 U.S.C. 6295(o)(2)(B)(i)(III)) As discussed in section IV.G.2 of this document, DOE uses the NIA spreadsheet models to project national energy savings.

d. Lessening of Utility or Performance of Products

In establishing equipment 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 equipment. (42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(2)(B)(i)(IV)) Based on data available to DOE, the standards adopted in this document would not reduce the utility or performance of the equipment under consideration in this rulemaking.

e. Impact of Any Lessening of Competition

EPCA directs DOE to consider the impact of any lessening of competition, as determined in writing by the Attorney General, that is likely to result from a standard. (42 U.S.C. 6316(a); 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 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. 6316(a); 42 U.S.C. 6295(o)(2)(B)(ii)) To assist the Department of Justice ("DOJ") in making such a determination, DOE transmitted copies of its proposed rule and the NOPR TSD to the Attorney General for review, with a request that the DOJ provide its determination on this issue. In its assessment letter responding to DOE, DOJ noted the possibility of anticompetitive effects stemming from the differences between the energy conservation standards for DPPP motors and DPPPs, as well as the high cost of compliance for domestic small businesses identified by DOE. DOJ elaborated that the difference in standards between DPPP motors and DPPPs would force domestic manufacturers to comply with both standards while foreign manufacturers could import DPPPs that are compliant with the DPPP rule but contain a non-compliant motor. DOJ ultimately concluded that they do not have sufficient information to conclude that the proposed energy conservation standards for DPPP motor are likely to have a significant adverse impact on competition. DOE notes that DPPP motors that are a component of an imported DPPP are subject to energy conservation standards. DOE is publishing the Attorney General's assessment at the end of this final rule.

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. 6316(a); 42 U.S.C. 6295(o)(2)(B)(i)(VI)) The energy savings from the adopted 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 adopted 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. 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.6 of this document. DOE also estimates the economic value of emissions reductions resulting from the considered TSLs, as discussed in section IV.L 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. 6316(a); 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."

2. Rebuttable Presumption

EPCA creates a rebuttable presumption that an energy conservation standard is economically justified if the additional cost to the equipment 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. (42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(2)(B)(iii)) DOE's LCC and PBP analyses generate values used to calculate the effect potential amended 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. 6316(a); 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 of this final rule.

IV. Methodology and Discussion of Related Comments

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

DOE used several analytical tools to estimate the impact of the standards considered 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 national impacts analysis 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 rulemaking: *www.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=76.* Additionally, DOE used output from the latest version of the Energy Information

Administration's ("EIA's") *Annual Energy Outlook* ("*AEO*") 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 DPPP motors. The key findings of DOE's market assessment are summarized in the following sections. *See* chapter 3 of the final rule TSD for further discussion of the market and technology assessment.

1. Scope of Coverage and Definitions

This document covers equipment meeting the definition of a DPPP motor as defined in 10 CFR 431.483 and the scope specified in 10 CFR 431.481(b). Specifically, the scope covers DPPP motors with a THP of less than or equal to 5, but does not apply to: (i) DPPP motors that are polyphase motors capable of operating without a drive and distributed in commerce without a drive that converts single-phase power to polyphase power; (ii) waterfall pump motors; (iii) rigid electric spa pump motors; (iv) storable electric spa pump motors; (v) integral cartridge-filter pool pump motors; and (vi) integral sand-filter pool pump motors.[39] The scope includes DPPP motors regardless of how the equipment is sold; *i.e.*, incorporated in a DPPP or sold separately. The DPPP motors in the scope of this rule are used primarily in the residential sector and light commercial applications, in self-priming pool filter pumps (typically used in inground pools), non-self-priming pool filter pumps (typically used in above-ground pools), and pressure cleaner booster pumps (typically used for pressure-side pool cleaner applications).

DOE received some comments on scope and definitions. PHTA and NEMA commented that storable pools use non-integral pumps, which are certified to DPPP, but the current direct motor replacements are not variable-speed capable per what the NOPR would require. PHTA and NEMA stated that the replacement motors made for this type of pool are motors integrated with the control unit, and that these motors are specific to a set pump for the storable pool and cannot be used in other applications, as there is no way to (dis)connect them. PHTA and NEMA further stated that these pools are purchased in retail stores, and based on input from two manufacturers, have an average retail price slightly over $400. Accordingly, PHTA and NEMA recommended that DOE consider exempting this specific type of motor based on application and obtain additional manufacturer information about this specific product related to the current market, shipments, and pricing for this type of pool, and to consider the limited use of replacement motors. (PHTA and NEMA, No. 92 at p. 5)

[39] These terms are defined in UL 1004-10:2020, which is incorporated by reference in DOE's test procedure at 10 CFR 431.484. In this NOPR, DOE is proposing to reference the latest version of the UL standard, UL 1004-10:2022; see discussion in section III.A.1 of this document.

DPPP motors in scope are those electric motors identified in sections 1.2, 1.3, and 1.4 of UL 1004-10:2022. 10 CFR 431.481(n), as updated in this final rule. DOE notes that the DPPP definition comprises self-priming pool filter pumps, non-self-priming pool filter pumps, waterfall pumps, PCBPs, integral sand-filter pool pumps, integral-cartridge filter pool pumps, storable electric spa pumps, and rigid electric spa pumps. 10 CFR 431.462. In addition, section 1.4 of UL 1004-10:2022 specifically excludes DPPP motors that are polyphase motors capable of operating without a drive and distributed in commerce without a drive that converts single-phase power to polyphase power, waterfall pump motors, rigid electric spa pump motors, storable electric spa pump motors, integral cartridge-filter pool pump motors, and integral sand-filter pool pump motors. As such, the example application provided by PHTA and NEMA would need to meet the definition of DPPP and not be one of the aforementioned exclusions to be considered within the scope of DPPP motor.

As previously noted, storable electric spa pump motors are specifically excluded from the scope of this rulemaking. Section 2 of UL 1004-10:2022 defines storable electric spa pump motor as a DPPP motor that is a component of a storable electric spa pump as defined 10 CFR 431.462, subpart Y, Pumps. Storable electric spa pumps are defined to include an integral heater and an integral air pump. 10 CFR 431.462. The example application provided by PHTA and NEMA specifically stated that it has a non-integral pump. However, PHTA and NEMA did not provide details on what type of DPPP the example would be considered to be.

As such, DOE attempted to determine what type of product PHTA and NEMA were referring to and reviewed manufacturer data and specification sheets to confirm what type of DPPP the example could be considered to be. Based on DOE's review, DOE did not identify any DPPPs for storable pumps that would not be applicable to variable-speed motors as defined due to their integration with controls and other components, and not already be excluded for other reasons. Specifically, of the examples DOE was able to find of variable-speed motors integrated with controllers, they were applicable to integral-cartridge or integral-sand filter pumps, both of which are already excluded from DPPP motor scope. Otherwise, DOE also reviewed an outlier filtration system for storable pools, but could not identify any apparent integration of the DPPP motor with controls, and there was also no indication that it would not be able to be replaceable with a variable-speed option being considered in this rulemaking. As such, DOE could not definitively conclude that there is a need for the exclusion recommended by PHTA and NEMA, and therefore maintains the scope from the June 2022 NOPR.

Regarding the variable-speed definition, CEC and NYSERDA recommended that DOE update the definition to align with the definition used in the California Code of Regulations, Title 20, section 1602(g)(4), instead of the current definition based on UL 1004-10:2022. CEC and NYSERDA stated that with the current definition, at minimum, only four operating speeds are required to meet the definition, whereas the California code specifies "operating at a variety of user-determined speeds," which CEC and NYSERDA suggested described a truly variable-speed motor and aligns with how variable-speed is understood by consumers. CEC and NYSERDA noted that they were unaware of any DPPP motors that meet the current definition of variable speed, but do not meet the Title 20 California definition. However, CED and NYSERDA also commented that if such a motor exists, having only four operating speeds would constrain operational flexibility and lead to non-optimal operation and unnecessary electricity consumption. CEC and NYSERDA stated that allowing for the potential introduction of less energy efficient "variable-speed" motors is unnecessary and might jeopardize some of the energy savings associated with this proposed rule. (CEC and NYSERDA, No. 94 at pp. 3–4)

DOE incorporated by reference UL 1004-10:2020, which includes a definition of variable speed in the July 2021 Final Rule. 86 FR 40765, 40769-40770. UL 1004-10 is an industry standard specific to DPPP motors and has been used by industry since 2019. In this final rule, DOE is not considering any changes in scope; rather, this rulemaking is finalizing standards based on the scope and definitions established in the July 2021 Final Rule, and which are currently in 10 CFR 431.481. Further, as noted by commenters, there are no DPPP motors that meet the current definition of variable speed but do not meet the Title 20 California definition. As such, if there is any discrepancy in the future, DOE may consider this issue in a future rulemaking.

In the June 2022 NOPR, DOE also proposed to update the UL 1004-10 reference to the latest version of the industry standard, from UL 1004-10:2020 to UL 1004-10:2022, in sections 10 CFR 431.481(b), 10 CFR 431.482(c)(1), and 10 CFR 431.483. 87 FR 37122, 37133-37134. DOE concluded that the only update was the addition of a glossary term for "factory default setting" in section 2.7A, which did not change the content and requirements of UL 1004-10:2020, but only provided a clarification regarding the factory default setting as it applies to the industry standard. *Id.* Further, DOE also proposed product-specific enforcement requirements at 10 CFR 429.134 that require DPPP motors be tested in accordance with UL 1004-10:2022 to verify variable-speed capability and applicable freeze protection design requirements. 87 FR 37122, 37131.

In response, PHTA and NEMA supported the DOE's decision to update from the 2020 to the 2022 version of the UL 1004-10 Standard. (PHTA and NEMA, No. 92 at p. 10) In this final rule, DOE is incorporating by reference the latest version of the UL standard, UL 1004-10:2022 to be consistent with industry practice.

Separately, the Joint Advocates supported the proposed product-specific enforcement provisions because they will provide clarity regarding how DOE would determine whether a DPPP motor complies with the requirements regarding variable-speed capability and freeze protection design. (Joint Advocates, No. 97 at p. 2) As such, DOE is also finalizing the proposed product-specific enforcement requirements at 10 CFR 429.134.

2. Market Review

In the June 2022 NOPR, to review the current market of DPPP motors incorporated in DPPPs, DOE relied on information from the DOE Compliance and Certification Database, the CEC, and the ENERGY STAR program. ("2021 DPPP Database") To supplement the market review, DOE also reviewed general motor catalog data from 2020 and created a database that contained information regarding motor speed-control, topology, THP, motor application, and full-load efficiency ("2020 Motor Database"). To make the two databases more comparable, DOE filtered the 2020 Motor Database to analyze only motors used in DPPP applications. 87 FR 37122, 37134.

DOE received a number of comments regarding the data that were used for the market analysis. Pentair commented that a lot has changed in the past 7 years and DOE should consider the latest data versus data used for the DPPP rule in 2015. (Pentair, No. 90 at p. 1) Hayward commented that DOE should update its information on the current market. Specifically, Hayward noted that it has stopped selling any pumps that were not compliant with the minimum WEF requirements and modified other pumps that were marginal in performance. In addition, Hayward noted that variable-speed pumps have continued to gain market share and therefore would provide a different baseline. (Hayward, No. 93 at p. 2) PHTA and NEMA commented that DOE relied heavily on the analysis performed during the 2017 DPPP DFR and recommended that DOE conduct interviews to obtain current market information, pricing, and shipments data. (PHTA and NEMA, No. 92 at p. 2) Regal commented that it agrees with PHTA and NEMA’s comments that DOE should consider conducting additional interviews and analyses to better understand current market offerings, pricing, and shipments. (Regal, No. 98 at p. 1) PHTA commented that using 2015 market data is not accurate because the DPPP market has substantially changed since then and the 2015 data is invalid in its application to the DPPPM analysis. PHTA provided data showing that nearly 60 percent of pool pump listings were non-compliant with the 2017 DPPP rule and had to be modified or removed by the July 19, 2021 compliance date. (PHTA, No. 100 at p. 2) On the other hand, CEC and NYSERDA stated that DOE's analysis is robust and appropriately representative. (CEC and NYSERDA, No. 94 at p. 3)

First, DOE notes that DOE did consider the latest DPPPM market data available for the analysis conducted in the June 2022 NOPR, as previously discussed. In addition, for this final rule, DOE updated the market review using current information from the DOE Compliance and Certification Database, the CEC, and the ENERGY STAR program. ("2022 DPPP Database") DOE supplemented this review with information from general motor catalogs surveyed in 2022; these motor catalogs contained information regarding motor THP, topology, full-load efficiency, pole configuration, and speed-control. DOE then analyzed the range of efficiencies offered at a given THP, topology, and pole configuration as well as the average efficiency of that subset of motors. DOE found that the average and range of efficiency offered for a given THP, topology, and pole configuration were not significantly different than what was observed in the data provided by manufacturers for the January 2017 Direct Final Rule. Based on the similar efficiencies being offered, DOE concluded that the technology used to meet each efficiency level has not substantially changed since the analysis for the January 2017 Direct Final Rule.

DOE notes that the shipments efficiency distribution are based on a review of the 2022 DPPP Database and that this updated database captures the changes to the DPPP market that have occurred since 2017, including those changes due to the January 2017 Direct Final Rule (See section IV.F.8 of this document for more details). For details on how DOE accounted for the DPPP motor price changes since the January 2017 Direct Final Rule, *see* section IV.C.2 of this document. DOE also notes that it had conducted manufacturer interviews as part of the January 2017 Direct Final Rule and incorporated the updated manufacturer feedback in its analysis. DOE also conducted DPPP motor manufacturer interviews as part of the June 2022 NOPR, as discussed in the manufacturer impact analysis, and incorporated feedback to estimate the manufacturer impacts of setting variable-speed requirements as standards. 87 FR 37122, 37154. As such, DOE concluded that additional manufacturer interviews were not needed since DOE performed interviews, and already considered recent market offering, pricing, and shipments information in this final rule.

3. Equipment Classes

When evaluating and establishing energy conservation standards, DOE shall establish separate standards for a group of covered products (*i.e.*, establish a separate equipment class) if DOE determines that separate standards are justified based on the type of energy used, or if DOE determines that a product's capacity or other performance-related feature, which other products within such type (or class) do not have, justifies a different standard. (42 U.S.C. 6316(a); 42 U.S.C. 6295(q)) In making a determination 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. (*Id.*)

In the June 2022 NOPR, DOE proposed to establish equipment classes for DPPP motors based on THP. DOE proposed an extra-small-size equipment class corresponding to motors with a THP less than 0.5 THP, a small-size equipment class corresponding to motors with a total horsepower rating greater than or equal to 0.5 THP but less than 1.15 THP, and a standard-size equipment class corresponding to motors with a THP greater than or equal to 1.15 THP and less than or equal to 5 THP. 87 FR 37122, 37130.

In response to the June 2022 NOPR, DOE received a number of comments regarding equipment classes. PHTA and NEMA recommended that DOE analyze DPPP motors based on equipment classes considered in the DPPP rule. PHTA and NEMA commented that it is critical to differentiate by application, not just size, to really determine what is or is not cost-effective. As such, PHTA and NEMA commented that if the analysis was separated based on PCBP self-priming and non-self-priming, it would show that not all the current proposed requirements were cost-effective. Specifically, PHTA and NEMA stated that when looking at PCBP as a separate equipment class, a variable-speed requirement is not cost-effective (PHTA and NEMA, No. 92 at pp. 4-5) In addition, PHTA and NEMA commented that DOE should break down the 0.5–1.15 THP and analyze the following additional THP ranges: 0.5 < 0.75 THP; 0.75 < 1 THP; 1 > 1.15 THP based on the assessment of available products and previously recommended THP disaggregation. (PHTA and NEMA, No. 92 at p. 5; PHTA, No. 100 at p. 3) Further, PHTA and NEMA commented that breaking down the 0.5-1.15 THP into smaller categories for an analysis would provide a truer picture of cost-effectiveness when combined with breaking out PCBP self-priming and non-self-priming applications. PHTA and NEMA stated that to do otherwise will cause market confusion and unintended consequences with non-compliant products being distributed. For example, PHTA and NEMA commented that imported pump products with THP ratings between 0.50 and 1.14 can meet the DPPP rule and bypass the DPPP motor proposal, which will negate the DPPP motor proposed rule and not deliver the intended energy savings. (PHTA and NEMA, No. 92 at p. 10)

Hayward stated that equipment class should be disaggregated by pump size and application and noted that THP misrepresents the overall effect and impact of the rule. Hayward also supported PHTA and NEMA's recommendations on disaggregation. (Hayward, No. 93 at p. 2) Fluidra recommended that equipment be disaggregated not only by THP, but also by application type. Specifically, Fluidra commented that it was concerned that PCBPs and pool filtration pumps were combined into the same equipment class. (Fluidra, No. 91 at p. 1)

Waterway Plastic commented that in the negotiations that resulted in the January 2017 Direct Final Rule, there was consideration of a separate category for non-self-priming pool pumps that are used in above-ground pool pump applications, that range from 0.75 to 1 THP, and are typically two-speed or single-speed pumps. Accordingly, they stated that the DPPPM rule would not consider this separate category of DPPPs, which allowed for single- or two-speed DPPPMs to be used to meet the ultimate WEF standard, and were concerned on how the DPPPM rulemaking would overwrite the conclusions from the January 2017 Direct Final Rule. (Waterway Plastic, Public Meeting Transcript, No. 88 at pp. 16-17) Dose also commented asking if DOE considered breaking the small-size THP range into subcategories after they suggested the favorable results would be from the higher THPs. (Dose, Public Meeting Transcript, No. 88 at pp. 39-40)

DOE notes that this rule concerns DPPP motors, not DPPPs. Further, DOE notes that the scope includes DPPP motors regardless of how the equipment is sold (*i.e.*, incorporated in a DPPP or sold separately). Accordingly, imported pump products that include a DPPP motor would be subject to the DPPP motor standard as well.

When considering equipment classes, DOE determines whether separate standards are justified based on the type of energy used for the equipment in question (which in this rulemaking is DPPP motors only), or if a DPPP motor's capacity or other DPPPM performance-related feature justifies a different standard. Manufacturers of covered equipment must use the Federal test procedure as the basis for certifying to DOE that their equipment complies with the applicable energy conservation standards adopted pursuant to EPCA (42 U.S.C. 6316(a); 42 U.S.C. 6295(s)). The metric for DPPP motors based on the DOE test procedure is full-load efficiency (10 CFR 431.484(b)), and full-load efficiency does not take into consideration the ultimate application of the DPPP motor in a DPPP and the motor is tested without an associated DPPP. The DPPP motors in this rule also consume the same type of energy. Further, DOE notes that there are no physical or technological distinguishing factors in a DPPP motor that could be used to identify a particular end-use DPPP application (*e.g.* PCBP, self-priming, non-self-priming). If sized correctly, a given DPPP motor could serve any of the DPPP applications discussed in this rulemaking. The ranges of motor THP that serve each application overlap and preclude DOE from setting equipment classes using the motor THP to distinguish each application. Accordingly, DOE is not considering DPPP application in addition to motor THP when setting equipment classes and energy conservation standards for this final rule.

In the June 2022 NOPR, DOE discussed that full-load efficiency generally correlates with motor horsepower. DOE explained motor horsepower dictates the maximum load that a motor can drive, which means that a motor's rated horsepower can influence and limit the end use applications where that motor can be used, which in this case is dedicated purpose pool pumps. Horsepower is a critical performance attribute of a DPPP motor, and since horsepower has a direct relationship with full load efficiency and consumer utility, used this element as a criterion for distinguishing among equipment classes. 87 FR 37122, 37134. In determining the proposed equipment classes, DOE considered how motor total horsepower can be used to decide whether separate standards are justified based on the utility of the DPPP motor. Accordingly, DOE first justified a utility argument for the 0.5 THP cut-off based on maximum efficiency potential in non-self-priming pool filter pumps (*i.e.*, two-speed or variable-speed motors below 0.5 THP would provide inadequate flow to the pool pump). Finally, DOE justified a utility argument for the 1.15 THP cut-off based on how almost all DPPP motors greater than or equal to 1.15 THP are primarily used in standard-size self-priming pool filter pumps, while pool pump motors below 1.15 THP are typically found in small-size, self-priming pool filter pumps, non-self-priming pool filter pumps, and PCBPs. 87 FR 37122, 37135.

To review the recommendation from PHTA and NEMA to further break down the 0.5–1.15 THP range (*i.e.*, small-size equipment class), DOE analyzed the 2022 DPPP Database to determine whether there was any other utility argument to consider. DOE identified DPPP motors used in PCBP applications primarily in the 0.75–1.15 DPPP motor THP range; however, PCBPs in that range were only 4 percent of the total model count (96 percent of the models were either self-priming or non-self-priming). Further, DPPP motors in self-priming pool filter pumps and non-self-priming pool filter pumps were identified throughout the small-size equipment class THP range. Accordingly, there was no THP range within the small-size equipment class that clearly illustrated that only PCBP motors would be used and therefore have a specific utility, and so, DOE was unable to determine a clear utility argument that would allow for the small-size equipment class to be segregated further. Therefore, because DOE is not considering DPPP application in addition to motor total horsepower for creating equipment classes, DOE is maintaining the June 2022 NOPR proposed equipment classes in this final rule.

Fluidra recommended including a definition for a PCBP DPPP motor as “a motor used for a pressure cleaner booster pump”, and a definition for pressure cleaner booster pump as “an end suction, dry rotor pump designed and marketed for pressure-side pool cleaner applications, and which may be UL listed under ANSI/UL 1081-2016. (Fluidra, No. 91 at p. 2) PHTA and NEMA recommended that DOE define a PCBP DPPP motor as “an electric motor that is single phase or poly phase and is designed and/or marketed for use on pressure cleaner booster pumps, as defined in 10 CFR 431.462.” PHTA and NEMA commented that this definition aligns with the definitions of a DPPP motor and PCBP, both of which define the respective equipment based on the design and marketed purpose of the equipment. (PHTA and NEMA, No. 92 at pp. 4-5) DOE understands that the definitions provided by the commenters were intended for distinguishing PCBP within the equipment class structure. As discussed previously, DOE is not separating equipment classes based on application. As such, DOE does not need to incorporate a definition for a PCBP motor and is therefore not including a definition in this final rule.

4. Technology Options

In the June 2022 NOPR market analysis and technology assessment, DOE identified several technology options initially determined to improve the efficiency of DPPP motors. Specifically, DOE stated that the efficiency of a DPPP motor is dependent on motor topology, capacity, and operating speed. Because DOE proposed to delineate equipment classes based on motor capacity (*i.e.*, motor horsepower), DOE considered motor topology and operating speed as technology options. 87 FR 37122, 37135-37136.

For motor topology, DOE considered AC induction motors and permanent magnet DPPP motors. Within AC induction motors, DOE identified six categories of motors, including shaded-pole, split-phase, capacitor-start (capacitor-start induction-run "CSIR" and capacitor-start capacitor-run "CSCR"), permanent-split capacitor ("PSC"), and polyphase. 87 FR 37122, 37135-37136. For operating speed, DOE considered single-speed, multi-speed, and variable-speed DPPP motors. Single-speed motors can operate at one predefined speed, and therefore the associated pool pump can provide only a single flow rate in any given pool system. Two-speed motors can be sized so that high-flow functions like pool cleaning are effective at full-speed operation and low-flow tasks like filtration can be completed at low-speed operation. Multi-speed motors function similarly to two-speed motors, but provide additional flexibility. Finally, variable-speed motors can provide greater energy savings than two-speed or multi-speed motors due to the ability to program these motors to operate at user-defined speed settings. 87 FR 37122, 37136. Variable-speed motors can also offer non-energy-saving benefits like reduced pool system wear and reduced noise levels during operation, both due to the reduced amount of water flow during pumping. DOE requested comment on the technologies considered for higher DPPP motor efficiency. *Id.*

PHTA and NEMA commented that to meet the current DPPP rulemaking, synchronous motor technologies with a variable frequency drive are already being utilized to meet system efficiency requirements. As such, PHTA and NEMA suggested that small additional increments in already implemented synchronous motor efficiency will have minimal impact on system efficiency, but significant impact on costs. (PHTA and NEMA, No. 92 at p. 10) DOE notes that this rule is specifically regarding the DPPP motor, not DPPP, and therefore technology options considered are with regards to DPPP motors and not the whole DPPP system. DOE also understands that meeting the current DPPP WEF standards would not require synchronous motor technologies for the range of DPPP motor equipment classes being considered. Specifically, in the October 2020 NOPR, DOE specified that only standard-size self-priming pool filter pumps, which are subject to the DOE DPPP energy conservation standards, would likely require a variable-speed control motor. 85 FR 62816, 62824. DOE noted that this generally reflects DPPP motors with a THP greater than or equal to 1.15. *Id*. As such, there are potential savings to be considered for the full scope of DPPP motors being considered, and as discussed previously, the synchronous motor technology option allows for multiple operating speeds, which can provide energy savings. Finally, DOE included the incremental costs for requiring variable speed as part of the engineering analysis, which is discussed further in section IV.C.2 of this document.

Similarly, PHTA and NEMA commented that variable-speed fractional HP pumps cannot provide minimum flow at required lower speeds. (PHTA and NEMA, No. 100 at p. 3) DOE notes that variable-speed motors are only considered as a design option for DPPP motors where the associated pump can provide adequate flow at lower speeds, and that the representative units analyzed in the January 2017 Direct Final Rule contained fractional THP variable-speed motors. *See* Table 5.6.5 of the January 2017 Direct Final Rule TSD, where a .44 hhp pump is driven by a .75 THP variable-speed motor and provides adequate flow.

Separately, Fluidra, PHTA, and NEMA suggested that the operating window of a PCBP in practical application is limited to an approximate motor speed of 2,900 RPM – 3,450 RPM (max speed); runs on a timer for 2–2.5 hours a day at a single operating speed; and, once set, is typically not further adjusted for speed like one would for a filtration pump. (Fluidra, No. 101 at p. 1; PHTA and NEMA, No. 100 at p. 3) Accordingly, Fluidra and PHTA stated that the definition for a variable-speed control DPPP motor does not make practical sense in a PCBP application, and therefore recommended separating PCBP requirements from other DPPP applications. (Fluidra, No. 101 at pp. 1–3; PHTA, No. 100 at pp. 2–3) DOE notes that the definition for variable speed comes from UL 1004-10:2020, which is an industry standard DOE incorporated by reference in the July 2021 Final Rule based on recommendations from several stakeholders. 86 FR 40765, 40769-40770. (July 29, 2021). Further, the scope of UL 1004-10:2020 does not specifically exclude PCBP applications for DPPP motors. *See* section 1 of UL 1004-10:2020. As such, DOE concludes that the definitions from UL 1004-10:2020 are applicable to all DPPP motors in scope, including PCBPs, and there is no technical reasoning to exclude application to PCBPs.

Separately, in the January 2017 Direct Final Rule, DOE also considered variable-speed motors for PCBPs (82 FR 5650, 5684), as the WEF metric accounts for energy savings available from reducing the pump speed to reach the minimum required pressure of 60 feet. *See* section 3.6.2 of the January 2017 Direct Final Rule TSD. While the test procedure specifies only one load point for testing PCBPs (*see* Table 1 of appendix C to subpart Y of 10 CFR part 431), the test procedure does not specify that PCBPs are tested at maximum speed; rather, it specifies that PCBPs are tested at the lowest speed that can achieve 60 feet of head at the 10 gpm test condition. Therefore, a PCBP may be able to achieve a higher (more beneficial) WEF score if it has the ability to operate at reduced speeds, and as such, the definition for a variable-speed control DPPP motor would still make practical sense in terms of examining energy savings potential.

Finally, as part of the January 2017 Direct Final Rule, the DPPP Working Group discussed that PCBPs on the market supply between 100 and 125 feet of head at the pump outlet at the test condition of 10 gpm, but these pumps provide more pressure than the cleaner requires because the pump must overcome head losses imposed by piping, couplings, and hoses between the pump and the cleaner. In pool installations with high head loss, these pumps may deliver the recommended amount of head to the cleaner when operating at maximum speed with no flow restriction; in pool installations with low head loss, these pumps may supply more head than is needed to drive the pressure cleaner. As such, the DPPP Working Group discussed how, in installations with low head loss, energy could be conserved by operating the pressure cleaner booster pump at a reduced speed rather than by releasing pressure that was supplied unnecessarily. Therefore, there is benefit to variable-speed control for PCBP applications. *See* section 3.6.2.2 of the January 2017 Direct Final Rule TSD.

NEEA recommended that DOE include non-proprietary, standardized connectivity design requirements for DPPP motors consistent with the voluntary requirements in the ENERGY STAR Product Specification for Pool Pumps Version 3.1. The ENERGY STAR specification presents connected product criteria for a connected pool pump system ("CPPS"). As part of the CPPS criteria, ENERGY STAR requires communication and demand response functionality. Specifically, ENERGY STAR requires that the CPPS shall meet the communication and equipment performance standards for OpenADR 2.0 and/or CTA-2045. NEEA commented that this requirement to use these non-proprietary communication protocols and hardware standards ensures there is an open-source platform that allows demand response service providers and utilities to interface with as many demand response customers as possible. NEEA noted that the DOE DPPP motor rule would benefit from this additional demand response design requirement because the DPPP motor serves as the energy-consuming component of the pool pump. However, NEEA further recommended that this requirement additionally be applied to the pool pumps themselves, so that the pump controller can provide interface for response signals. Finally, NEEA noted that connectivity design requirements would provide the greatest benefits to two-speed or variable-speed motors, and that DOE should assess the additional cost requirements for integrating connectivity requirements into DPPP motors with the multitude of efficiency and grid benefits that grid-connected pool pumps can provide. NEEA also provided an example of a case study by Electric Power Research Institute[40], which showed connected pool pumps systems can provide significant grid benefits. (NEEA, No. 99 at pp. 1–2)

The subject of this final rule is DPPP motors, which are within the scope of electric motors. DOE notes that these potential design criteria described by NEEA would not directly impact the measured efficiency of DPPP motors per the DOE test procedure,

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[40] Performance Test Results: CTA-2045 Variable Speed Pool Pumps, *https://www.bpa.gov/-/media/Aep/energy-efficiency/emerging-technologies/ET-Documents/NREL-testing-CTA-2045-VariableSpeedPoolPump-Nov2017-000000003002011749.pdf*.

but could serve an important purpose for grid flexibility generally, when used in conjunction with the DPPP. For this final rule, DOE is only considering technology options that can be directly implemented as part of the DPPP motor to improve measured efficiency. As such, an additional connectivity design requirement would be beyond the scope of this final rule and therefore is not being considered at this time.

B. Screening Analysis

DOE uses the following four 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 commercially viable, existing prototypes will not be considered further.

(2) *Practicability to manufacture, install, and service.* If it is determined that mass production of a technology in commercial products and reliable installation and servicing of the technology 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.* If a technology is determined to have a significant adverse impact on the utility of the product to subgroups of consumers, or results 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) *Safety of technologies.* 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 technology has proprietary protection and represents a unique pathway to achieving a given EL, it will not be considered further, due to the potential for monopolistic concerns.

10 CFR 431.4; 10 CFR part 430, subpart C, appendix A, sections 6(c)(3) and 7(b).

In sum, 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 reasons for eliminating any technology are discussed in the following sections.

In the June 2022 NOPR, DOE determined that all the technology options considered continue to be technologically feasible because they are being used or have previously been used in commercially available products or working prototypes. DOE also found that the technology options continue to meet the other screening criteria (*i.e.*, practicable to manufacture, install, and service; do not result in adverse impacts on consumer utility, product availability, health, or safety; and are not unique-pathway proprietary technologies). 87 FR 37122, 37137. As such, DOE screened-in all technology options considered.

DOE did not receive any comments regarding the screening analysis. As such, through a review of each technology, similar to the conclusions from the June 2022

NOPR, DOE concludes that all of the identified technologies listed in section IV.A.4 of this document met all five screening criteria to be examined further as design options in DOE's final rule analysis.

C. Engineering Analysis

The purpose of the engineering analysis is to establish the relationship between the efficiency and cost of DPPP motors. 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 equipment, DOE considers technologies and design option combinations not eliminated by the screening analysis. For each equipment class, DOE estimates the baseline cost, as well as the incremental cost for the equipment 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 interpolate to define "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 final rule, DOE applied a combination of the two approaches. In line with the January 2017 Direct Final Rule, DOE considered three tiers of motor efficiency (low, medium, and high efficiency) and design requirements specifically for two-speed, multi-speed, and variable-speed motors. As discussed in sections IV.A.2 and IV.A.4 of this document, the motor technologies applicable to pool pump motors analyzed in the January 2017 Direct Final Rule remain relevant and applicable in the current DPPP motor market.

a. Representative Units

In the June 2022 NOPR, DOE opted to use representative units for each equipment class for the engineering analysis. The associated motor THP of the proposed representative units were consistent with the motor THPs provided in Table 5.7.1 of the January 2017 Direct Final Rule TSD, with three exceptions: (1) Representative unit 2A was added to represent standard-size DPPP motors that are used in small-size self-priming DPPPs; (2) Representative unit 6 was added to analyze standard-size DPPP motors used in non-self-priming filter pump applications; and (3) Representative unit 7 at 1.125 THP, instead of 1.25 THP was considered so as to keep this representative unit in the small-size equipment class (EC 2), and to better represent the THP range of motors in PCBPs.[41] 87 FR 37122, 37137-37138. The proposed representative units are provided in Table IV.1.

Table IV.1 Representative Units THP and DPPP Application

Rep. Unit	Equipment Class	THP	DPPP Application*
1	2 (Small)	0.75	Self-priming Filter Pump, Small-size (0.44 hhp)
2	3 (Standard)	1.65	Self-priming Filter Pump, Standard-size (0.95 hhp)
2A	3 (Standard)	1.65	Self-priming Filter Pump, Small-size (0.65 hhp)
3	3 (Standard)	3.45	Self-priming Filter Pump, Standard-size (1.88 hhp)
4	1 (Extra-small)	0.22	Non-Self-priming Filter Pump, Extra-Small-size (0.09 hhp)
5	2 (Small)	1	Non-Self-priming Filter Pump, Standard-size (0.52 hhp)
6	3 (Standard)	1.5	Non-Self-priming Filter Pump, Standard-size (0.87 hhp)
7	2 (Small)	1.125	Pressure Cleaner Booster Pump

* For self-priming pumps, the terms small and standard refer to the hydraulic horsepower ("hhp"). Small-size designates pool pump applications with hydraulic horsepower less than 0.711 hhp, while standard-size designates pool pump applications with hydraulic horsepower greater than or equal to 0.711 hhp. DOE distinguishes extra-small non-self-priming filter pumps (less than 0.13 hhp) and standard-size non-self-priming filter pumps (less than 2.5 hhp and greater than 0.13 hhp).

In response to the proposal, DOE received a number of comments. Fluidra commented that Rep. Unit #4 appears too small and irrelevant and may only be used for pump/filter combos or spas, which is out of the scope of this regulation. (Fluidra, No. 91 at p. 3) Based on the 2022 DPPP Database, DOE notes that there are at least 15 non-self-

[41] The Joint Petition noted that almost all motors used in pressure cleaner booster pumps have THPs less than 1.15 THP. (Joint Petition, No. 14 at p. 8).

priming filter pumps having DPPP motors at or less than 0.22 THP. While Rep. Unit #4 may be a small segment of the whole DPPPM market (3 percent; see shipments in Table IV.9), these are DPPP motors that would be in scope as they are part of the non-self-priming DPPP motor class. For this final rule, DOE specifically included an extra-small-size equipment class because DPPP motors in that class have different maximum efficiency potential than small- or standard-size equipment classes and therefore need to be analyzed separately. As such, DOE continues to include Rep. Unit #4 as part of the analysis.

Fluidra also stated that Rep. Unit #7 only represents single-stage booster pumps and not multi-stage, which are typically >1.125 THP and significantly higher WEF, and therefore should be reviewed separately. (Fluidra, No. 91 at p. 3) PHTA stated that DOE should review the improvements made in booster pump hydraulic efficiency and go on to note that a multi-stage booster pump can result in a 40-percent higher WEF than a single-stage booster pump. (PHTA, No. 100 at p. 3) DOE notes that representative units exemplify typical capacities in each equipment class and are used to quantify the manufacturing costs and the energy savings potential for each equipment class. As discussed previously, almost all DPPP motors used in PCBPs have THPs less than 1.15 THP. DOE also confirmed the same in the 2022 DPPP Database, with PCBP applications having DPPPMs ranging from 0.75 to 1.13 THP, with the majority of the models in the 1.1 to 1.13 THP range. Accordingly, the chosen DPPP motor representative unit for the PCBP application, Rep. Unit #7 at 1.125 THP, was considered to represent the full THP range of motors in PCBPs, which are primarily in the small-size equipment class.

The pump performance curve associated with the DPPP motor Rep. Unit #7 and used in the analysis was based on the pump performance curve used in the January 2017 Direct Final Rule. Section 5.8.2.3 of the January 2017 Direct Final Rule TSD specifically notes that DOE developed the equations by aggregating pump test data that were submitted by manufacturers, and does not specify that the test data was only for single-stage pumps. In reviewing the underlying data that were used to develop the equations, DOE can confirm that the selection of a representative PCBP unit and its corresponding performance characteristics was informed by the presence of more efficient multi-stage pumps available on the market to the extent they represent PCBP units with the exceptionally high hydraulic efficiency. However, DOE believed that these motors do not comprise as significant of a share of the market as single-stage pumps. Consequently, the ultimate representative unit and performance characteristics more closely resembled the single-stage PCBPs.

PHTA and NEMA commented that PCBP motors at or above 1.15 THP were not included in the DOE analysis, and if DOE intends to regulate these products, PHTA and NEMA requested that DOE update the analysis. (PHTA and NEMA, No. 92 at p. 5) Further, in a separate comment, PHTA restated the need for analysis of PCBP motors above 1.15 THP. (PHTA, No. 100 at p. 2) Based on the 2022 DPPP Database, DOE identifies only one DPPP motor used in a PCBP application that would be above the 1.15 THP threshold. Further, based on the 2022 DPPP Database, DOE notes that the majority of DPPP motors above 1.15 THP are self-priming DPPP applications (74 percent based on model count), with non-self-priming DPPP applications being the next highest percentage (26 percent based on model count). DOE generally selects representative units based on the quantity of motor models available within an equipment class. Considering that the number of DPPP motors above 1.15 THP with a PCBP application is not significant, and that most DPPP motors with a PCBP application are in the small-size equipment class, DOE continues to consider Rep. Unit #7 only for PCBP applications.

b. Baseline Efficiency

For each product/equipment 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/equipment class represents the characteristics of a product/equipment 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.

In the June 2022 NOPR, mirroring the January 2017 Direct Final Rule, DOE considered the least-efficient single-speed DPPP motor on the market for each representative unit. 87 FR 37122, 37138. DOE did not receive any comments regarding the baseline efficiencies, and therefore is maintaining the same levels from the June 2022 NOPR in this final rule.

c. Higher Efficiency Levels

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

In the June 2022 NOPR, DOE proposed higher efficiency levels by substituting higher full-load efficiency DPPP motors and DPPP motors with finer levels of speed control, consistent with the January 2017 Direct Final Rule. 87 FR 37122, 37138. Efficiency levels 0 through 2 were consistent with Table 5.6.3 of the January 2017 Direct Final Rule TSD and represented the low-efficiency, medium-efficiency, and high-efficiency performance of single-speed DPPP motors. Efficiency levels 3 through 6 incorporated certain design requirements based on motor speed capability and topology.[42] DOE proposed that EL 3 require motors that are two-speed, multi-speed, or variable-speed, but with no restrictions on motor topology. EL 4 required motors that are two-speed or multi-speed, but did not allow for the low-efficiency motor topologies (split-phase, shaded-pole, CSIR)—or—required variable-speed motors. EL 5 required motors that are two-speed or multi-speed, but did not allow for PSC motors in addition to the other low-efficiency motor topologies—or—requires variable-speed motors. Finally, EL 6 included variable speed only, which provides the highest energy savings. 87 FR 37122, 37139.

In response, CEC and NYSERDA commented that DOE should reevaluate the "max-tech" levels considered for small-size and standard-size DPPP motors, and work toward a performance metric that captures the benefits of variable-speed motors. Specifically, CEC and NYSERDA noted that not all variable-speed DPPP motors are created equal, because an AC induction motor paired with a variable-frequency drive and a permanent magnet motor with an integral drive exist and provide different performance

[42] For the purposes of the analysis, however, DOE did consider the full-load efficiencies presented in Table 5.6.3 of the January 2017 Direct Final Rule TSD for efficiency levels 3 through 6.

characteristics depending on speed settings. Accordingly, CEC and NYSERDA encouraged DOE to update the DPPP motor test method and performance metric that can distinguish between different speed DPPP motors and between different categories of variable-speed DPPP motors. While CEC and NYSERDA noted that this approach may be outside the scope of the current rulemaking, they stated that it is important to acknowledge that the proposed efficiency levels for small-size and standard-size DPPP motors do not represent “max-tech,” and that there are potential future improvements for both the DPPP motor test method and the DPPP motor energy conservation standards. (CEC and NYSERDA, No. 94 at p. 6)

The DOE test procedure in 10 CFR 431.484(b) establishes full-load efficiency as the metric for DPPP motors. For the engineering analysis, while DOE considers full-load efficiency per the DOE test procedure for ELs 0 through 3, the higher ELs only consider design requirements based on speed control. Accordingly, the variable-speed requirement considered as part of the analysis is based on the definition of variable-speed control dedicated-purpose pool pump motor in section 2 “Glossary” of UL 1004-10:2020.[43] 10 CFR 431.483. The variable-speed definition includes specific requirements for motor operation that are supposed to be met, but does not distinguish between the designs on the motors. As such, for this rulemaking, DOE is basing the engineering analysis on the definitions and test procedures prescribed at 10 CFR 431.484. DOE concurs that there

[43] In this final rule, DOE is updating UL 1004-10:2020 to UL 1004-10:2022. *See* further discussion in section IV.A.1 of this document.

may be future improvements for efficiency, and would consider these improvements in the next stage rulemaking.

As such, in this final rule, DOE maintains the DPPP motor engineering analysis from the June 2022 NOPR, as presented in Table IV.2.

Table IV.2 Performance and Design Requirements for DPPP motor ELs

EC	Rep. Unit	Motor THP	DPPP Application	EL0	EL1	EL2	EL3*	EL4*	EL5*	EL6*
1	4	0.22	Non-self-priming Filter Pump, Extra-Small-size (0.09 hhp)	55%	69%	76%	-	-	-	-
2	1	0.75	Self-priming Filter Pump, Small-size (0.44 hhp)	55%	69%	76%	Two-speed —OR— Multi-speed —OR— Variable-speed	Two-speed/Multi-speed, not CSIR, not shaded pole, not split-phase; —OR— Variable-speed	Two-speed/Multi-speed, not CSIR, not shaded pole, not split-phase, not PSC; —OR— Variable-speed	Variable-speed only
2	5	1	Non-self-priming Filter Pump, Small-size (0.52 hhp)	55%	69%	76%	Two-speed —OR— Multi-speed —OR— Variable-speed	Two-speed/Multi-speed, not CSIR, not shaded pole, not split-phase; —OR— Variable-speed	Two-speed/Multi-speed, not CSIR, not shaded pole, not split-phase, not PSC; —OR— Variable-speed	Variable-speed only
2	7	1.125	Pressure Cleaner Booster Pump	55%	69%	76%	Variable-speed only	Variable-speed only	Variable-speed only	Variable-speed only
3	6	1.5	Non-self-priming Filter Pump (0.87 hhp)	55%	69%	77%	Two-speed —OR— Multi-speed	Two-speed/Multi-speed, not CSIR, not shaded pole,	Two-speed/Multi-speed, not CSIR, not shaded pole, not split-	Variable-speed only

							—OR— Variable-speed	not split-phase; —OR— Variable-speed	phase, not PSC; —OR— Variable-speed	
3	2	1.65	Self-priming Filter Pump, Standard-size (0.95 hhp)	55%	69%	77%	Two-speed —OR— Multi-speed —OR— Variable-speed	Two-speed/Multi-speed, not CSIR, not shaded pole, not split-phase; —OR— Variable-speed	Two-speed/Multi-speed, not CSIR, not shaded pole, not split-phase, not PSC; —OR— Variable-speed	Variable-speed only
3	2A	1.65	Self-priming Filter Pump, Small-size (0.65 hhp)	55%	69%	77%	Two-speed —OR— Multi-speed —OR— Variable-speed	Two-speed/Multi-speed, not CSIR, not shaded pole, not split-phase; —OR— Variable-speed	Two-speed/Multi-speed, not CSIR, not shaded pole, not split-phase, not PSC; —OR— Variable-speed	Variable-speed only
3	3	3.45	Self-priming Filter Pump, Standard-size (1.88 hhp)	75%	79%	84%	Two-speed —OR— Multi-speed —OR— Variable-speed	Two-speed/Multi-speed, not CSIR, not shaded pole, not split-phase; —OR— Variable-speed	Two-speed/Multi-speed, not CSIR, not shaded pole, not split-phase, not PSC; —OR— Variable-speed	Variable-speed only

* Includes freeze protection control design requirements.

PHTA and NEMA commented that if DOE finds this 0.5 THP requirement feasible from a lifecycle cost analysis, motor manufacturers can produce motors meeting the performance requirements; however, this may result in replacement market fit issues as the product will become larger in size. (PHTA and NEMA, No. 92 at p. 10) Pentair stated concern with the proposal to require replacement motors as small as 0.5 THP to meet variable speed. Specifically, that if motors meeting the DPPP rule fail, then those motors will not be able to be replaced with an original single-speed motor. (Pentair, No. 90 at p. 1)

A DPPP motor is subject to standards regardless of how it is sold (*i.e.*, with or without a corresponding DPPP). As such, Pentair is correct that if DPPPs using a 0.5 THP motor or smaller sold before the compliance date of this rule fail after the compliance date of this rule, consumers would likely be unable to replace the original single-speed motor with a similar single-speed motor. *See* section IV.G.3 for more discussion of repair scenarios in the standards cases. Additionally, DOE notes that there are a number of variable-speed DPPP motors on the market that are currently being used in DPPPs. DOE also notes that PHTA, NEMA, and Pentair did not provide information supporting the claim that there may be fit issues. In other industries, variable-speed motors (particularly electronically commutated motors, or ECMs) have been produced to be drop-in replacements in larger equipment (i.e., with no fit issues) for single-phase and polyphase motors in horsepower ranges identified by commenters.[44] There are no unique design characteristics of DPPP motors that would prevent variable-speed motors from being drop-in replacements to single-speed DPPP motors.[45] Accordingly, DOE cannot conclude that there will be fit issues for DPPP motors in this lower THP range, and that

[44] *www.regalrexnord.com/brands/genteq/aftermarket-products/Evergreen-Motors/Evergreen-VS-Motor.*
[45] As noted in section 5.7.1 of the January 2017 Direct Final Rule TSD, DOE researched the design and engineering constraints associated with motor substitution by examining manufacturer interview responses and holding discussions with the DPPP Working Group. DOE concluded that for the representative equipment capacities being considered, the wet end of the pump can be paired with a range of motors with various efficiencies and speed configurations without significant adaptations. *See* chapter 5 of the dedicated-purpose pool pumps direct final rule TSD, at *www.regulations.gov/document?D=EERE-2015-BT-STD-0008-0105*.

in the scenario identified by Pentair the single-speed motor could be replaced by a variable-speed motor.

Motor Input Power and Pump Hydraulic Power

Each efficiency level presented in Table IV.2 has an associated energy factor (in Gallons/Watt-hour "G/Wh") and flow (in gallons per minute "gpm") used to determine efficiency of the pump system. In the June 2022 NOPR, DOE used the pump performance curves consistent with the January 2017 Direct Final Rule TSD to represent the energy factors and flows. 87 FR 37122, 37139.

The CA IOUs commented that DOE should update its analysis to show motor turn-down savings from variable-speed motors. Specifically, the CA IOUs commented that the DOE analysis for PCBP assumes an operating point of 10 gpm and 112 ft of head, which is not representative of variable-speed capability at EL 3 nor consistent with the DPPP test procedure. The CA IOUs recommended that DOE consider an operating point consistent with the DOE test procedure of 10 gpm and 60 ft of head, which the CA IOUs noted the industry and advocates agreed to this test point during the ASRAC negotiation for DPPP standard. The CA IOUs provided estimates of the input power and WEF for a variable-speed PCBP corresponding to a 60 ft head, and showing a 52-percent decrease compared to the values used in DOE's NOPR analysis. (CA IOUs, No. 96 at p. 4) Nidec commented that PCBPs and variable speed will have to run at nearly full speed or maybe slightly less than full speed. Therefore, they stated that representation of power usage on variable speed is most likely incorrect in the analysis, which would make an assumption of actually having the ability to slow the speed down to take advantage of the power savings in lower speed. (Nidec, Public Meeting, No. 88 at pp. 28-29) As discussed in section IV.A.4, the DPPP Working Group considered variable-speed technology option for PCBPs because in installations with low head loss, energy could be conserved by operating the pressure cleaner booster pump at a reduced speed. In reviewing the January 2017 Direct Final Rule TSD, DOE notes that the analysis does only account for motor and hydraulic efficiency improvements for variable-speed efficiency levels of PCBPs, and does not account for any change in energy consumption from the reduction of motor speed. As such, DOE agrees that a revised approach is necessary to reflect the expected reduced energy use of variable-speed PCBPs resulting more accurately from motor turndowns. Additionally, DOE acknowledges the method of calculation in the CA IOUs comment as properly representative. As such, in this final rule, DOE has updated the pump curves for PCBPs to be consistent with the recommendation by the CA IOUs. Further discussion is provided in chapter 5 of the final rule TSD.

Fluidra stated that, at maximum speed, the variable-speed PCBP consumed more energy than the single-speed system. As such, Fluidra commented that a consumer with operating conditions and equipment similar to those used in this analysis would never be able to recover the additional cost of variable-speed control. (Fluidra, No. 91 at pp. 1-2) In addition, Fluidra stated that while this test represents only two sites and two PCBP models, Fluidra feels that the operating conditions are reasonably representative. (Fluidra, No, 91 at p. 6) Finally, Fluidra stated that the power consumption of the booster pump variable-speed motor operating at maximum speed measured noticeably higher than the single-speed base comparison. Specifically, Fluidra commented that operating the PCBP at maximum speed is necessary in many pool applications due to plumbing head loss from extended pipe runs where the pool equipment pad is further from the pool for aesthetics and noise reduction. (Fluidra, No. 91 at pp. 1–2).

PHTA and NEMA referenced the same Fluidra study and assertions in their comment submission. (PHTA and NEMA, No. 92 at pp. 2–3) Further, PHTA and NEMA commented that the restrictor plates in PCBPs have multiple purposes and should not be mistaken as used for flow rate tuning. PHTA and NEMA commented that industry uses restrictor plates/discs in testing to decrease flow and pressure, and that they start off with the largest plates and determine if sufficient flow is present, and if not, go down in size, and if needed, remove completely. PHTA and NEMA pointed out that the plates are ultimately used because many times consumers do not turn off the booster pump when they remove the pressure cleaner; therefore, the plate protects the booster pump if the pressure cleaner is removed. (PHTA and NEMA, No. 92 at p. 3)

On the other hand, the CA IOUs supported the technical feasibility of energy savings from variable-speed motors in PCBP applications and discussed the PCBP variable-speed-motor retrofit study that the CA IOUs had conducted for the DPPP rulemaking. Specifically, the CA IOUs stated that the results showed that a variable-speed motor could provide substantial energy savings by reducing the PCBP pump speed, while maintaining consumer utility. The CA IOUs stated that the definition of consumer utility for a pressure side pool cleaner (pool sweep) is the correct number of wheel revolutions per minute in cleaning operation. In addition, the CA IOUs stated that a single-speed PCBP produces more pressure than the pool sweep requires, and the consumer may use the included flow restrictor discs and a bleed to reduce the pressure and flow to the sweep's required operating condition. Accordingly, the flow restrictor and bleed valve allow unused energy from the pump to escape to the pool, and variable-speed PCBP offers an energy-saving alternative by allowing the consumer to set the speed of the pump to deliver the pressure and flow needed to operate the sweep, with low or no usage of the bleed valve and restrictor rings. The CA IOUs demonstrated the variable-speed capability by retrofitting a variable-speed motor to two PCBPs, which resulted in energy savings of 54 percent to 67 percent. (CA IOUs, No. 96 at p. 3)

In the January 2017 Direct Final Rule, for the analysis conducted for PCBPs, DOE selected a DPPP capacity that was representative of the cluster of model capacities on the market. As such, the resulting representative capacity was 10 gpm of flow and 112 ft of head, which equated to 0.28 hhp. *See* section 5.4.3 of the January 2017 Direct Final Rule TSD. DOE notes that the flow rate of 10 gpm aligns with the testing load point specified in the test procedure. See Table 1 of appendix C to subpart Y of 10 CFR part 431. In addition, while the DPPP Working Group initially recommended that PCBPs be tested at 90 ft of head and a volumetric flow rate that corresponds to 90 ft of head, the DPPP Working Group revised its recommendation for PCBPs to be tested at the load point of 10 gpm and a head greater than 60 ft. *See* section 5.4.3 of the January 2017 Direct Final Rule TSD.

In reviewing the 2022 DPPP Database, DOE observed DPPPMs in PCBP applications ranging from 0.22 to 0.33 hhp, and therefore concluded that 0.28 hhp is in the middle of that range and would still be representative of the PCBP models currently available on the market. As such, with the required test procedure flow rate for PCBPs at

10 gpm (*see* Table 1 of appendix B to subpart Y of 10 CFR part 431), the representative DPPP head will continue to be around 112 ft.[46] In reviewing the analysis that Fluidra, PHTA, and NEMA submitted, the measured sites #1 and #2 are not representative of typical PCBP application, as the supplied heads of 74 ft and 71.5 ft, respectively, which are well below the January 2017 Direct Final Rule analysis representative dynamic head of 112 ft. See section 5.4.3 of the January 2017 Direct Final Rule TSD. In addition, as noted in the January 2017 Direct Final Rule, the DPPP Working Group did acknowledge the existence of ideal systems with head demands as low as 50 ft, they determined that pumps typically supplied 100 ft of head or more. *See* section 3.6.2.2 of the January 2017 Direct Final Rule TSD. As such, DOE understands that the smaller difference between the operating head of the single-speed and variable-speed PCBPs is responsible for the smaller savings potential and reduced cost-effectiveness. DOE does not have any evidence to suggest that the representative capacity used in the January 2017 Direct Final Rule and subsequently in the June 2022 NOPR should be revised. As such, DOE maintains the pump performance inputs from the June 2022 NOPR in this final rule.

Further, in chapter 3 of the January 2017 Direct Final Rule TSD, DOE noted that for installations where the PCBP supplies more pressure than is recommended for the cleaner, pressure may be reduced using a throttling valve or restrictor rings, or excess pressure may be relieved using a pressure relief valve. The pressure relief valve is attached to the hose line that connects the pump outlet to the pressure cleaner, and the valve bypasses the cleaner and releases pressure into the pool being serviced. Further, in

[46] Section 3.3.3 of the January 2017 Direct Final Rule TSD specifies the relationship between pump flow, head, and power.

reviewing manufacturer operating instructions online, DOE observed directions to remove or replace restrictor discs, or to unscrew pressure relief valves, to reduce the pump flow rate. This is consistent with the information provided by the CA IOUs. Further discussion and responses to the commenters' payback period analysis are provided in section IV.F.9 of this document.

Hayward stated that it reviewed energy and cost savings for six of its currently compliant single-speed pumps, including self and non-self-priming, and estimated that the average payback period for conversion to variable speed was over 12 years. Hayward provided details of its analysis as part of its comment, and noted use of a flow rate of 24.7 gpm, even though some pool equipment requires a greater flow rate. (Hayward, No. 93 at p. 2) In reviewing the analysis provided by Hayward, DOE first notes that the prices used were for the pump. The analysis DOE conducted in the June 2022 NOPR, however, considers the motor only, as this rule is specific to the cost-effectiveness of the DPPP motor. While the engineering analysis determines the manufacturer selling price ("MSP") (*see* section IV.C.2 for further discussion), DOE uses the markups from the markups analysis (in section IV.D of this document) to convert the MSP to consumer prices as it relates to the DPPP motor. Accordingly, the costs included in the Hayward analysis do not directly translate to the analysis at hand, which is for the DPPP motor. Further discussion and responses to the commenters' payback period analysis are provided in section IV.F.9 of this document.

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, and the availability and timeliness of purchasing the equipment 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.

In the June 2022 NOPR, DOE used feedback from manufacturers presented in the January 2017 Direct Final Rule to determine the cost of DPPP motors, and updated the cost data to be representative of the market in 2020. DOE adjusted the *2015$* costs to

2020$ using the historical Bureau of Labor Statistics Producer Price Index ("PPI") for each product's industry.[47] DOE also conducted physical teardowns to determine updated DPPP motor controller costs for variable-speed motors. To account for manufacturers' non-production costs and profit margin, DOE applied a non-production cost multiplier (the manufacturer markup) to the MPC to determine the manufacturer selling price ("MSP"). DOE developed an average manufacturer markup of 1.37 by examining the annual Securities and Exchange Commission ("SEC") 10-K reports filed by publicly traded manufacturers primarily engaged in DPPP manufacturing and whose combined product range includes a variety of pool products. 87 FR 37122, 37139-37140.

In response, Fluidra noted that single-speed motor costs have increased roughly 20 – 22 percent in the last 3 years. This is just material costs and does not include transportation costs, which have risen exponentially since 2020. Further, Fluidra noted that component shortages and inflation have dramatically increased material costs since 2020, and that should be evaluated. (Fluidra, No. 91 at p. 3) To account for the recent price changes to the DPPP motor market, DOE inflated the cost data in 2020$ to 2022$ using the updated PPI values for each industry.[48] DOE notes that these indices sufficiently characterize the change in motor prices due to material price changes, transportation costs, and changes in labor costs.

[47] Series IDs: Integral motors (≥1 hp): WPU117304, Fractional motors (<1 hp): WPU117303, Environmental Controls: WPU1181; *www.bls.gov/ppi/*.
[48] Series IDs: Integral motors (≥ 1 hp): WPU117304, Fractional motors (<1 hp): WPU117303, Environmental Controls: WPU1181; *www.bls.gov/ppi/*.

PHTA and NEMA commented that they believe the 1.37 manufacturer markup is a reasonable markup for domestically produced product, but it may be a little low if the product is produced overseas. (PHTA and NEMA, No. 92 at p. 10) As previously discussed, the 1.37 markup was based on publicly available financial information for manufacturers of DPPP motors. The calculation includes general and administrative ("SG&A") expenses, research and development ("R&D") expenses, interest, and profit. DOE does not have data to suggest that these costs would change if a DPPP motor is not manufactured domestically, nor have PHTA and NEMA provided any additional data on how the markup would need to be updated. As such, for this analysis, DOE maintains the manufacturer markup from the June 2022 NOPR.

Table IV.3 lists the MSPs of each EL for DPPP motors. *See* TSD chapter 5 for additional detail on the engineering analysis and complete cost-efficiency results.

Table IV.3 MSPs in 2022$ for DPPP motors

EC	Rep. Unit	THP	DPPP Application	EL 0	EL 1	EL 2	EL 3	EL 4	EL 5	EL 6
1	4	0.22	Non-self-priming Filter Pump, Extra-Small-size (0.09 hhp)	$24.84	$31.04	$50.71	-	-	-	-
2	1	0.75	Self-priming Filter Pump, Small-size (0.44 hhp)	$56.92	$70.37	$90.03	$93.13	$103.48	$114.87	$353.97
2	5	1	Non-self-priming Filter Pump, Small-size (0.52 hhp)	$51.94	$56.45	$76.21	$78.47	$93.71	$110.09	$353.97
2	7	1.125	Pressure Cleaner Booster Pump	$59.84	$77.91	$97.67	-	-	-	$353.97
3	6	1.5	Non-self-priming Filter Pump (0.87 hhp)	$67.86	$89.31	$107.38	$108.51	$127.70	$148.03	$353.97
3	2	1.65	Self-priming Filter Pump, Standard-size (0.95 hhp)	$74.52	$95.97	$114.04	$115.17	$134.36	$154.68	$353.97
3	2A	1.65	Self-priming Filter Pump, Small-size (0.65 hhp)	$74.52	$95.97	$114.04	$115.17	$134.36	$154.68	$353.97
3	3	3.45	Self-priming Filter Pump, Standard-size (1.88 hhp)	$160.33	$199.85	$223.56	$255.17	$269.85	$285.66	$475.85

D. Markups Analysis

The markups analysis develops appropriate markups (*e.g.*, manufacturer markups, retailer markups, distributor markups, contractor markups) 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 and in the manufacturer impact analysis. At each step in the distribution channel, companies mark up the price of the product to cover business costs and profit margin.

In the June 2022 NOPR, DOE identified distribution channels for DPPP motors incorporated in pumps and replacement DPPP motors sold alone as well as the fraction of shipments sold through each channel. To characterize these channels, DOE referred to information collected in support of the January 2017 Direct Final Rule, which reflects the consensus of the Appliance Standards and Rulemaking Federal Advisory Committee ("ASRAC") DPPP Working Group. 87 FR 37122, 37140.

Nidec stated that for motors sold alone, they estimate that the market is not 50 percent from the motor manufacturer to a retailer. Instead, Nidec commented that it is significantly weighted to the motor manufacturer, to the wholesaler, to the retailer, then to the end user. (Nidec, Public Meeting, No. 88 pp. 24-25)

PHTA and NEMA provided updated estimates of fraction of sales by distribution channels. In addition, for DPPP motors sold within DPPPs and going into new pool installations, NEMA and PHTA commented that these also go through a wholesaler step. For DPPP motors sold alone as replacement motors, NEMA and PHTA also recommended adding an additional channel to capture 5 percent of the market being sold through pool product retailers. (PHTA and NEMA, No. 92 at p. 11)

For this final rule, DOE revised its distribution channels to incorporate the feedback from PHTA and NEMA as presented in Table IV.4 and Table IV.5.

Table IV.4 Distribution Channels for DPPP Motors Incorporated in Pumps

Distribution Channel	June 2022 NOPR Fraction of Shipments %	Fraction of Shipments %
DPPP Motor Manufacturer ➔ DPPP Manufacturer ➔ Wholesaler ➔ Pool Service Contractor ➔ Consumer	75	65
DPPP Motor Manufacturer ➔ DPPP Manufacturer ➔ Pool Product Retailer ➔ Consumer	20	15
DPPP Motor Manufacturer ➔ DPPP Manufacturer ➔ Pool Builder ➔ Wholesaler ➔ Consumer	5	20

Table IV.5 Distribution Channels for Replacement DPPP Motors Sold Alone

Distribution Channel	June 2022 NOPR Fraction of Shipments %	Fraction of Shipments %
DPPP Motor Manufacturer ➔ Wholesaler ➔ Contractor ➔End-User	25	45
DPPP Motor Manufacturer ➔ Wholesaler ➔ Retailer ➔ End-User	25	25
DPPP Motor Manufacturer ➔ Pool Pump Retailer ➔End-User	50	25
DPPP Motor Manufacturer ➔ DPPP Manufacturer ➔ Pool Pump Retailer ➔End-User	-	5

DOE developed baseline and incremental markups for each actor in the distribution chain. 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.[49]

To estimate average baseline and incremental markups DOE relied on several sources including: (1) for DPPP wholesalers, SEC form 10-K from Pool Corp[50]; (2) for pool product retailers, SEC form 10-K from several major home improvement centers[51] and U.S. Census Bureau 2017 Annual Retail Trade Survey for the miscellaneous store retailers sector (NAICS 453)[52]; (3) for pool contractors and pool builders, U.S. Census Bureau 2017 Economic Census data for the plumbing, heating, and air-conditioning contractor sector (NAICS 238220) and all other specialty trade contractors sector (NAICS 238990)[53]; (4) for motor wholesalers, U.S. Census Bureau 2017 Annual Wholesale Trade Survey for the household appliances and electrical and electronic goods

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[49] 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.

[50] U.S. Securities and Exchange Commission. SEC 10-K Reports for Pool Corp (2017–2021). Available at *www.sec.gov/* (last accessed July 26, 2021.)

[51] U.S. Securities and Exchange Commission. SEC 10-K Reports for Home Depot, Lowe's, Wal-Mart and Costco. (2017–2021) Available at *www.sec.gov/* (last accessed July 26, 2022.)

[52] U.S. Census Bureau, 2017 Annual Retail Trade Survey, available at *www.census.gov/retail/index.html* (last accessed July 26, 2021).

[53] U.S. Census Bureau, 2017 Economic Census Data, available at *www.census.gov/econ/* (last accessed July 26, 2021).

merchant wholesaler sector (NAICS 4536)[54]; (5) for electrical contractors, 2022 RSMeans Electrical Cost Data[55]; (6) for motor retailers, U.S. Census Bureau 2017 Annual Retail Trade Survey for the building material and garden equipment and supplies dealers (NAICS 444); and (7) for pool pump retailers, U.S. Census Bureau 2017 Annual Retail Trade Survey for the miscellaneous store retailers sector (NAICS 453).

In addition to the markups, DOE obtained State and local taxes from data provided by the Sales Tax Clearinghouse.[56] These data represent weighted average taxes that include county and city rates. DOE derived shipment-weighted average tax values for each state considered in the analysis.

Chapter 6 of the final rule TSD provides details on DOE's development of markups for DPPP motors.

E. Energy Use Analysis

The purpose of the energy use analysis is to determine the annual energy consumption of DPPP motors at different efficiencies in representative U.S. single-family homes, multi-family residences, and commercial buildings, and to assess the energy savings potential of increased DPPP motors efficiency. The energy use analysis estimates the range of energy use of DPPP motors in the field (*i.e.*, as they are actually used by consumers). The energy use analysis provides the basis for other analyses DOE

[54] U.S. Census Bureau, 2017 Annual Wholesale Trade Survey, available at *www.census.gov/awts* (last accessed July 26, 2021).
[55] RSMeans Electrical Cost Data, available at *www.rsmeans.com* (last accessed July 26, 2022).
[56] Sales Tax Clearinghouse Inc., State Sales Tax Rates Along with Combined Average City and County Rates, available at *thestc.com/STrates.stm* (last accessed Jan. 04, 2023).

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. DPPP Motor Applications

The annual energy consumption of a DPPP motor is expressed in terms of electricity consumption and depends on the DPPP motor efficiency level, the pool pumping requirement, the performance of the DPPP incorporating the motor, and the DPPP annual operating hours. This electricity consumption is identical to the annual electricity consumption of the DPPP incorporating the motor. The DPPP motor energy consumption value is the sum of the energy consumption values in each mode of operation. Each mode of operation corresponds to a motor speed setting. Single-speed motors only have one mode of operation while dual- and variable-speed pool pump motors operate at a low-speed and a high-speed mode. The unit energy consumption values in each mode are calculated based on the DPPP usage, which is calculated based on the pool pump system curve that the DPPP is operating on, the pump flow rate of the mode, the pump energy factor of the mode (which in turn determines the motor input power)[57] and the annual run time of the pool pump spent in that mode. In the June 2022 NOPR, DOE calculated the pool pump annual run time based on the application (residential or commercial), the assumed pool size, the assumed number of turns per day, and the sample application's geographic location, which implies the corresponding pool seasons. 87 FR 37122, 37141. A typical DPPP application, characterized by the DPPP equipment class and hydraulic horsepower ("hhp"), was associated to each representative

[57] The motor input power is equal to the DPPP flow (gpm) divided by the DPPP Energy Factor (G/Wh) and multiplied by 60 (number of minutes in an hour).

unit in equipment classes 1, 2, and 3 based on inputs from the engineering analysis. *See* section IV.C.1.a of this document.

DOE did not receive comments regarding this methodology and retained the same approach in the final rule.

2. DPPP Motor Consumer Sample

In the June 2022 NOPR, DOE created individual consumer samples for five DPPP motor markets: (1) single-family homes with a swimming pool; (2) indoor swimming pools in commercial applications; (3) single-family community swimming pools; (4) multi-family community swimming pools; and (5) outdoor swimming pools in commercial applications. DOE used the samples to determine DPPP motor annual energy consumption and to conduct the LCC and PBP analyses. 87 FR 37122, 37141.

PTHA and NEMA commented that within the scope of the document, there is little to no distinction between the types of motors that would be used across community and commercial pool applications. As a result, PHTA and NEMA commented that DOE could consider combining community pool types (single and multi-family), as well as commercial (indoor and outdoor). (PHTA and NEMA, No. 92 at p. 12)

In the June 2022 NOPR analysis, as noted by NEMA and PTHA, community pools and commercial pools were combined and analyzed as the commercial sector by DOE. In this final rule, DOE continued to use the same approach. 87 FR 37122, 37141

See section 7.3 of chapter 7 of the final rule TSD for details of community and commercial indoor and outdoor pool samples used.

DOE used the Energy Information Administration's ("EIA") 2020 Residential Energy Consumption Survey ("RECS 2020") to establish a sample of single-family homes that have a swimming pool.[58] For DPPPs used in indoor swimming pools in commercial applications, DOE developed a sample using the 2018 Commercial Building Energy Consumption Survey ("CBECS 2018").[59] RECS and CBECS include information such as the household or building owner demographics and the location of the household or building.

Neither RECS nor CBECS provide data on community pools or outdoor swimming pools in commercial applications, so DOE created samples based on other available data. To develop samples for DPPPs in single or multi-family communities, DOE used a combination of RECS 2020, U.S. Census 2009 and 2011 American Home Survey Data (AHS),[60,61,62] and the 2022 PK Data report.[63] To develop a sample for pool

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[58] U.S. Department of Energy–Energy Information Administration. 2020 RECS Survey Data. *www.eia.gov/consumption/residential/data/2020/* (last accessed February 2, 2023).
[59] U.S. Department of Energy–Energy Information Administration. 2018 CBECS Survey Data. *https://www.eia.gov/consumption/commercial/data/2018/* (last accessed: February 2, 2023).
[60] U.S. Census Bureau. 2009 AHS survey data. www.census.gov/programs-surveys/ahs/data/2009/ahs-2009-public-use-file--puf-/2009-ahs-national-puf-microdata.html (last accessed: February 2, 2023).
[61] U.S. Census Bureau. 2011 AHS survey data. www.census.gov/programs-surveys/ahs/data/2011/ahs-2011-summary-tables/h150-11.html (last accessed: February 2, 2023).
[62] The earlier versions of AHS was used due to the lack of pool ownership information in the more recent AHS.
[63] PK Data. 2022 Swimming Pool and Pool Heater Customized Report for LBNL. *pkdata.com/annual-reports/* (last accessed: February 2, 2023).

pumps in outdoor commercial swimming pools, DOE relied on data from both CBECS 2018 and the 2022 PK Data report.

DPPPs can be installed with either above-ground or in-ground swimming pools. In the June 2022 NOPR, DOE established separate sets of consumer samples for in-ground pools and above-ground pools by adjusting the original sample weights using data on the number of installed in-ground and above-ground pools gathered during the January 2017 Direct Final Rule, which relied on 2014 data per State provided by APSP.[64] The consumer samples for DPPP motors used in self-priming and pressure cleaner booster pumps are drawn from the in-ground pool samples; the consumer samples for motors used with non-self-priming pool pumps are obtained from the above-ground pool samples. 87 FR 37122, 37142. *See* chapter 8 of the June 2022 NOPR TSD. DOE did not receive comments on this approach and retained the same method in this final rule.

See chapter 7 of the final rule TSD for more details about the creation of the consumer samples and the regional breakdowns.

3. Self-priming and Non-self-priming Pool Pump Motor Input Power

The input power of DPPP motors used in self-priming and non-self-priming pump applications is calculated based on the flow rates (gpm) and typical energy factor (G/Wh) associated with each representative unit.[65] At efficiency levels corresponding to single-

[64] For more details *see* chapter 7 of the January 2017 Direct Final Rule TSD at *www.regulations.gov/document?D=EERE-2015-BT-STD-0008-0105*.
[65] The motor input power is equal to the flow (gpm) divided by the energy factor (G/Wh) and multiplied by 60 (number of minutes in an hour).

speed and two-speed motors, the flow and energy factor values were based on input from the engineering analysis and provided for each system curve (A, B, or C).[66] In the June 2022 NOPR, for each user of self-priming and non-self-priming pool pumps in the consumer sample, DOE specified the system curve used (A, B, or C) by drawing from a probability distribution in which 35 percent of the pool pumps follow curve A, 10 percent of the pool pumps follow curve B, and the remaining 55 percent follow curve C. The probability distribution was based on inputs from the ASRAC DPPP Working Group gathered during the January 2017 Direct Final Rule.[67] 87 FR 37122, 37142.

DOE did not receive any comments on this approach and retained the same methodology and inputs for this final rule.

At efficiency levels corresponding to variable-speed motors, the engineering analysis only provides flow and energy factor values for the high-speed mode on each system curve. In the June 2022 NOPR, for the low-speed mode, DOE used data on pool volume and desired time per turnover from the January 2017 Direct Final Rule TSD to calculate a consumer-specific low-speed flow.[68] These relied on inputs from stakeholders

[66] When a pump is tested on a system curve (such as curve C), any one of the measurements hydraulic power, P (hp), volumetric flow, Q (gpm) and total dynamic head, H (ft of water) can be used to calculate the other two measurements.
[67] For more details see chapter 7 of the January 2017 Direct Final Rule TSD, at *www.regulations.gov/document?D=EERE-2015-BT-STD-0008-0105*.
[68] Flow (in gpm) is equal to the pool volume (in gallons) divided by the desired time per turnover (in minutes).

and several other references.[69, 70, 71] DOE then used the equation provided by the engineering analysis to calculate the energy factor as a function of Q for each representative unit on each system curve. 87 FR 37122, 37142. The equations from the engineering analysis are provided in chapter 5 of the final rule TSD.

Pentair and PHTA and NEMA commented that the minimum flow rate of 24.7 gpm that is being used in the energy use analysis is not high enough to operate certain equipment. (Pentair, No. 90 at p. 2; PHTA and NEMA, No. 92 at p. 4)

Specifically, PHTA and NEMA commented that in looking at filtration pump motors, DOE did not consider additional factors, such as whether the requirements apply to existing pool versus new construction, and whether the requirements to operate certain equipment. PHTA and NEMA commented that when designing a new pool, the piping and equipment are selected in conjunction with the pump system to ensure the pool works properly and safely. However, in existing pools, the piping and much of the equipment, including sanitation items such as skimmers, main drains, and filters, are already in place and would be cost prohibitive for consumers to replace. As such, PHTA and NEMA commented that any replacement motor needs to be capable to provide the flow rates needed to work with the existing system. PHTA and NEMA stated that previous norm in the pool construction industry was small pipe and bigger pump; and although that has changed over

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[69] CEE Residential Swimming Pool Initiative, December 2021.
[70] California Energy Commission Pool Heater CASE. *efiling.energy.ca.gov/GetDocument.aspx?tn=71754&DocumentContentId=8285* (last accessed July 28, 2016).
[71] Evaluation of potential best management practices –Pools, Spas, and Fountains 2010. *calwep.org/wp-content/uploads/2021/03/Pools-Spas-and-Fountains-PBMP-2010.pdf* (last Accessed July 28, 2016).

the last 15 years, there are 5.4 million existing inground pools[3] with a significant percentage that may have 1.5-inch piping. PHTA and NEMA commented that the smaller more restrictive piping size impacts the pump size, which also impacts the filter maintenance. Further, PHTA and NEMA added that many existing pools have skimmers that need a certain minimum flow rate (historically 30-35 gpm) to properly remove surface debris. A skimmer is one part of the sanitation system of the pool and removes containments off the surface to protect swimmers from infections. In some existing pool cases, PHTA and NEMA commented that this will be compromised based on the requirements found in the NOPR and possibly increase the risk of recreational water illnesses for bathers. PHTA and NEMA commented that the energy savings analysis for filtration pumps assumes a minimum flow rate of 24.7gpm for all filtration pump systems. However, PHTA and NEMA stated that different equipment has minimum flow rates higher than this value (e.g. electrolytic chlorinators, pool heaters, suction cleaners and skimmers). Further, PHTA and NEMA stated that as equipment begins to wear out over time, higher flow rates may be needed to continue having the equipment work properly. PHTA and NEMA added that while the minimum flow rate of 24.7 gpm was established as a reasonable estimate of the low-flow conditions a pool may see, different equipment have minimum flowrates above 24.7gpm. PHTA and NEMA commented that through a review of the various equipment, four manufacturers identified products that require flowrates above 24.7gpm. These manufacturers indicated that they sell various products, including gas heaters, sand filters, high efficiency heaters, skimmers, and suction cleaners that all have minimum flowrates at or above 30 gpm. PHTA and NEMA commented that the NOPR analysis did not assume a range of minimum flow rates, and as a result, does not account for the decreased savings (or incompatibility of small variable-speed motors) associated with existing systems that have higher minimum flow rates. PHTA and NEMA commented that a minimum flow rate of 24.7 gpm would result in an existing small-size pump being run at high speed—once installed with a small variable-speed motor—to ensure the equipment continues to run as intended, and would defeat the energy savings and purpose for requiring variable speed. (PHTA and NEMA, No. 92 at pp.3-4) Pentair added that the ICC/ANSI/PHTA 15 Energy Standard has a minimum flow rate of 36 gpm that is being enforced nationwide by many building departments. Therefore, Pentair noted that a variable-speed fractional hp motor would have to operate at a max speed or close to it to produce this minimum flow rate needed at any reasonable total dynamic head loss. (Pentair, No. 90 at p. 2) Pentair further added that in the exiting DPPP rule, there was a minimum filtration rate of 36 gpm. (Pentair, Public Meeting Transcript, No. 88 at p. 62)

PHTA commented that DOE's analysis does not consider the range of minimum flow rates required for certain pool equipment. PHTA stated that in doing so, the analysis does not account for the decreased savings associated with existing systems with and that higher minimum flow rates require the motor to run at higher speeds. (PHTA, No. 100 at p. 4)

The CA IOUs commented that during the 2015 – 2016 ASRAC DPPP Working Group, DOE, industry representatives, and energy efficiency advocates unanimously agreed to a low flow test point of 24.7 gpm on Curve C. The CA IOUs commented that the test point is equivalent to 5 ft of head, the minimum head loss required to account for static losses in the system from the pool filter, pool heater, and skimmer. The CA IOUs recommended that, at this operating point, there would be enough head to push water through the complete pool filtration system, including pool piping, pool filter, and pool heater.[72] (CA IOUs, No. 96 at pp. 2–3)

The Joint Advocates stated that DOE's analysis accurately captures the energy savings for variable speed. The Joint Advocates noted that DOE did not assume that the low speed of a variable-speed pump is a fixed percentage of high speed, but rather calculated an appropriate low-speed flow rate and the associated energy factor for each consumer in its sample, taking into account the minimum flow rate thresholds. (Joint Advocates, No. 97 at pp. 1–2)

In the June 2022 NOPR, DOE calculated the low-speed flow rate as the sampled pool size (drawn from a distribution) divided by the desired number of hours to complete one turnover of the pool and divided by 60 minutes per hour to get the low-flow rate per minute. In addition, if the calculated low-speed flow rate obtained was below 24.7 gpm or 31.1 gpm, DOE used below 24.7 gpm or 31.1 gpm instead. Such an approach results in a range of low-speed flow rates that are higher than minimum flow rates. *See* chapter 7 of the June 2022 NOPR TSD. This is consistent with the comments provided by PHTA and NEMA, Pentair, PHTA, and the CA IOUs. As noted by the Joint Advocates, DOE clarifies that the minimum flow rate is used as a threshold to ensure all low-speed flow rates (at which the pump is assumed to operate) would be greater than 24.7 or 31.1 gpm, as appropriate. The minimum flow rate does not represent the assumed flow rate at which

[72] The CA IOUs provided the following reference: ASRAC DPPP term sheet, *www.regulations.gov/document/EERE-2015-BT-STD-0008-0051*, rec 6.

the variable speed pump operates. As noted by the CA IOUs, the minimum flow rate of 24.7 gpm was developed during the 2015–2016 ASRAC DPPP Working Group. Specifically, the CA IOUs commented that the minimum flow rates for two-speed pumps of 24.7 gpm for two-speed pool filter pumps that have a rated hydraulic horsepower less than or equal to 0.75 hp (small pool filter pumps) and 31.1 gpm for two-speed pool filter pumps that have a rated hydraulic horsepower greater than 0.75 (large pool filter pumps) are consistent with the DPPP Working Group's recommended low-flow rates for multi-speed and variable-speed pool filter pumps (Docket No. EERE-2015-BT-STD-0008, No. 51, Recommendation #6 at p. 5). The DPPP Working Group developed these low-flow rates based on the minimum effective flow rates for typical pool sizes.[73] DOE believes these flow rates are also representative of minimum flow rates for two-speed pool filter pumps and effectively prevent the inclusion of unreasonably low speeds on two-speed pool filter pumps for the sole purpose of inflating WEF ratings. 82 FR 36858, 36880 (Aug. 7, 2017) (citing 81 FR 64580, 64606 (Sept. 20, 2016)). DOE believes that the proposed load points for two-speed pool filter pumps are representative of typical pool filter pump operation and energy performance, and that the load points characterize the efficiency of the pump speeds and flow points in typical applications (*i.e.*, cleaning/mixing and filtration). 82 FR 36858, 36880. In addition, while Pentair, NEMA, and PTHA recommended using a range of minimum flow rates, they did not provide supporting information to develop such distribution. In addition, DOE believes that a single value of minimum flow rate is sufficient to set a threshold and has developed a

[73] The minimum values of 24.7 and 31.1 gpm were used to provide a threshold when developing low flow values in the 2017 DPPP DFR. DOE did not use a value of 36 gpm as stated by Pentair. See Chapter 7 of the January 2017 Direct Final Rule TSD, *at www.regulations.gov/document?D=EERE-2015-BT-STD-0008-0105*, p.7-6, footnote c.

range of low-flow rates. Therefore, in this final rule, DOE retained the same approach as in the June 2022 NOPR.

4. Pressure Cleaner Booster Pumps Motor Input Power

The input power of DPPP motors used in pressure cleaner booster pumps is calculated using the relationship between input power and flow and the system curve provided by the engineering analysis. To characterize operating flow for each consumer in the sample, in the June 2022 NOPR, DOE drew a value from a statistical distribution of flow established during the January 2017 Direct Final Rule. This distribution was developed around the test procedure test point of 10 gpm of flow rate, as recommended by the ASRAC DPPP Working Group. (Docket EERE-2015-BT-STD-0008, No. 92 at p. 311) For single-speed pressure cleaner booster pumps, DOE then calculated the input power using the power curve from the engineering analysis. For variable-speed motors used in pressure cleaner booster pumps, DOE also calculated the pool pump motor input power in a low-speed setting. Based on information from the January 2017 Direct Final Rule, DOE used a value of 10 gpm to characterize the low-speed flow and calculate the hydraulic horsepower using the system curve.[74] Then, DOE calculated the input power using the relationship between input power and flow as provided by the engineering analysis. 87 FR 37122, 37142.

The Joint Advocates commented that for PCBPs, DOE estimated savings associated with reducing flow rate to the 10 gpm specified in the test procedure, which is

[74] For more details, *see* chapter 7 of the January 2017 Direct Final Rule TSD, at *www.regulations.gov/document?D=EERE-2015-BT-STD-0008-0105*.

the typical flow rate required or recommended for suction-side pressure cleaners to function. In addition, the Joint Advocates noted that the savings associated with variable-speed pressure cleaner booster pump motors are supported by testing conducted by the CA IOUs during the DPPP rulemaking, which demonstrated that variable-speed control can reduce pressure cleaner booster pump energy consumption by 54 to 67 percent. Finally, the Joint Advocates commented that because of the cubic relationship between pump speed and power, reducing the speed of a pump by a small amount can yield large energy savings. (Joint Advocates, No. 97 at p. 2)

As previously described in section IV.C.1.c of this document, DOE developed a revised pump curve and input power curves as a function of flow rate for PCBP with variable-speed motors. Accordingly, for both single-speed and variable-speed PCBPs, DOE calculated the power directly from the equation providing power as a function of flow developed in the from the engineering analysis. For variable-speed PCBPs, as noted by the Joint Advocates, DOE maintained a value of 10 gpm to characterize the flow in the low-speed setting.

5. Daily Operating Hours

In the June 2022 NOPR, DOE relied on information gathered during the January 2017 Direct Final Rule to develop estimates of pool pump daily operating hours. For self-priming and non-self-priming pool filter pumps in residential applications, operating hours are calculated uniquely for each consumer based on pool size, number of turnovers per day (itself based on ambient conditions), and the pump flow rate. In commercial applications, DOE assumed that these pumps operate 24 hours per day. 87 FR 37122, 37142-37143. For PCBPs, operating hours were drawn from a distribution based on the January 2017 Direct Final Rule and assumed a minimum operation of 2 hours per day and a maximum of 3 hours per day. See section 7.4.2.2. of the June 2022 NOPR TSD.

PHTA and NEMA commented in support using the same methodology and inputs to estimate DPPP motor energy use that were used in the dedicated-purpose pool pump direct final rule TSD. (PHTA and NEMA, No. 92 at p. 12)

PHTA commented that PCBP motors operate within a small window of 2–2.5 hours per day and that once a PCBP is set, customers have no reason to further adjust the speed of the PCBP motor. (PHTA, No. 100 at pp. 2–3)

In the June 2022 NOPR analysis, as noted above, DOE assumed that PCBP motors operate between 2 and 3 hours per day, which is in line with the information provided by PHTA regarding PCBP operating windows. In addition, as noted in section IV.A.4 of this document, DOE believes that variable speed is an appropriate design option for these motors and would result in energy savings to the consumer.

DOE did not receive any other comments on daily operating hours and retained its approach for calculating the daily operating hours during the pool operating season.

6. Annual Days of Operation

In the July 2022 NOPR, DOE calculated the annual unit energy consumption by multiplying the daily operating hours by the annual days of operation, which depend on the number of months of pool operation. For each consumer sample, DOE assigned different annual days of operation depending on the region in which the DPPP is installed. This assignment was based on information related to pool pump operating season based on geographical locations collected during the January 2017 Direct Final Rule. 87 FR 37122, 37143-37144.

DOE did not receive any comments on this topic and continued to use the same inputs regarding annual days of operation by region.

Chapter 7 of the January 2017 Direct Final Rule TSD provides details on DOE's energy use analysis for DPPP motors.

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 DPPP motors. 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 DPPP motors 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 from various data sources including 2009 AHS, 2011 AHS, 2020 RECS, 2018 CBECS and 2022 PK data. For each sample consumer, DOE determined the energy consumption for DPPP motors and the appropriate energy price. By developing a representative sample of households, the analysis captured the variability in energy consumption and energy prices associated with the use of DPPP motors.

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 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 DPPP motors user samples. For this rulemaking, the Monte Carlo approach is implemented in MS Excel together with the Crystal Ball™ add-on.[75] The model calculated the LCC for products at each efficiency level for 10,000 consumers 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 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.

[75] Crystal Ball™ is a 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/technetwork/middleware/crystalball/overview/index.html* (last accessed February 3, 2023).

DOE calculated the LCC and PBP for consumers of DPPP motors as if each were to purchase a new product in the first year of required compliance with new or amended standards. As discussed in section III.A of this document, for all TSLs except TSL 7, new standards apply to DPPP motors manufactured 2 years after the date on which any new standard is published, which corresponds to a first full year of compliance of 2026.[76] At TSL 7, new standards would also apply 2 years after the publication of any new standard except for small-size DPPP motors, for which new standards apply to DPPP motors manufactured 4 years after the date on which any new standard is published. For the purposes of the LCC and PBP analysis, DOE used 2026 as the first full year of compliance with any amended standards for DPPP motors.

Table IV.6 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 final rule TSD and its appendices.

[76] At this time, DOE estimates publication of a final rule in the second half of 2023. Therefore, for purposes of its analysis, DOE used 2026 as the first full year of compliance with any amended standards for DPPP motors.

Table IV.6 Summary of Inputs and Methods for the LCC and PBP Analysis*

Inputs	Source/Method
Equipment Cost	Derived by multiplying MPCs by manufacturer and distribution channel markups and sales tax, as appropriate. Used historical data to derive a price scaling index to project equipment costs.
Installation Costs	Baseline installation costs determined using data from manufacturer gathered during the January 2017 Direct Final Rule.
Annual Energy Use	The daily energy consumption multiplied by the number of operating days per year. Variability: Based on the 2009 AHS, 2011 AHS, 2020 RECS, 2018 CBECS, 2022 PK data and other data sources.
Energy Prices	Electricity: Based on EEI data for 2021. Variability: Regional energy prices determined for nine census divisions for pool pump motors in individual single-family homes and nine census divisions for pool pump motors in community and commercial pool pump motors. Average and marginal prices used for electricity.
Energy Price Trends	Based on AEO2023 price projections.
Repair and Maintenance Costs	Assumed no repair or maintenance on pool pump motors.
Equipment Lifetime	Average: 3.6 to 5 years depending on the DPPP applications. Variability: Based on Weibull distribution.
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 entities purchasing pool pumps. Primary data source was Damodaran Online.
Compliance Date	2026 (first full year for analytical purposes)

* Not used for PBP calculation. References for the data sources mentioned in this table are provided in the sections following the table or in chapter 8 of the 2017 Direct Final Rule TSD.

1. Equipment 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.

In the June 2022 NOPR, to project an equipment price trend, DOE derived an inflation-adjusted index of the Producer Price Index ("PPI") for integral and fractional horsepower motors and generators manufactured over the period 1967–2020.[77] For fractional horsepower motors, the data showed a slightly downward trend prior to the early 2000s, and then the price index increased to a small degree. For integral horsepower motors, the trend was mostly flat before the early 2000s, and then the price index increased slightly. The trend aligned with the copper and steel deflated price indices to some extent, as they are the major materials used in small electric motors. Given the degree of uncertainty, in the June 2022 NOPR, DOE used a constant price assumption as the default price factor index to project future DPPP motor prices. For two-speed DPPP motors[78], however, DOE assumed that the timer control portion of the installation cost would be affected by price learning. DOE used PPI data on "Automatic environmental control manufacturing" between 1980 and 2020 to estimate the historic price trend of the electronic components in the timer control.[79] For variable-speed DPPP motors, DOE assumed that the controls portion of the DPPP motor would be affected by price learning. Similarly, DOE used PPI data on "Semiconductors and related device manufacturing" between 1967 and 2020 to estimate the historic price trend of electronic components in the control.[80] 87 FR 37122, 37145.

DOE did not receive any comments on the equipment price trends. DOE updated the data used to include an additional year (2021) and retained the same approach to develop equipment price trends.

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[77] Series ID PCU 3353123353121; *www.bls.gov/ppi/*.
[78] DOE uses the terms "dual-speed" and "two-speed" interchangeably throughout this document.
[79] Automatic environmental control manufacturing PPI series ID PCU334512334512; *www.bls.gov/ppi/*.
[80] Semiconductors and related device manufacturing PPI series ID PCU334413334413; *www.bls.gov/ppi/*.

2. Installation Costs

Installation costs include labor, overhead, and any miscellaneous materials and parts needed to install the equipment. In the June 2022 NOPR, DOE simplified the calculation and only accounted for the difference of installation costs by efficiency levels. Specifically, for two-speed pumps, DOE included the cost of a timer control and its installation where applicable. DOE also incorporated the supplemental installation labor costs for variable-speed pumps where applicable. *Id.*

Pentair commented that older pools with large single-speed pumps would begin to fail and need replacement, as older pools usually do not have any automation to control the pool equipment and automation is needed to be able to program and control a variable-speed pump easily. Pentair commented that the cost to automate is between $2,000 to $3,000, and because of this cost, many pool owners rebuild the motor or purchase a foreign-made motor and pump. (Pentair, No. 90 at p. 1)

DOE understands Pentair's comment regarding automation systems as relating to additional control systems that can be used to further automate the operation of a DPPP via computer or mobile devices. These systems permit sophisticated control over e.g. filtration, pumps, lighting chemical management, wireless remote control. [81] DOE notes that these systems are not necessary to operate a variable-speed DPPP. As noted in section 5.7.1 of the January 2017 Direct Final Rule TSD,[82] DOE researched the design and

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[81] See for example: www.pentair.com/en-us/products/residential/pool-spa-equipment/pool-automation/easytouch_pl4_andpsl4poolandspacontrolsystems.html?queryID=b1f890f14ae08bf7d162fc1ae8f116e8&objectID.
[82] *See* chapter 5 of the dedicated-purpose pool pumps direct final rule TSD, at *www.regulations.gov/document?D=EERE-2015-BT-STD-0008-0105*.

engineering constraints associated with motor substitution by examining manufacturer interview responses and holding discussions with the DPPP Working Group. DOE concluded that for the representative equipment capacities being considered, the wet end of the pump can be paired with a range of motors with various efficiencies and speed configurations without significant adaptations. In other words, a motor swap results in negligible incremental costs to the non-motor components of the DPPP. Thus, DOE concluded that the incremental MPC of the motor swap design options (improved motor efficiency and ability to operate at reduced speeds) may be considered equivalent to the incremental MPC of the motor component being swapped. Therefore, for variable-speed DPPP motors, DOE is not including the additional cost of automation systems in its analysis.

DOE did not receive other comments on installation costs and retained the same estimates as in the June 2022 NOPR as applied to two-speed and variable-speed DPPP motors.[83]

3. Annual Energy Consumption

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

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

[83] Adjusted to 2021$.

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.

DOE derived electricity prices in 2022 using data from EEI Typical Bills and Average Rates reports. Based upon comprehensive, industry-wide surveys, this semi-annual report presents typical monthly electric bills and average kilowatt-hour costs to the customer as charged by investor-owned utilities. For the residential sector, DOE calculated electricity prices using the methodology described in Coughlin and Beraki (2018).[84] For the commercial sector, DOE calculated electricity prices using the methodology described in Coughlin and Beraki (2019).[85]

DOE's methodology allows electricity prices to vary by sector, region, and season. In the analysis, variability in electricity prices is chosen to be consistent with the way the consumer economic and energy use characteristics are defined in the LCC analysis. For DPPP motors, regional weighted-average values for both average and marginal prices were calculated for the nine census divisions. Each EEI utility in a region was assigned a weight based on the number of consumers it serves. Consumer counts

[84] Coughlin, K. and B. Beraki.2018. Residential Electricity Prices: A Review of Data Sources and Estimation Methods. Lawrence Berkeley National Lab. Berkeley, CA. Report No. LBNL-2001169. *ees.lbl.gov/publications/residential-electricity-prices-review.*
[85] Coughlin, K. and B. Beraki. 2019. Non-residential Electricity Prices: A Review of Data Sources and Estimation Methods. Lawrence Berkeley National Lab. Berkeley, CA. Report No. LBNL-2001203. *ees.lbl.gov/publications/non-residential-electricity-prices.*

were taken from the most recent EIA Form EIA-861 data (2021). *See* chapter 8 of the final rule TSD for details.

To estimate energy prices in future years, DOE multiplied the 2022 energy prices by the projection of annual average price changes for each of the nine census divisions from the Reference case in *AEO2023*, which has an end year of 2050.[86] To estimate price trends after 2050, DOE used the average of 2046-2050 values, held constant.

5. Maintenance and Repair Costs

Repair costs are associated with repairing or replacing product components that have failed in the equipment; maintenance costs are associated with maintaining the operation of the equipment. Typically, small incremental increases in equipment efficiency entail no, or only minor, changes in repair and maintenance costs compared to baseline efficiency products. In the June 2022 NOPR, DOE assumed that for maintenance costs, there is no change with efficiency level, and therefore DOE did not include those costs in the model. In addition, DPPP motors are not typically repaired and DOE assumed no repair costs. 87 FR 37122, 37146.

DOE did not receive any comments regarding maintenance and repair costs and maintained the same approach in this final rule.

[86] U.S. Department of Energy–Energy Information Administration. *Annual Energy Outlook 2023 with Projections to 2050.* Washington, DC. Available at *www.eia.gov/forecasts/aeo/* (last accessed May 23, 2023).

6. Equipment Lifetime

In the June 2022 NOPR, for DPPP motors used in residential applications, DOE calculated lifetime estimates using DPPP lifetime data and rates of repair from the January 2017 Direct Final Rule, which estimated that motor replacement occurs at the halfway point in a pump's lifetime, but only for those DPPPs whose lifetime exceeds the average lifetime for the relevant equipment class.[87] The data allowed DOE to develop a survival function, which provides a distribution of lifetime ranging from a minimum of 1 year based on a period covered by warranty, to a maximum of 10 years, with a mean value of 5 years for self-priming pumps, to a maximum of 8 years, with a mean value of 3.6 years for non-self-priming and pressure cleaner booster pumps. These values are applicable to DPPP motors in residential applications. For commercial applications, DOE adjusted the lifetimes to account for the higher operating hours compared to residential applications, resulting in a reduced average lifetime of 3.2 years for self-priming pumps and 3.5 years for pressure cleaner booster pumps. The resulting shipments-weighted average lifetime across all DPPP motor equipment classes is 4.5 years. *Id.*

The CA IOUs recommended that DOE increase the PCBP lifetimes to account for shorter operating hours compared to non-self-priming pump applications, similar to how DOE assumed longer lifetimes for DPPP motors used in the residential sector vs.

[87] For DPPPs that do not include a repair, the DPPP motor lifetime is equal to the DPPP lifetime. For DPPPs that are repaired, the DPPP motor lifetime is equal to half of the DPPP lifetime. *See* chapter 8 of the dedicated-purpose pool pumps January 2017 Direct Final Rule TSD, at *www.regulations.gov/document?D=EERE-2015-BT-STD-0008-0105*.

commercial sector. The CA IOUs estimated the PCBP operating hours are about 40 percent shorter than the non-self-priming pool filter pump. (CA IOUs, No. 96 at pp. 5–6)

The CEC and NYSERDA recommended that DOE revise its lifetime estimates for PCBPs pumps, as well as for variable-speed DPPPs as compared to single- or two-speed DPPPs. The CEC and NYSERDA commented that they expected that more up-to-date information would be available to support increased lifetime estimates for PCBPs, as well as for variable-speed DPPPs generally. (CEC and NYSERDA, No. 94 at p. 6)

DOE does not have lifetime data for PCBP motors. As stated previously, DOE calculated PCBP motor lifetimes based on information on PCBP lifetimes. DOE developed separate DPPP motor lifetimes by DPPP applications in line with the lifetime estimates from the January 2017 Direct Final Report. Specifically, for PCBPs, a shorter average lifetime was considered compared to self-priming pumps to reflect a higher risk of failure typical of these DPPPs. (Docket EERE-2015-BT-STD-0008; No. 94 p. 221) The PCBP lifetimes were developed with input from the Working Group and DOE believes these are representative of PCBP lifetimes. In addition, the CA IOUs, the CEC, and NYSERDA did not provide data to support longer lifetimes for DPPP motors used in PCBPs, nor did they provide data to support longer lifetimes for DPPP motors used in variable-speed DPPPs. Therefore, DOE believes its current approach is valid and retains its lifetime estimates for DPPP motors used in PCBPs.

The CEC and NYSERDA stated although the approach[88] described in the June 2022 NOPR is reasonable, DOE should revisit its underlying assumptions for the LCC calculations and ensure the product lifetime estimates are consistent with the assumptions for motor replacements and warranty lengths. Specifically, the CEC and NYSERDA noted that there was a mismatch between the assumptions made for product lifetime, repair frequency, and warranty length in the January 2017 Direct Final Rule, and because of this, the resulting estimated equipment lifetime used in this NOPR underestimates the actual lifetimes of DPPP motors. The CEC and NYSERDA stated that they believed the Working Group members did not factor in potential repairs or warranties when coming up with product lifetime estimates. (Docket EERE-2015-BT-STD-0008; No. 94 pp. 209–223). The CEC and NYSERDA added that motor failure is the major failure mode for DPPPs and so if the motor is replaced after failure, the estimated lifetime of a DPPP is doubled. Further, the CEC and NYSERDA noted that if the DPPP fails during the warranty period and is replaced at no cost to the consumer, then the estimated lifetime of the DPPP is increased by the number of years the DPPP worked before it failed. The CEC and NYSERDA provided the example of the lifetime distribution for variable-speed non-self-priming pumps from the January 2017 Direct Final Rule and stated that the assumptions regarding lifetime, repair frequency, and warranty period were incompatible and required increasing the mean and maximum values of the Weibull distributions used to estimate the equipment lifetime. The CEC and NYSERDA commented that DOE relied on an overly conservative assessment of equipment lifetime, which would mean that the economics of the proposed standard, in reality, would be even more favorable than what DOE presented in the LCC analysis. The CEC and NYSERDA,

[88] The CEC and NYSERDA referred to the following description: "for DPPPs that do not include a repair, the DPPP motor lifetime is equal to the DPPP lifetime. For DPPPs that are repaired, the DPPP motor lifetime is equal to half of the DPPP lifetime." 87 FR 37122, 37146.

therefore, commented that DOE should ensure that the product lifetime estimates are consistent with the assumptions on motor replacements and warranty lengths. (CEC and NYSERDA, No. 94 at pp. 4–6)

DOE reviewed the DPPP lifetime assumptions and notes in the January 2017 Direct Final Rule TSD; the average lifetimes and associated Weibull distributions represent the age at which the equipment is retired from service and include any repairs[89] or motor replacement during the warranty period. (*See* section 8.2.2.4 of the January 2017 Direct Final Rule TSD)[90] As noted by the CEC and NYSERDA, the DPPP lifetimes used in the January 2017 Direct Final Rule were developed primarily based on input from manufacturers (in responses found in DOE's manufacturer interviews) and feedback from the ASRAC DPPP Working Group. The manufacturers interview guide reflects that DPPP lifetime is considered to include any motor replacement that would occur. (*See* section 12A.9 of the January 2017 Direct Final Rule TSD)[91] As such, DOE believes that the lifetimes estimated in the January 2017 Direct Final Rule are inclusive of any repair and warranty periods. In addition, while the CEC and NYSERDA recommended revising equipment lifetimes, they did not provide alternative estimates and DOE retains the lifetimes as calculated in the June 2022 NOPR.

7. Discount Rates

In the calculation of LCC, DOE applies discount rates appropriate to consumers to estimate the present value of future operating cost savings. DOE estimated a

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[89] The warranty period is represented by the location or delay parameter of the Weibull distribution.
[90] See chapter 8 of the January 2017 Direct Final Rule TSD, at *www.regulations.gov/document?D=EERE-2015-BT-STD-0008-0105*.
[91] *See* appendix 12A of the January 2017 Direct Final Rule TSD, at *www.regulations.gov/document?D=EERE-2015-BT-STD-0008-0105*.

distribution of discount rates for DPPP motors based on 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.[92] The LCC analysis 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 longtime 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 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

[92] The implicit discount rate is inferred from a consumer purchase decision between two otherwise identical goods with different first cost and operating cost. It is the interest rate that equates the increment of first cost to the difference in net present value of lifetime operating cost, incorporating the influence of several factors: transaction costs; risk premiums and response to uncertainty; time preferences; interest rates at which a consumer is able to borrow or lend. The implicit discount rate is not appropriate for the LCC analysis because it reflects a range of factors that influence consumer purchase decisions, rather than the opportunity cost of the funds that are used in purchases.

using data from the Federal Reserve Board's triennial Survey of Consumer Finances[93] ("SCF") starting in 1995 and ending in 2019. 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, is 4.26 percent.

To establish commercial discount rates for the small fraction of applications where businesses purchase and use DPPP motors, DOE estimated the weighted-average cost of capital using data from Damodaran Online.[94] 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 commercial discount rate is 6.77 percent.

[93] U.S. Board of Governors of the Federal Reserve System. *Survey of Consumer Finances*. 1995, 1998, 2001, 2004, 2007, 2010, 2013, 2016, and 2019. *www.federalreserve.gov/econresdata/scf/scfindex.htm* (last accessed September 1, 2022).
[94] Damodaran Online, Data Page: Costs of Capital by Industry Sector (2021). *pages.stern.nyu.edu/~adamodar/* (last accessed April 22, 2022).

DOE did not receive any comments related to discount rates. DOE retained the same methodology used in NOPR and updated the discount rate distributions based on the most recent available data.

See chapter 8 of the January 2017 Direct Final Rule 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).

In the June 2022 NOPR, to estimate the efficiency distribution of DPPP motors in 2026, DOE first established efficiency distributions in 2021. Then, as in the January 2017 Direct Final Rule, DOE projected the 2026 efficiency distribution by assuming a 1-percent market shift from EL 0–EL 2 (single-speed DPPP motors) to EL 6 (variable-speed DPPP motors) where applicable. To establish the efficiency distributions of DPPP motors in 2021, DOE considered two market segments: (1) DPPP motors incorporated in DPPPs and (2) replacement DPPP motors sold alone. 87 FR 37122, 37147.

For DPPP motors incorporated in DPPPs, in the June 2022 NOPR, DOE relied on the 2021 DPPP Database that included a total of 345 models of DPPPs with WEF ratings and on the ELs developed in the January 2017 Direct Final Rule to establish the 2021 efficiency distributions of DPPPs. DOE also used the scenario of roll-up market response to the DPPP standards as presented in the January 2017 Direct Final Rule. DOE then assumed that the distributions of DPPP motors incorporated in DPPPs would be equivalent to the 2021 efficiency distributions of DPPPs, based on the equivalent structure of the ELs used in this NOPR and in the January 2017 Direct Final Rule. For representative units 4 (*i.e.*, DPPP motors used in non-self-priming pumps, extra-small) and 7 (*i.e.*, DPPP motors used in pressure cleaner booster pumps), the 2021 DPPP Database did not include any information specific to these DPPPs. Instead, for these representative units, DOE relied on the efficiency distributions provided in the January 2017 Direct Final Rule and applied a scenario of roll-up market response to the upcoming DPPP standards. *Id.*

For replacement DPPP motors sold alone, in the June 2022 NOPR, for the United States, not including California,[95] DOE assumed that the DPPP standards would have no impact on the DPPP motor efficiency distributions. Therefore, to establish the efficiency distributions of replacement DPPP motors sold alone, DOE relied on the 2021 no-new-standards case efficiency distributions provided in the January 2017 Direct Final Rule, which reflect efficiency distributions prior to the compliance date of the DPPP standards. DOE then assumed that the efficiency distributions of replacement DPPP motors sold alone would be equivalent to the efficiency distributions of DPPPs, based on the

[95] DOE considered California separately in light of the July 2021 California standards for replacement DPPP motors adopted April 7, 2020 with an effective date July 19, 2021. *See* Docket 19-AAER-02 at *www.energy.ca.gov/rules-and-regulations/appliance-efficiency-regulations-title-20/appliance-efficiency-proceedings-2*.

equivalent structure of the ELs used in this NOPR and in the January 2017 Direct Final Rule. For California, DOE applied a scenario of roll-up market response to the upcoming California replacement DPPP motor standards.[96] DOE then relied on the market shares of replacement DPPP motors sold in California[97] and in the rest of the United States to establish the nationwide 2021 replacement DPPP motor efficiency distributions. *Id.*

In response to the June 2022 NOPR, PHTA and NEMA commented that DOE overestimated the percentage of PCBP and small filter pumps that would be variable speed in 2026. PHTA and NEMA commented that based on a review of the CCMS data, there is limited availability of fractional THP motors currently on the market. Further, PHTA and NEMA commented that the limited models available are not mass produced. Recognizing the limited models of motors that exist in the small motor category, PHTA and NEMA cited this as a rationale for the fact that there are zero or very limited variable-speed replacement motors in the CEC database since the July 19, 2021, compliance date of CEC's replacement motor rule (the database appears to not identify whether products listed are variable speed or not; it lists only model information). PHTA and NEMA commented that in discussions with the California pool service, installer, and distribution industry as well as PHTA and NEMA manufacturers, it was revealed that small fractional VS motors are simply not being sold and instead consumers are choosing

[96] For the purposes of this analysis, DOE considered EL 1 (for motors below 0.5 THP) and EL 6 (for motors above 0.5 THP) as equivalent levels to the California standards.
[97] California Energy Commission, Final Analysis of Efficiency Standards for Replacement Dedicated-Purpose Pool Pump Motors, February 20, 2020. Docket 9-AAER-02 *https://efiling.energy.ca.gov/GetDocument.aspx?tn=232151* (last accessed August 2021)

to replace the entire pump or repair the existing motor due to the cost justification and lack of product availability. (PHTA and NEMA, No. 92 at pp. 6–7)

Fluidra commented that DOE's estimate for the share of DPPP motors used in PCBP at EL 2 appears to be too low. Specifically, Fluidra commented that EL 2 represents multistage booster pumps, which it estimates to be approximately a third of total booster pump market share. Fluidra further commented that DOE's estimated market share of DPPP motors used in PCBP at EL 6 appears to be too high. Although technologically feasible, Fluidra noted that it is not economically practical and there appears to be no availability of this type of pump in distribution at this time. Fluidra also noted that DOE's estimate for DPPP motors used in small-size 0.75 hp self-priming DPPP at EL 6 appears to be too high because there are currently no or very limited variable-speed DPPPs of this size in the market. Fluidra added that for representative unit 7, the estimated 35 percent of replacement variable-speed PCBP motors is much too high and should be 0–1 percent, instead. (Fluidra, No. 91 at pp. 3-4)

Pentair questioned whether variable-speed motors are being shipped in large numbers and stated that this is not the case. (Pentair, No. 90 at p. 2)

PHTA stated that there are no variable-speed pumps on the market below 0.75 hp. (PHTA, No. 100 at p. 3) Hayward recommended that DOE review the availability of low-horsepower variable-speed DPPP motors in the current market, and that Hayward offers three basic variable-speed pump models that can achieve a rating of 0.85 THP, but only when installed with 115V power. Accordingly, Hayward noted that each of these models is made with dual-voltage capability, and estimated that over 98 percent are installed with 230V power which yields 1.65 THP. (Hayward, No. 93 at p. 2)

In this final rule, DOE revised the no-new-standards case efficiency distributions to incorporate stakeholder feedback. First, DOE revised the approach used to develop the no-new-standards case efficiency distributions for replacement DPPP motors in California (which was based on a roll-up scenario) and assumed shipments of replacement variable-speed DPPP motors would not always increase as a result of the California standard. Instead, in cases where the California standard requires a variable-speed replacement DPPP motor and the current DOE standards for DPPPs can be met without the use of a variable-speed motor (i.e., for small-size DPPP motors and for standard-size DPPP motors used in non-self priming DPPPs), DOE assumed that consumers would choose to purchase a new, cheaper, non-variable-speed DPPP instead of purchasing a more expensive variable-speed replacement motor.[98] This approach results in a lower market share of variable-speed DPPP motors overall (*i.e.*, lower shipments), and specifically for DPPP motors used in PCBPs as recommended by NEMA, PTHA, and Fluidra. This approach also results in a decrease in the market share of DPPP motors used in small size 0.75 hp self-priming DPPP at EL 6 compared to the estimates from the June 2022 NOPR, as recommended by Fluidra. In addition, DOE updated the information used to develop the efficiency distributions based on the 2022 DPPP Database. Further to derive the efficiency distributions for each representative unit,

[98] As noted by NEMA and PTHA, a consumer may also choose to repair its existing motor. However, DOE notes in section IV.F.5 of this document that DPPP motors are typically not repaired and DOE believes that the purchase of a new DPPP represents the more likely scenario.

DOE relied on all models of DPPP with a DPPP motor THP included in the range represented by the representative unit (*e.g.*, for representative unit 1, DOE relied on DPPP motor data with DPPP motor THP greater than 0.5 and less than 1.15 THP). For this analysis, DOE considered the DPPP motor THP as rated by manufacturers when submitting compliance to the DOE Compliance and Certification Database, the CEC, and the ENERGY STAR program (which DOE collected as part of the 2022 DPPP Database), which may include ratings at different voltages. As a result, although DOE did not find DPPP motors at 0.75 THP, DOE found several variable-speed DPPP motors within the 0.5–1.15 THP range. In addition, DOE does not have any technical basis for, or has not received any comments on, variable-speed technology not being feasible at 0.75 THP (*See* section IV.A.4 of this document), and believes the efficiency distributions as established are representative of the 0.5–1.15 THP range associated with representative unit 1.

Regarding Fluidra's comment related to the share of shipments at EL 2 for PCBP, Fluidra did not provide supporting data to justify the recommended one-third market share. In addition, DOE notes that EL 2 represents a level achieved by a higher-efficiency DPPP motor and does not relate to the pump design (*e.g.*, multi-stage). The market shares from the June 2022 NOPR were based on information collected during the January 2017 Direct Final Rule. DOE maintained the same approach as the 2022 DPPP Database and did not have sufficient information[99] to revise these estimates.

[99] The 2022 DPPP Database includes 12 models of PBCPs.

The projected 2026 market shares by EL for the no-new-standards case for DPPP motors are shown in Table IV.7 and Table IV.8 by market segment. *See* chapter 8 of the final rule TSD for further information on the derivation of the efficiency distributions.

Table IV.7 DPPP Motors Incorporated in DPPPs 2026 No-New-Standards Case Efficiency Distributions

Equipment Class	Rep. Unit	THP	DPPP Application	EL 0	EL 1	EL 2	EL 3	EL 4	EL 5	EL 6
Extra-Small-size	4	0.22	Non-self-priming Filter Pump, Extra-Small-size (0.09 hhp)	0%	67%	33%	-	-	-	-
Small-size	1	0.75	Self-priming Filter Pump, Small-size (0.44 hhp)	0%	0%	45%	9%	0%	1%	44%
Small-size	5	1	Non-self-priming Filter Pump, Small-size (0.52 hhp)	0%	38%	27%	10%	6%	1%	18%
Small-size	7*	1.125	Pressure Cleaner Booster Pump	0%	81%	10%	-	-	-	9%
Standard-size	6	1.5	Non-self-priming Filter Pump (0.87 hhp)	0%	38%	27%	10%	6%	1%	18%
Standard-size	2	1.65	Self-priming Filter Pump, Standard-size (0.95 hhp)	0%	0%	0%	0%	0%	0%	100%
Standard-size	2A	1.65	Self-priming Filter Pump, Small-size (0.65 hhp)	0%	0%	45%	9%	0%	1%	44%
Standard-size	3	3.45	Self-priming Filter Pump, Standard-size (1.88 hhp)	0%	0%	0%	0%	0%	0%	100%

* For Pressure cleaner booster pumps EL 3, EL 4, and EL 5 are equivalent to EL 6
Note: may not sum to 100% due to rounding

Table IV.8 Replacement DPPP Motors Sold Alone 2026 No-New-Standards Case Efficiency Distributions

Equipment Class	Rep. Unit	THP	DPPP Application	EL 0	EL 1	EL 2	EL 3	EL 4	EL 5	EL 6
Extra-small-size	4	0.22	Non-self-priming Filter Pump, Extra-Small size (0.09 hhp)	29%	38%	33%	-	-	-	-
Small-size	1	0.75	Self-priming Filter Pump, Small-size (0.44 hhp)	33%	11%	9%	2%	2%	2%	42%
Small-size	5	1	Non-self-priming Filter Pump, Small-size (0.52 hhp)	26%	26%	31%	2%	1%	1%	12%
Small-size	7*	1.125	Pressure Cleaner Booster Pump	11%	65%	10%	-	-	-	14%

Standard-size	6	1.5	Non-Self-priming Filter Pump (0.87 hhp)	26%	26%	31%	2%	1%	1%	12%
Standard-size	2	1.65	Self-priming Filter Pump, Standard-size (0.95 hhp)	27%	9%	7%	1%	1%	1%	52%
Standard-size	2A	1.65	Self-priming Filter Pump, Small-size (0.65 hhp)	33%	11%	9%	2%	2%	2%	42%
Standard-size	3	3.45	Self-priming Filter Pump, Standard-size (1.88 hhp)	27%	9%	7%	1%	1%	1%	52%

* For Pressure cleaner booster pumps EL 3, EL 4, and EL 5 are equivalent to EL 6

The LCC Monte Carlo simulations draw from the efficiency distributions and randomly assign an efficiency to the DPPP motor purchased by each sample household in the no-new-standards case. The resulting percent shares within the sample match the market shares in the efficiency distributions.

In the June 2022 NOPR, when assigning an equipment efficiency to a sample consumer, DOE relied on a random assignment of no-new-standards case efficiencies (sampled from the developed efficiency distribution) in the LCC model. 87 FR 37142. 37144. DOE did not receive any comments on this approach and continued to rely on a random assignment in this final rule.

9. Payback Period Analysis

The payback period is the amount of time (expressed in years) it takes the consumer to recover the additional installed cost of more-efficient products, compared to baseline products, through energy cost savings. 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. DOE refers to this as a "simple PBP" because it does not consider changes over time in operating cost savings. The PBP calculation uses the same inputs as the LCC analysis when deriving first-year operating costs.

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. 6316(a); 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 standards would be required.

Fluidra presented a study of PCBP power consumption taken from two typical residential in-ground pool installations to compare the power consumption of a production multi-stage single-speed booster pump, with a multi-stage and a single-stage booster pump fitted with the most compatible variable-speed DPPP motor currently available. Fluidra commented that in the study, power was measured at various motor rotations per minute ("RPM") down the lowest possible RPM to maintain the necessary flow and pressure for pool cleaner operation. Fluidra concluded from the study that a minimum payback period of approximately 9 years was needed, and this was larger than the average lifetime of the PCBP motor (at 3.6 years from the 2017 Direct Final Rule TSD). Further, Fluidra noted that the power consumption of the booster pump variable-speed motor operating at maximum speed measured noticeably higher than the single-speed base comparison. Specifically, Fluidra commented that operating a PCBP at maximum speed is necessary because of the plumbing head loss from extended pipe runs where the pool equipment pad is further from the pool for aesthetics and noise reduction. Accordingly, Fluidra concluded that the variable speed would have incremental costs, without ever realizing the fiscal benefit of potential energy savings, and with limited impact to energy and waste reduction. (Fluidra, No. 91 at pp. 1–2, 6–9)

Hayward stated that it reviewed energy and cost savings for six of its currently compliant single-speed pumps, including self-priming and non-self-priming, and estimated that the average payback period for conversion to variable speed was over 12 years. Hayward provided a separate analysis spreadsheet of this evaluation. Hayward also noted use of a 24.7 gpm flow rate, although Hayward knows of pool equipment requiring a greater flow rate. (Hayward, No. 93 at p. 2)

PHTA and NEMA provided the results of field tests of two separate variable-speed PCBPs showing payback periods of 9-30 years, while a PCBP has an average lifetime of 3.6 years. In addition, PHTA and NEMA noted that in some cases, the variable-speed PCBP consumed more energy than the constant-load system. PHTA and NEMA noted that these results are consistent with the LCC results from the January 2017 Direct Final Rule. (PHTA and NEMA, No. 92 at pp. 2–3)

PHTA restated that PCBPs, when analyzed as their own equipment class, would not show cost-effective results; thus, it requested that DOE confirm its analysis and not require variable speed for these motors. (PHTA, No. 100 at p. 2) PHTA added that the rule is not cost-effective and pointed to data provided by Hayward that calculated a 12-year payback period for both self-priming and non-self-priming pumps under 1 hp as well as data submitted by Fluidra that calculated a 9-year payback period for a variable-speed PCBP. (PHTA, No. 100 at pp. 3–4)

Waterway Plastics commented that savings are application-related. Waterway Plastics noted that non self-priming pool pumps are used on smaller swimming pools that have less filtration load, and some of them are seasonal. Therefore, they questioned the representativeness of average values for all applications. (Waterway Plastics, Public Meeting, No. 88 at p. 32) Waterway Plastics added that above-ground swimming pool and non-self-priming pump is used to filter a much smaller body of water on average and therefore averaging and combining the non-self-priming application with the self-priming application do not provide an accurate economic analysis. Further, Waterway Plastics added that using variable speed motors results in energy savings because they are flexible on the speed of operation and do not provide significant savings when used a maximum speed compared to single speed motors. (Waterway Plastics, Public Meeting, No. 88 at pp. 58-59)

While the Fluidra and Hayward studies analyzed a number of specific installations, DOE notes that the LCC analyzes a larger consumer sample and characterizes inputs using statistical distributions to reflect variability in the field (see description in sections IV.E. and IV.F of this document). DOE does not believe that the two or six installations considered by Fluidra and Hayward are representative of the entire market as they do not reflect the entire range of possible installation costs, energy usage and usage conditions (e.g. as noted by Hayward, they relied on a single value of 24.7 gpm flow rate, although pool equipment typical runs at higher rates), and related operating costs. Further, as previously described, DOE believes that variable-speed motors can lead to energy savings in PCBPs as discussed in section IV.A.4 of this document. Instead, in the LCC and PBP analysis, DOE considers a distribution of installations with variations in heads and flow rates and efficiency as described in sections IV.E and IV.F.8 of this document. In addition, as presented in section IV.A.3 of this document, DOE's LCC and PBP analysis results are provided at the equipment-class level and not at the DPPP-application level *(e.g.*, PCBP). The resulting payback periods are presented in section V.B.1.a of this document.

G. Shipments Analysis

DOE uses projections of annual product shipments to calculate the national impacts of potential amended or new energy conservation standards on energy use, NPV, and future manufacturer cash flows.[100] 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

[100] 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.

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.

1. Base-year Shipments

In the June 2022 NOPR, DOE estimated motor shipments by DPPP application and considered two pool pump motor market segments: (1) DPPP motors incorporated in DPPPs and (2) replacement DPPP motors sold alone. For DPPP motors incorporated in DPPPs, DOE used the 2015 shipments of DPPPs by DPPP application from the January 2017 Direct Final Rule, which were based on manufacturer interviews. For replacement DPPP motors sold alone, DOE used estimates of historical shipments of DPPPs for the period 2007–2014 and estimates of repair frequency as provided by the ASRAC DPPP Working Group during the January 2017 Direct Final Rule to calculate the resulting number of failing DPPP motors each year, and corresponding replacement DPPP motor shipments by DPPP application.[101] DOE also used 2018 confidential DPPP motor shipments data and information from the 2021 DPPP Database to estimate market share of motor shipments by total horsepower and distribution of DPPP motor shipments by representative unit. 87 FR 37122, 37148.

Regarding DOE's base year shipments estimate, Fluidra commented that shipments of replacement DPPP motors for booster pumps appear to be too high. Fluidra stated that it offers two Pressure Cleaner Booster Pump Models (PB4-60 and PB4SQ),

[101] DOE relied on a repair frequency of 40 percent as provided in the January 2017 Direct Final Rule. At the end of life of a motor, the motor is replaced (*i.e.*, pump repair) 40 percent of the time, and in the remaining 60 percent of the time, the pump is replaced by a new pump. For more details, *see* chapter 9 of the January 2017 Direct Final Rule TSD, at *www.regulations.gov/document?D=EERE-2015-BT-STD-0008-0105.*

and combined ships less than 1,000 replacement motors per year, which includes warranty replacements. Fluidra added that due to the low price point of booster pumps, the cost of a replacement motor and service/repair of a booster pump outweighs the cost of simply replacing the entire booster pump, which also comes with a manufacturer warranty. (Fluidra, No. 91 at p. 4)

In this final rule, as described in section IV.F.8 of this document, DOE revised the base year 2021 shipments to account for consumers that elect to purchase a new pump, rather than a replacement motor in California[102]. This resulted in reduced shipments of replacement DPPP motors sold alone and increased shipments of motors sold in DPPP for PCBP, small-size self-priming, small and standard-size non-self-priming filter pump applications.

Table IV.9 provides the breakdown of DPPP motor shipments by market segment and representative unit.

Table IV.9 2021 Shipments of DPPP Motors by Market Segment and Representative Unit

Equipment Class	**Rep. Unit***	**THP**	**DPPP Category**	**Represented THP Range within the DPPP Category**	**DPPP Motors incorporated in pumps (*thousand units*)**	**Replacement DPPP Motors sold alone (*thousand units*)**
Small-size	1	0.75	Small Size Self-priming Filter Pump	0.5≤ THP <1.15	148.3	37.4
Standard-size	2A	1.65		1.15≤ THP ≤5	103.8	26.1

[102] As noted in section IV.F.8 of this document, DOE considered California separately in light of the July 2021 California standards for replacement DPPP motors adopted April 8, 2020 with an effective date July 19, 2021. *See* Docket 19-AAER-02 at *www.energy.ca.gov/rules-and-regulations/appliance-efficiency-regulations-title-20/appliance-efficiency-proceedings-2*.

Standard-size	2	1.65	Standard Size Self-priming Filter Pump	1.15≤ THP <1.7	155.2	151.7
Standard-size	3	3.45		1.7≤ THP ≤5	243.1	237.5
Extra-Small-size	4	0.22	Non-self-priming Filter Pump	< 0.5	47.4	16.2
Small-size	5	1		0.5≤ THP <1.15	299.3	86.9
Standard-size	6	1.5		1.15≤ THP ≤5	116.4	33.8
Small-size	7	1.125	Pressure Cleaner Booster Pump	0.5≤ THP <1.15	151.8	39.7

* Representative unit

2. No-new-standards Case Shipment Projections

DOE projected shipments of DPPP motors incorporated in DPPPs and shipments of replacement DPPP motors sold alone separately.

In the June 2022 NOPR, in the no-new-standards case, DOE assumed the total shipments of DPPP motors incorporated in DPPPs was equal to the total shipments of DPPPs as projected in the January 2017 Direct Final Rule, at the trial standard level corresponding to the DPPP energy conservation standard.[103] 87 FR 37122, 37149. DOE did not receive any comments on this approach and retained the same method to estimate DPPP motors incorporated in DPPPs.

In the June 2022 NOPR, in the no-new-standards case, for replacement DPPP motors sold alone, DOE used the projected shipments of DPPPs and estimates of repair frequency to calculate the resulting number of failing motors each year and

[103] These were calculated based on input from the ASRAC DPPP Working Group and using a repair-replace model, and accounted for price elasticity of demand. A price elasticity of -0.02 was used for standard-size self-priming pool pumps. For more details see chapter 9 of the January 2017 Direct Final Rule TSD, at *www.regulations.gov/document?D=EERE-2015-BT-STD-0008-0105*.

corresponding motor replacement sales. For replacement motors sold alone outside of California, DOE relied on repair frequency rates as provided in the January 2017 Direct Final Rule. For standard-size, self-priming pump motors sold before 2021 and at efficiency levels below the DPPP standards, DOE assumed that the repair frequency would increase from 40 percent to 60 percent to calculate corresponding replacement DPPP motors sales.[104] For other categories of DPPPs, DOE relied on a 40-percent repair frequency as provided in the January 2017 Direct Final Rule. These repair-replace rates were based on inputs from the ASRAC DPPP Working Group during the January 2017 Direct Final Rule. For replacement motors sold alone in California, DOE projects that with the California efficiency standards for replacement DPPPs,[105] the repair frequency of standard-size, self-priming pump motors will remain at its pre-2021 rate of 40 percent as estimated in the January 2017 Direct Final Rule, rather than increasing to 60 percent due to the smaller price difference between replacing the entire pump and replacing the motor only. *Id.*

In response to the June 2022 NOPR, Fluidra commented that a 60-percent estimate for replacement motors may be too high, adding that the tendency for the consumer is to replace motors only when they are under warranty, and once the motor

[104] In the January 2017 Direct Final Rule, DOE assumed that users of standard-size self-priming pool pumps purchased before compliance year of the DPPP standards (*i.e.*, 2021), at efficiency levels below the upcoming DPPP standards, would seek to increase their pump's lifetime by performing an additional repair (*i.e.*, cheaper motor replacement with a non-variable speed motor), rather than replacing the entire pump with a more efficient and variable-speed DPPP (due to the DPPP energy conversation standards at 10 CFR 431.465(f) which correspond to a variable-speed efficiency levels for these DPPPs). In the January 2017 Direct Final Rule, DOE therefore increased the repair frequency of these DPPPs from 40 percent to 60 percent. For more details *see* chapter 9 of the January 2017 Direct Final Rule TSD, at *www.regulations.gov/document?D=EERE-2015-BT-STD-0008-0105*.

[105] Adopted April 7, 2020 with an effective date July 19, 2021. See Docket # 19-AAER-02 at *www.energy.ca.gov/rules-and-regulations/appliance-efficiency-regulations-title-20/appliance-efficiency-proceedings-2*.

warranty expires, the consumer purchases a whole new pump to get a new manufacturer's warranty (typically a 3-year warranty). (Fluidra, No. 91 at p. 4)

In the June 2022 NOPR, in order to estimate shipments of DPPP motors, DOE relied on a 40-percent DPPP repair rate for the majority of DPPPs. See footnote 85 of the June 2022 NOPR. 87 FR 37122, 37148. As previously noted, for standard-size self-priming pump motors sold outside California before 2021 and at efficiency levels below the DPPP standards, DOE assumed that the repair frequency would increase from 40 percent to 60 percent to calculate corresponding replacement DPPP motors sales. *See* 87 FR 37122, 37149. Similar to the assumptions used in the January 2017 Direct Final Rule, DOE assumed that users of standard-size self-priming pool pumps purchased before compliance year of the DPPP standards (*i.e.*, 2021), at efficiency levels below the upcoming DPPP standards, would seek to increase the pump's lifetime by performing an additional repair (*i.e.*, cheaper motor replacement with a non-variable-speed motor), rather than replacing the entire pump with a more efficient and variable-speed DPPP (due to the DPPP energy conversation standards at 10 CFR 431.465(f), which correspond to variable-speed efficiency levels for these DPPPs). See footnote 87 of the June 2022 NOPR 87 FR 37122, 37149. DOE believes this approach is appropriate and continues to rely on a 60-percent DPPP repair rate for DPPPs sold prior to 2021 below the current DPPP standards. For all other categories of DPPPs, DOE relied on a 40-percent repair rate as using a 60-percent rate would be too high as noted by Fluidra. DOE did not receive any other comments on this topic and relied on the same repair rates and approach to estimate replacement DPPP motors sold alone in the no-new-standards case.

3. Standards Case Shipment Projections

The standards-case shipments projections account for the effects of potential standards on shipments.

In the June 2022 NOPR, in the standards cases for which the DPPP motor efficiency level was set below the level equivalent to the standard-size self-priming DPPP standards, DOE assumed the increase in repair frequency (*i.e.*, 60 percent) of standard-size self-priming pool pumps, which was accounted for in the no-new-standards case, was maintained for the entire United States except for California (*i.e.*, TSLs 1 to 5 as described in section V.A of this document). In California, due to the California efficiency standards for replacement DPPP motors, DOE estimated that the repair frequency of standard-size self-priming pump motors in California would remain at its pre-2021 rate of 40 percent in the standards case (the same as in the no-new-standards case) because California standards are at or above the levels equivalent to the DPPP standards at 10 CFR 431.465(f) for all equipment classes. 87 FR 37122, 37149.

In the June 2022 NOPR, outside of California, in the standards cases for which the DPPP motor efficiency levels are set at or above the level equivalent to the standard-size self-priming DPPP standard, DOE assumed the increase in repair for standard-size self-priming pumps would no longer occur starting from the compliance year due to the smaller price difference between replacing the entire pump and replacing the motor only. Under these scenarios, DOE assumed the pumps were repaired 40 percent of the time, and new pumps were purchased 60 percent of the time to replace failed pumps (*i.e.*, TSLs 6 to 8 as described in section V.A of this document). *Id.*

In addition, DOE accounted for potential downsizing that could occur as a result of setting different efficiency levels by equipment classes and THP. Specifically, DOE assumed that DPPP manufacturers may not want to incorporate variable-speed motors in DPPPs, where the DPPP energy conservation standard level does not require the use of a variable-speed motor. Therefore, at TSLs requiring a variable-speed motor for certain equipment classes with larger THP (*i.e.*, TSL 8, 7, 6. *See* section V.A), DOE assumed that DPPP manufacturers might decide to use motors with smaller THP for DPPPs that were not required to comply with a DPPP standard level corresponding to a variable-speed-motor efficiency level. DOE analyzed DPPP motor THP size as a function of DPPP hhp in the 2021 DPPP Database to estimate where such downsizing may occur. For TSL 8 and 7, DOE did not identify any possible downsizing from small-size DPPP motors to extra-small-size DPPP motors. Furthermore, at TSL 8 and 7, small-size and standard-size DPPP motors are both set at EL 6. Therefore, DOE did not consider any downsizing at these TSLs. At TSL 6, based on a review of the 2021 DPPP Database, DOE identified representative unit 2A as a candidate for downsizing. Therefore, at TSL 6, DOE assumed that the majority of shipments of standard-size DPPP motors used in small-size self-priming pool pumps (80 percent) would downsize to small-size DPPP motors. For standard-size DPPP motors used in standard-size non-self-priming pumps (*i.e.*, representative unit 5), DOE did not identify DPPP models with oversized DPPP motors in its 2021 DPPP Database and did not assume any downsizing. 87 FR 37122, 37149-37150.

DOE did not receive any comments on its approach to establish standards-case shipments projections and maintain the same methodology in this final rule with the following update. For those California consumers that elect to purchase a new DPPP rather than a replacement variable-speed motor in the no-new-standards case (based on the discussion in section IV.F.8 of this document), at the TSLs for which the DPPP motor efficiency levels are set at or above the level equivalent to the PCBP, small-size self-priming, small and standard-size non-self-priming DPPP standards, DOE assumed that these California consumers would select to purchase a replacement motor rather than a new DPPP. This results in an increase of shipments of replacement DPPP motors sold alone and a decrease of shipments of motors sold in DPPP at these TSLs, for those DPPP applications. *See* chapter 9 of the final rule TSD for more details.

H. National Impact Analysis

The NIA assesses the national energy savings ("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.[106] ("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. For the present analysis, DOE projected the energy savings, operating cost savings, product costs, and NPV of consumer benefits over the lifetime of DPPP motors sold from 2026 through 2055, except at TSL 7 where for small

[106] The NIA accounts for impacts in the 50 States and U.S. territories.

size motors at TSL 7, the analysis considers DPPP motors sold from 2028 through 2055.[107]

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.

[107] Because the anticipated compliance date is late in the year, for analytical purposes, DOE conducted the analysis for shipments in 2026–2055 and 2028–2055.

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

Table IV.10 Summary of Inputs and Methods for the National Impact Analysis

Inputs	Method
Shipments	Annual shipments from shipments model.
Compliance Date of Standard	2026 (2028 at TSL 7 for small-size DPPP motors) (first full year)
Efficiency Trends	No-new-standards case: shifted 1 percent per year of the market share in the single-speed levels to the variable-speed efficiency levels. Standard cases: shifted 1 percent per year of the market share in the single-speed levels to the variable-speed efficiency levels.
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	*AEO 2023* projections (to 2050) and held constant thereafter.
Energy Site-to-Primary and FFC Conversion	A time-series conversion factor based on *AEO 2023*.
Discount Rate	Three and seven percent.
Present Year	2024

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) for each of the considered product classes for the year of anticipated compliance with an amended or new standard. To project the trend in efficiency absent amended standards for DPPP motors over the entire shipments projection period, DOE relied on the same approach described in section IV.F.8 this document and shifted 1 percent per year of the market share in the single-speed levels to the variable-speed efficiency levels. The approach is further described in chapter 10 of the final rule TSD.

For the standards cases, DOE used a "roll-up" scenario to establish the shipment-weighted efficiency for the year that standards are assumed to become effective (2026 or 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 June 2022 NOPR, to develop standards case efficiency trends after the first full year of compliance (2026 or 2028), DOE also shifted 1 percent per year of the market share in the single-speed levels to the variable-speed efficiency levels. 87 FR 37122, 37151. This approach is consistent with the assumption made in the 2017 DPPP DFR. See section 8.4 of the June 2022 NOPR TSD. DOE did not receive any comments on this assumption and retained the same approach in the final rule.

2. National Energy Savings

The national energy savings 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 *AEO 2023*. Cumulative energy savings are the sum of the NES for each year over the timeframe of the analysis.

Use of higher-efficiency products is sometimes 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 DPPP motors and, in the June 2022 NOPR, DOE did not apply a rebound effect. 87 FR 37122, 37151. DOE did not receive any comments on this topic and maintains the same approach in this final rule.

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 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[108] 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 and 13A of the final rule TSD.

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 developed DPPP motors price trends based on historical PPI data. DOE applied the same trends to project prices for each equipment class at each considered efficiency level. By 2055, which is the end date of the projection period, the average DPPP motor price is projected to drop between

[108] For more information on NEMS, refer to *The National Energy Modeling System: An Overview 2009*, DOE/EIA-0581(2009), October 2009. Available at www.eia.gov/analysis/pdfpages/0581(2009)index.php (last accessed September 2, 2021).

0 and 52 percent depending on the efficiency level relative to 2026. DOE's projection of product prices is described in appendix 10C of the final rule 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 DPPP motors. In addition to the default price trend, DOE considered two product price sensitivity cases: (1) a high price decline case and (2) a low price decline case based on historical PPI data. The derivation of these price trends and the results of these sensitivity cases are described in appendix 10C of the final rule TSD.

The energy cost savings 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 average regional energy prices by the projection of annual national-average residential energy price changes in the Reference case from *AEO 2023*, which has an end year of 2050. To estimate price trends after 2050, DOE used the average of 2046 to 2050 prices, held constant. As part of the NIA, DOE also analyzed scenarios that used inputs from variants of the *AEO 2023* 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 final rule TSD.

In calculating the NPV, DOE multiplies the net savings in future years by a discount factor to determine their present value. For this final rule, 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.[109] The discount rates for the determination of NPV are in contrast to the discount rates used in the LCC analysis, which are designed to reflect a consumer's perspective. 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.

In the June 2022 NOPR, DOE analyzed the impacts of the considered standard levels on one subgroup: senior-only households. The analysis used subsets of the RECS 2015 sample composed of households that meet the criteria for the subgroup. DOE used

[109] United States Office of Management and Budget. *Circular A-4: Regulatory Analysis*. September 17, 2003. Section E. Available at *georgewbush-whitehouse.archives.gov/omb/memoranda/m03-21.html* (last accessed Feb. 2, 2023).

the LCC and PBP spreadsheet model to estimate the impacts of the considered efficiency levels on this subgroup. DOE did not evaluate low-income consumer subgroup impacts because the sample size of the subgroup was too small for meaningful analysis. 87 FR 37122, 37152 FN97.

NEMA and PHTA commented that DOE should consider the economic impact on lower median income and underserved communities whose consumers utilize above-ground and storable pools that typically fall within the small fractional motor category currently requiring a variable-speed motor in the NOPR. NEMA and PHTA commented that there are 3.3 million permanent above-ground pools in the United States; in 2020, there were 227,000 new above-ground pools installed and in 2021 this number increased to 247,000 (compared to 96,000 in-ground in 2020 and 117,000 in-ground in 2021); the average above-ground pool price in 2021 was $3,615 compared to $56,000 for the average in-ground pool. (PHTA and NEMA, No. 92 at p. 5) PHTA commented that lower-income consumers and underserved communities would be more negatively impacted by a variable-speed requirement for small fractional motors because of the use of such motors in above-ground and storable pools. (PHTA, No. 100 at p. 4)

In the June 2022 NOPR, DOE did not evaluate low-income consumer subgroup impacts because the sample size of the subgroup was too small for meaningful analysis. 87 FR 37122, 37186 FN97. In this final rule, DOE updated the sample based on RECS 2020 and found that RECS 2020 only included 37 low-income consumer samples representing 2.6% of U.S households with a pool.[110] Therefore, in this final rule, DOE did not evaluate low-income consumer subgroup impacts because the sample size of the subgroup continues to be too small for meaningful analysis.

For this final rule, DOE analyzed the impacts of the considered standard levels on senior-only households. The analysis used subsets of the RECS 2020 sample composed of households that meet the criteria for the considered 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 final rule TSD describes the consumer subgroup analysis.

J. Manufacturer Impact Analysis

1. Overview

DOE performed an MIA to estimate the financial impacts of new energy conservation standards on manufacturers of DPPP motors 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 energy conservation standards might affect manufacturing employment, capacity, and competition, as well as how standards contribute to overall

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[110] After adjusting the RECS sample to represent the geographic distribution of above ground pools, this results in 2.5 percent of consumers of above-ground pools that are low-income.

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 equipment. 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 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 ("TSLs"). To capture the uncertainty relating to manufacturer pricing strategies following new standards, the GRIM estimates a range of possible impacts under different manufacturer 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 final rule TSD.

DOE conducted the MIA for this rulemaking in three phases. In Phase 1 of the MIA, DOE prepared a profile of the DPPP motors manufacturing industry based on the market and technology assessment, preliminary manufacturer interviews, and publicly available information. This included a top-down analysis of DPPP motors 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 DPPP motors manufacturing industry, including company filings of form 10-K from the SEC,[111] corporate annual reports, the U.S. Census Bureau's "Economic Census,"[112] and reports from Dunn & Bradstreet.[113]

In Phase 2 of the MIA, DOE prepared a framework industry cash-flow analysis to quantify the potential impacts of new 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.

[111] See online at *www.sec.gov/edgar.shtml* (Last accessed on January 13, 2023)
[112] See online at *www.census.gov/programs-surveys/asm/data/tables.html* (Last accessed on January 13, 2023)
[113] See online at *app.avention.com* (Last accessed on January 13, 2023)

In addition, during Phase 2, DOE developed interview guides to distribute to manufacturers of DPPP motors 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 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 ("LVMs"), niche players, and/or manufacturers exhibiting a cost structure that largely differs from the industry average. DOE identified one subgroup for a separate impact analysis: small business manufacturers. The small business subgroup is discussed in section VI.B of this document, "Review under the Regulatory Flexibility Act" and in chapter 12 of the final rule TSD.

2. Government Regulatory Impact Model and Key Inputs

DOE uses the GRIM to quantify the changes in cash flow due to new standards that result in a higher or lower industry value. The GRIM uses a standard, annual discounted cash-flow analysis that incorporates manufacturer costs, manufacturer 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 energy conservation standards. The GRIM spreadsheet uses the inputs to arrive at a series of annual cash flows, beginning in 2024 (the base year of the analysis) and continuing to 2055. DOE calculated INPVs by summing the stream of annual discounted cash flows during this period. For manufacturers of DPPP motors, DOE used a real discount rate of 7.2 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 energy conservation standards on 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 and subsequent Working Group meetings. 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 final rule TSD.

a. Manufacturer Production Costs

Manufacturing more efficient equipment is typically more expensive than manufacturing baseline equipment due to the use of more complex components, which are typically more costly than baseline components. The changes in the MPCs of covered equipment can affect the revenues, gross margins, and cash flow of the industry.

DOE initially used data from the January 2017 Direct Final Rule to determine the MSP of DPPP motors. Specifically, DOE used Table 5.7.1 of the January 2017 Direct Final Rule TSD, which estimated the MSPs of DPPP motors used in the analysis. For this final rule DOE adjusted the MSPs used in the June 2022 NOPR from 2020 dollars into 2021 dollars. For a complete description of the MPCs, *see* chapter 5 of the final rule 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 this analysis, the GRIM uses the NIA's annual shipment projections derived from the shipments analysis from 2024 (the base year) to 2055 (the end year of the analysis period). *See* chapter 9 of the final rule TSD for additional details.

c. Product and Capital Conversion Costs

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

DOE continued to use the conversion costs estimates form the June 2022 NOPR. DOE updated these conversion cost estimates from 2020 dollars to 2022 dollars using the PPI NAICS code 335312 (motor and generator manufacturing).[114] In the June 2022 NOPR, DOE assumed that DPPP motor manufacturers would not incur any capital conversion costs for efficiency levels that single-speed or dual-speed motors would be able to meet. The same production equipment currently used to manufacture single-speed and dual-speed motors would still be able to be used to manufacture more efficient single- and dual-speed motors. However, DOE did assume that DPPP motor manufacturers would incur capital conversion costs at efficiency levels that variable-speed motors would be needed to meet the analyzed energy conservation standards. 87 FR 37122, 37153.

Additional production equipment would be needed to manufacture both additional variable-speed motor models and a larger production volume of variable-speed motors than are currently being produced. DOE used feedback from manufacturer interviews to

[114] *www.bls.gov/ppi/databases/* (last accessed on February 9, 2023)

estimate the cost of adding a production line to manufacture variable-speed motors. DOE then estimated the number of additional variable-speed production lines needed at each TSL, based on the increase in variable-speed shipments estimated at the analyzed TSL and the number of DPPP motor manufacturers that would need to introduce variable-speed motor models to meet the analyzed TSL.

DOE assumed that DPPP motor manufacturers would not incur any additional product conversion costs for the standard size equipment classes. All DPPP motor manufacturers currently manufacture multiple variable-speed motor models in the standard size equipment classes. Additionally, the current DOE energy conservation standard for DPPPs that most commonly use the standard size DPPP motors use variable speed motors to meet those efficiency requirements. Therefore, almost all standard size DPPP motors sold as part of a new DPPP are already variable-speed motors. However, DOE did assume that DPPP motor manufacturers would incur product conversion costs for the other equipment classes at each analyzed efficiency level.

Additionally, DPPP motor models would need to be introduced for the extra small-size and small-size DPPP motor equipment classes at each efficiency level analyzed. To evaluate the level of product conversion costs manufacturers would likely incur to comply with the analyzed energy conservation standards for these equipment classes, DOE used a model database to estimate the number of DPPP motor models that would have to be redesigned at each efficiency level for each equipment class. 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 standards.

PHTA and NEMA commented that manufacturers have already made investments that ranged between $50,000 and $6.5 million to comply with the January 2017 Direct Final Rule and that in order to comply with the standards proposed in the June 2022 NOPR, DPPP motor and DPPP manufacturers may have to make investments that are 10 times larger than the investments required to comply with the January 2017 Direct Final Rule. Additionally, PHTA and NEMA stated that some of the investments that were made to comply with the January 2017 Direct Final Rule will not be able to be recouped by the time compliance with the DPPP motor energy conservation standards are required. (PHTA and NEMA, No. 92 at p. 8) DOE accounted for these additional investments that DPPP motor manufacturers will have to make to comply with the analyzed energy conservation standards for DPPP motors, in the form of conversion costs. These investments are displayed as conversion costs in Table V.15 and Table V.16.

The conversion cost figures used in the GRIM can be found in section V.B.2 of this document. For additional information on the estimated capital and product conversion costs, *see* chapter 12 of the final rule TSD.

d. 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. Modifying these markups in the standards cases yield different sets of impacts on manufacturers. For the MIA, DOE modeled two standards-case markup scenarios to represent uncertainty regarding the potential impacts on prices and profitability for manufacturers following the implementation of new energy conservation standards: (1) a preservation of gross margin scenario; and (2) a preservation of operating profit 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 scenario, DOE applied a single uniform "gross margin percentage" across all efficiency levels, which assumes that manufacturers would be able to maintain the same amount of profit as a percentage of revenues at all efficiency levels within an equipment class. DOE continued to use a manufacturer markup of 1.37 for all DPPP motors, which is the same manufacturer markup that was used in the June 2022 NOPR.[115] This manufacturer markup scenario represents the upper bound to industry profitability under new energy conservation standards.

Under the preservation of operating profit scenario, DOE modeled a situation in which manufacturers are not able to increase per-unit operating profit in proportion to increases in MPC. Under this scenario, as the MPCs increase, manufacturers are generally required to reduce the manufacturer markup to maintain a cost competitive

[115] 87 FR 37122, 37154.

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 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 interviews with manufacturers prior to the publication of the June 2022 NOPR. In these interviews, DOE asked manufacturers to describe their major concerns regarding this rulemaking. The following section highlights manufacturer concerns that helped inform the projected potential impacts of new energy conservation standards on the industry. Manufacturer interviews are conducted under non-disclosure agreements (''NDAs''), so DOE does not document these discussions in the same way that it does public comments in the comment summaries and DOE's responses throughout the rest of this document.

Some manufacturers stated they only produce single-speed and dual-speed motors within the small-size equipment class ($0.5 \leq THP < 1.15$) and no longer supply DPPP motors used in new DPPP in that range to the California market after the CEC standard took effect. These manufacturers stated that they would need to design variable-speed motor models to meet any energy conservation standard that would require a variable-speed motor for the small-size equipment class. Additionally, these manufacturers would need to build additional production lines or make significant changes to existing single-speed or dual-speed production lines to be able to meet energy conservation standards requiring variable-speed DPPP motors for this equipment class. DOE included the capital and product conversion costs necessary for these DPPP motor manufacturers to introduce variable-speed DPPP motor models for the small-size equipment class.

4. Comments From Interested Parties

Several interested parties commented on DOE's NOPR MIA. These comments were made either in writing during the comment period following the publication of the June 2022 NOPR or during the NOPR public meeting for DPPP motors.

PHTA and NEMA commented that the lack of timing alignment between DPPP and DPPP motors standards will impact manufacturer's ability to make proper investments and product design if the DPPP motor energy conservation standards make the investments made for the DPPP energy conservation standards moot. (PHTA and NEMA, No. 92 at p. 8) PHTA and NEMA also commented that the lack of harmonization between the DPPP energy conservation standards and the DPPP motor energy conservation standard proposed in the NOPR could result in manufacturers being required to produce multiple, separate, motor types to serve aftermarket applications versus OEM applications. PHTA and NEMA stated that harmonization between the two rules would reduce overall regulatory burden on DPPP motor manufacturers by allowing manufacturers to leverage economies of scale. (PHTA and NEMA, No. 92 at p. 13) Pentair also commented that the investments spent to meet the DPPP rule would be wasted because of the new proposal. (Pentair, No. 90 at p. 1) The compliance date for the DPPP energy conservation standards occurred on July 19, 2021. As part of this final rule, and the NOPR, MIA, DOE examined the additional investments that DPPP motor manufacturers will have to make to comply with the analyzed energy conservation standards for DPPP motors. DOE used the methodology described in section IV.J.2.c of this document to estimate the conversion costs for each analyzed TSL. DOE incorporated these conversion costs into the cash flow analysis presented in section V.B.2.a of this document

Additionally, PHTA and NEMA commented that complex DPPP motor energy conservation standards superimposed on the DPPP energy conservation standards which are not aligned will make compliance with both energy conservation standards matters difficult for manufacturers. PHTA and NEMA stated it is essential that DOE align the performance requirements of the DPPP energy conservation standards with the requirements of the DPPP motors energy conservation standards in order to facilitate compliance with both standards. (PHTA and NEMA, No. 92 at pp. 8-9) PHTA and NEMA also expressed concerns on how the regulatory burden of complying with both the DPPP and DPPPM regulations, that are not align in the performance requirements and in the timing, could be burdensome on DPPP motor manufacturers. (PHTA and NEMA, No. 92 at p. 13)

EPCA directs DOE to establish energy conservation standards for DPPP motors that are designed to achieve the maximum improvement in energy efficiency that are technologically feasible and economically justified. 42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(2)(A) and 42 U.S.C. 6295(o)(3)(B)) As previously stated in this section, DOE accounted for the additional investments that DPPP motor manufacturers will have to make to comply with the analyzed energy conservation standards for DPPP motors. DOE examined the regulatory burden on DPPP motor manufacturers when deciding what energy conservation standard was technologically feasible and economically justified in section V.C. of this document. Lastly, DOE may consider separately coordinating a similar compliance timeline with any upcoming DPPP rulemaking.

Hayward commented that they have already made substantial investments to comply with DPPP energy conservation standards and noted that if they knew DOE planned to initiate DPPP motor energy conservation standards with more stringent requirements than the DPPP energy conservation standards their strategic direction and investments would have been very different. Additionally, Hayward states that if DOE decides against the implementation of a UL 1004-10 based rule, then they requested a compliance date of at least 5 years following effectivity. (Hayward, No. 93. at p. 2) DOE acknowledges that it is adopting more stringent energy conservation standards for small-size DPPP motors in this final rule than the small-size DPPP energy conservation standards established in the January 2017 Direct Final Rule. DOE notes that the compliance date for DPPPs was on July 19, 2021, while the compliance date for energy conservation standards for these small-size DPPP motors is in 2028, approximately seven years after the compliance date for the DPPP energy conservation standards. Additionally, DOE has initiated an effort to determine whether to amend the current energy conservation standards for DPPPs with the publication of an RFI. 87 FR 3461. If DOE proposes to amend energy conservation standards for DPPPs in a future rulemaking, DOE will consider the impacts of the DPPP motor energy conservation standards that are adopted in this rulemaking.

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 in 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 electric power sector emissions of CO_2, NO_X, SO_2, and Hg uses emissions intended to represent the marginal impacts of the change in electricity consumption associated with amended or new standards. The methodology is based on results published for the *AEO*, including a set of side cases that implement a variety of efficiency-related policies. The methodology is described in appendix 13A in the final rule TSD. The analysis presented in this notice uses projections from *AEO 2023*. Power sector emissions of CH_4 and N_2O from fuel combustion are estimated using Emission Factors for Greenhouse Gas Inventories published by the Environmental Protection Agency (EPA).[116]

FFC upstream emissions, which include emissions from fuel combustion during extraction, processing, and transportation of fuels, and "fugitive" emissions (direct

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

leakage to the atmosphere) of CH_4 and CO_2, are estimated based on the methodology described in chapter 15 of the final rule TSD.

The emissions intensity factors are expressed in terms of physical units per MWh or MMBtu of site energy savings. For power sector emissions, specific emissions intensity factors are calculated by sector and end use. Total emissions reductions are estimated using the energy savings calculated in the national impact analysis.

1. Air Quality Regulations Incorporated in DOE's Analysis

DOE's no-new-standards case for the electric power sector reflects the *AEO*, which incorporates the projected impacts of existing air quality regulations on emissions. *AEO 2023* generally represents current legislation and environmental regulations, including recent government actions, that were in place at the time of preparation of *AEO 2023*, including the emissions control programs discussed in the following paragraphs.[117]

SO_2 emissions from affected electric generating units ("EGUs") are subject to nationwide and regional emissions cap-and-trade programs. Title IV of the Clean Air Act sets an annual emissions cap on SO_2 for affected EGUs in the 48 contiguous States and the District of Columbia ("D.C."). (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

[117] For further information, see the Assumptions to *AEO 2022* 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 May 23, 2023).

effect as of January 1, 2015.[118] *AEO 2023* 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, for states subject to SO_2 emissions limits under CSAPR, 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). The final rule establishes power plant emission standards for mercury, acid gases, and non-mercury metallic toxic pollutants. In order to continue operating, coal 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 will

[118] 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), and EPA issued the CSAPR Update for the 2008 ozone NAAQS. 81 FR 74504 (Oct. 26, 2016).

generally reduce SO_2 emissions. DOE estimated SO_2 emissions reduction using emissions factors based on *AEO 2023*.

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. Depending on the configuration of the power sector in the different regions and the need for allowances, however, NO_X emissions might not remain at the limit in the case of lower electricity demand. That would mean that 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. Standards would be expected to reduce NO_X emissions in the States not covered by CSAPR. DOE used *AEO 2023* 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 *AEO 2023*, which incorporates the MATS.

L. Monetizing Emissions Impacts

As part of the development of this final 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 final rule.

To monetize the benefits of reducing GHG emissions this analysis uses the interim 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).

1. Monetization of Greenhouse Gas Emissions

DOE estimates the monetized benefits of the reductions in emissions of CO_2, CH_4, and N_2O by using a measure of the SC of each pollutant (*e.g.*, "SC-CO_2"). 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 DOE would reach the same conclusion presented in this rulemaking in the absence of the social cost of greenhouse gases. That is, the social costs of greenhouse gases, whether measured using the February 2021 interim estimates presented by the Interagency Working Group on the Social Cost of Greenhouse Gases ("IWG") or by another means, did not affect the rule ultimately adopted by DOE.

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 IWG. 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, 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 processes, peer-reviewed methodologies, the best science available at the time of that process, and with input from the public. Specifically, in 2009, the IWG, which 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 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—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*.[119] 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).[120] 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" (EO 13783, Section 5(c)). Benefit-cost analyses following E.O. 13783 used SC-GHG estimates that attempted to focus on the U.S.-specific share of climate change damages as estimated by the models and were calculated using two discount rates recommended by Circular A-4, 3-percent and 7-

[119] Marten, A. L., E. A. Kopits, C. W. Griffiths, S. C. Newbold, and A. Wolverton. Incremental CH4 and N2O mitigation benefits consistent with the US Government's SC-CO2 estimates. *Climate Policy*. 2015. 15(2): pp. 272–298.

[120] National Academies of Sciences, Engineering, and Medicine. *Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide*. 2017. The National Academies Press: Washington, DC.

percent. All other methodological decisions and model versions used in SC-GHG calculations remained the same as those used by the IWG in 2010 and 2013, respectively.

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 are used here to estimate the climate benefits for this 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 the SC-GHG estimates used under E.O. 13783 fail to fully capture many climate impacts that affect the welfare of U.S. citizens and residents, and those impacts are better reflected by global measures of the SC-GHG. Examples of omitted effects from the E.O. 13783 estimates include direct effects on U.S. citizens, assets, and investments located abroad, supply chains, U.S. military assets and interests abroad, and tourism, and spillover pathways such as economic and political destabilization and global migration that can lead to adverse impacts on U.S. national security, public health, and humanitarian concerns. In addition, assessing the benefits of U.S. GHG mitigation activities requires consideration of how those actions may affect mitigation activities by other 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. A wide range of scientific and economic experts have emphasized the issue of reciprocity as support for considering global damages of GHG emissions. 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. The only way to achieve an efficient allocation of resources for emissions reduction on a global basis—and so benefit the United States and its citizens—is for all countries to base their policies on global estimates of damages. As a member of the IWG involved in 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. A robust estimate of climate damages that accrue only to U.S. citizens and residents does not currently exist in the literature. As explained in the February 2021 TSD, existing estimates are both incomplete and an underestimation of total damages that accrue to the citizens and residents of the United States because they do not fully capture the regional interactions and spillovers discussed above; nor do they include all of the important physical, ecological, and economic impacts of climate change recognized in the climate change literature. 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,[121] and recommended that discount rate uncertainty and relevant aspects of intergenerational ethical considerations be accounted for in selecting future discount rates.

Furthermore, the damage estimates developed for use in the SC-GHG are estimated in consumption-equivalent terms, and so an application of OMB Circular A-4's

[121] Interagency Working Group on Social Cost of Carbon. Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12866. 2010. United States Government. *www.epa.gov/sites/default/files/2016-12/documents/scc_tsd_2010.pdf* (last accessed April 15, 2022). Interagency Working Group on Social Cost of Carbon. Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. 2013. *www.federalregister.gov/documents/2013/11/26/2013-28242/technical-support-document-technical-update-of-the-social-cost-of-carbon-for-regulatory-impact* (last accessed April 15, 2022). Interagency Working Group on Social Cost of Greenhouse Gases, United States Government. Technical Support Document: Technical Update on the Social Cost of Carbon for Regulatory Impact Analysis-Under Executive Order 12866. August 2016 (last accessed January 18, 2022). Interagency Working Group on Social Cost of Greenhouse Gases, United States Government. Addendum to Technical Support Document on Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12866: Application of the Methodology to Estimate the Social Cost of Methane and the Social Cost of Nitrous Oxide. August 2016. *www.epa.gov/sites/default/files/2016-12/documents/addendum_to_sc-ghg_tsd_august_2016.pdf* (last accessed January 18, 2022).

guidance for regulatory analysis would then use the consumption discount rate to calculate the SC-GHG. DOE agrees with this assessment and will continue to follow developments in the literature pertaining to this issue. DOE also notes that while OMB Circular A-4, as published in 2003, recommends using 3-percent and 7-percent discount rates as "default" values, Circular A-4 also reminds agencies that "different regulations may call for different emphases in the analysis, depending on the nature and complexity of the regulatory issues and the sensitivity of the benefit and cost estimates to the key assumptions." On discounting, Circular A-4 recognizes that "special ethical considerations arise when comparing benefits and costs across generations," and Circular A-4 acknowledges that analyses may appropriately "discount future costs and consumption benefits…at a lower rate than for intragenerational analysis." In the 2015 Response to Comments on the Social Cost of Carbon for Regulatory Impact Analysis, OMB, DOE, and the other IWG members recognized that "Circular A-4 is a living document" and "the use of 7 percent is not considered appropriate for intergenerational discounting. There is wide support for this view in the academic literature, and it is recognized in Circular A-4 itself." Thus, DOE concludes that a 7-percent discount rate is not appropriate to apply to value the social cost of greenhouse gases in the analysis presented in this document.

To calculate the present and annualized values of climate benefits, DOE uses the same discount rate as the rate used to discount the value of damages from future GHG emissions, for internal consistency. That approach to discounting follows the same approach that the February 2021 TSD recommends "to ensure internal consistency—*i.e.*, future damages from climate change using the SC-GHG at 2.5 percent should be discounted to the base year of the analysis using the same 2.5-percent rate." DOE has also consulted the National Academies' 2017 recommendations on how SC-GHG estimates can "be combined in RIAs with other cost and benefits estimates that may use different discount rates." The National Academies reviewed several options, including "presenting all discount rate combinations of other costs and benefits with [SC-GHG] estimates."

As a member of the IWG involved in the development of the February 2021 SC-GHG TSD, DOE agrees with the above 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 were 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 best 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.

There are a number of limitations and uncertainties associated with the SC-GHG estimates. First, the current scientific and economic understanding of discounting approaches suggests discount rates appropriate for intergenerational analysis in the context of climate change are likely to be less than 3 percent—near 2 percent or lower.[122] Second, the IAMs used to produce these interim estimates do not include all of the important physical, ecological, and economic impacts of climate change recognized in the climate change literature and the science underlying their "damage functions"—*i.e.*, the core parts of the IAMs that map global mean temperature changes and other physical impacts of climate change into economic (both market and nonmarket) damages—lags behind the most recent research. For example, limitations include the incomplete treatment of catastrophic and non-catastrophic impacts in the IAMs, their incomplete treatment of adaptation and technological change, the incomplete way in which inter-regional and intersectoral linkages are modeled, uncertainty in the extrapolation of damages to high temperatures, and inadequate representation of the relationship between

[122] Interagency Working Group on Social Cost of Greenhouse Gases (IWG). 2021. Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990. February. United States Government. Available at *www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf/*.

the discount rate and uncertainty in economic growth over long-time horizons. Likewise, the socioeconomic and emissions scenarios used as inputs to the models do not reflect new information from the last decade of scenario generation or the full range of projections. The modeling limitations do not all work in the same direction in terms of their influence on the SC-CO_2 estimates. However, as discussed in the February 2021 TSD, the IWG has recommended that, taken together, the limitations suggest that the interim SC-GHG estimates used in this final rule likely underestimate the damages from GHG emissions. DOE concurs with this assessment.

DOE's derivations of the SC-CO_2, SC-N_2O, and SC-CH_4 values used for this final rule are discussed in the following sections, and the results of DOE's analyses estimating the benefits of the reductions in emissions of these GHGs are presented in section V.B.6 of this document.

a. Social Cost of Carbon

The SC-CO_2 values used for this final rule were based on the values developed for the IWG's February 2021 TSD. Table IV.11 shows the updated sets of SC-CO_2 estimates from the IWG's TSD in 5-year increments from 2020 to 2050. The full set of annual values that DOE used is presented in appendix 14A of the final rule TSD. For purposes of capturing the uncertainties involved in regulatory impact analysis, DOE has determined it is appropriate to include all four sets of $SC\text{-}CO_2$ values, as recommended by the IWG.[123]

Table IV.11. Annual $SC\text{-}CO_2$ Values from 2021 Interagency Update, 2020–2050 (2020$ per Metric Ton CO_2)

Year	Discount Rate and Statistic			
	5%	3%	2.5%	3%
	Average	Average	Average	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

For 2051 to 2070, DOE used $SC\text{-}CO_2$ estimates published by EPA, adjusted to 2020$.[124] These estimates are based on methods, assumptions, and parameters identical to the 2020-2050 estimates published by the IWG.

DOE multiplied the CO_2 emissions reduction estimated for each year by the $SC\text{-}CO_2$ value for that year in each of the four cases. DOE adjusted the values to 2022$ using the implicit price deflator for gross domestic product ("GDP") from the Bureau of Economic Analysis. To calculate a present value of the stream of monetary values, DOE

[123] 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.
[124] *See* EPA, Revised 2023 and Later Model Year Light-Duty Vehicle GHG Emissions Standards: Regulatory Impact Analysis, Washington, D.C., December 2021. Available at *nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1013ORN.pdf* (last accessed February 21, 2023).

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.

b. Social Cost of Methane and Nitrous Oxide

The SC-CH_4 and SC-N_2O values used for this final rule were based on the values developed for the February 2021 TSD. Table IV.12 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 final rule 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. DOE derived values after 2050 using the approach described above for the SC-CO_2.

Table IV.12. Annual SC-CH_4 and SC-N_2O Values from 2021 Interagency Update, 2020–2050 (2020$ per Metric Ton)

Year	SC-CH_4				SC-N_2O			
	Discount Rate and Statistic				Discount Rate and Statistic			
	5%	3%	2.5%	3%	5%	3%	2.5 %	3%
	Average	Average	Average	95th percentile	Average	Average	Average	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. DOE adjusted the values to 2022$ using the implicit price deflator for GDP from the Bureau of Economic

Analysis. 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.

2. Monetization of Other Emissions Impacts

For this final rule, DOE estimated the monetized value of NO_X and SO_2 emissions reductions from electricity generation using benefit per ton estimates for that sector from the EPA's Benefits Mapping and Analysis Program.[125] DOE used EPA's values for $PM_{2.5}$-related benefits associated with NO_X and SO_2 and for ozone-related benefits associated with NO_X for 2025 and 2030, and 2040, calculated with discount rates of 3 percent and 7 percent. DOE used linear interpolation to define values for the years not given in the 2025 to 2040 range; for years beyond 2040 the values are held constant. DOE combined the EPA benefit per ton estimates with regional information on electricity consumption and emissions to define weighted-average national values for NO_X and SO_2 (See appendix 14B of the final rule TSD).

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.

The Joint SC-GHG Commenters stated that DOE appropriately applies the social cost estimates developed by the Interagency Working Group on the Social Cost of

[125] Estimating the Benefit per Ton of Reducing PM2.5 Precursors from 21 Sectors. Available at *www.epa.gov/benmap/estimating-benefit-ton-reducing-pm25-precursors-21-sectors.*

Greenhouse Gases to its analysis of emissions reduction benefits. The Joint SC-GHG Commenters stated that there are numerous legal, economic, and policy justifications that further DOE's adoption of the Working Group's climate-damage valuations. They added that DOE should consider conducting sensitivity analysis using a sound domestic-only social cost estimate as a backstop, and should explicitly conclude that the rule is cost-benefit justified even using a domestic-only valuation that may still undercount climate benefits. They also stated that their comments offer additional justification for adopting the range of discount rates endorsed by the Working Group and urged DOE to consider providing additional sensitivity analysis using discount rates of 2 percent or lower for climate impacts. Lastly, the Joint SC-GHG Commenters commented that DOE should clearly state that any criticisms of the SC-GHG are moot in this rulemaking because the proposed rule is easily cost-justified without any climate benefits. (Joint SC-GHG Commenters, No.95 at. pp. 1-3)

In response, DOE maintains that the reasons for using global measures of the SC-GHG previously discussed (See section IV.L.1 of this document) are sufficient for the purposes of this rulemaking. DOE notes that further discussion of this topic is contained in the February 2021 SC-GHG TSD, and DOE agrees with the assessment therein. Regarding conducting sensitivity analysis using a domestic-only social cost estimate, DOE agrees with the assessment in the February 2021 SC-GHG TSD that the only currently-available quantitative characterization of domestic damages from GHG emissions is both incomplete and an underestimate of the share of total damages that accrue to the citizens and residents of the U.S. *See* section 2 of the February 2021 SC-GHG TSD. Therefore, it would be of questionable value to conduct the suggested sensitivity analysis at this time. DOE considered performing sensitivity analysis using discount rates lower than 2.5% for climate impacts, as suggested by the IWG, but it concluded that such analysis would not add meaningful information in the context of this rulemaking.

As noted by the Joint SC-GHG Commenters and previously stated by DOE in section IV.L.1 of this document, the final rule is economically justified without inclusion of climate benefits. *See* Section V.C.1 of this document for more discussion on economic justification.

M. Utility Impact Analysis

The utility impact analysis estimates the changes in installed electrical capacity and generation projected to result for each considered TSL. The analysis is based on published output from the NEMS associated with *AEO 2023*. 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 electricity sector generation, installed capacity, fuel consumption and emissions in the *AEO 2023* Reference case and various side cases. Details of the methodology are provided in the appendices to chapters 13 and 15 of the final rule 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 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.[126] 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 final rule using an input/output model of the U.S. economy called Impact of Sector Energy Technologies version 4 ("ImSET").[127] 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

[126] *See* 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 Feb. 2, 2023).
[127] 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's Guide*. 2015. Pacific Northwest National Laboratory: Richland, WA. PNNL-24563.

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 change in the later years of the analysis. Because ImSET does not incorporate price changes, the employment effects predicted by ImSET may overestimate actual job impacts over the long run for this rule. Therefore, DOE used ImSET only to generate results for near-term timeframes (2026-2030 or 2028-2030), where these uncertainties are reduced. For more details on the employment impact analysis, *see* chapter 16 of the final rule TSD.

One of the inputs to the employment impact analysis is the fraction of shipments that are imported vs. domestically manufactured. In the June 2022 NOPR, DOE assumed the fraction of DPPP motors shipments that are imported vs. domestically manufactured was identical to small electric motors and assumed a 40 percent were imported vs 60 percent were domestically manufactured. *See* Chapter 15 of the June NOPR TSD.

PHTA and NEMA commented that DOE estimated that 60 percent of pool pump motors are manufactured domestically, with the remaining 40 percent imported. PHTA and NEMA commented that DOE did not conduct manufacturer interviews specific to DPPPM and that much of the analyses relies on market research conducted in 2016 to support the energy conservation standard established for DPPP. PTHA and NEMA commented that while DPPPM are often sold as a component of DPPP, there are different market characteristics that manufacturers feel necessitate new interviews, focused specifically on DPPPM. (PHTA and NEMA, No. 92 at p. 7)

In this final rule, DOE revised the fraction of DPPP motors shipments that are imported vs. domestically manufactured used in the employment impact analysis to align with the estimates from the manufacturer impact analysis specific to DPPP motors (See section IV.J of this document) and assumed 50 percent of DPPP motors shipments are imported vs. 50 percent are domestically manufactured.[128] Finally, DOE notes that DOE conducted DPPP motor manufacturer interviews as part of the June 2022 NOPR, as discussed in the manufacturer impact analysis, and incorporated feedback to estimate this fraction.

V. Analytical Results and Conclusion

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

[128] In the NOPR, DOE assumed that 40 percent of DPPP motors are imported based on estimates for small electric motors. In the final rule, DOE revised the percentage imported to be more specific to DPPP motors and align with the estimate used in the MIA.

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.

In the analysis conducted for this final rule, DOE analyzed the benefits and burdens of eight TSLs for DPPP motors. DOE developed TSLs that combine specific efficiency levels for each of the DPPP motor equipment classes analyzed by DOE. The TSLs that were chosen in the final rule represent DPPP motors at maximum technologically feasible ("max-tech") energy efficiency levels and similar performance (*i.e.*, variable-speed, two-speed, multi-speed, and/or single-speed). DOE presents the results for the TSLs in this document, while the results for all efficiency levels that DOE analyzed are in Chapter 8 the final rule TSD.[129]

Table V.1 and Table V.2 presents the TSLs and the corresponding efficiency levels that DOE has identified for potential amended energy conservation standards for DPPP motors. TSL 8 represents the max-tech energy efficiency for all equipment classes, as well as freeze protection control requirements for DPPP motors greater than and equal

[129] Efficiency levels that were analyzed for this final rule are discussed in section IV.C of this document. Results by efficiency level are presented in Chapter 8.

to 0.5 THP. TSL 7 represents the California CEC standards[130] and includes a variable-speed requirement for DPPP motors at or above 0.5 THP, an EL 1 efficiency requirement below 0.5 THP, and freeze-protection control requirements for DPPP motors greater than and equal to 0.5 THP. TSL 6 represents the performance requirements included in UL 1004-10:2022, which ensures DPPP motors operate similarly to motors in DPPPs that comply with the DOE standards at 10 CFR 431.465(f) and includes a variable-speed requirement for DPPP motors at or above 1.15 THP, an EL 1 efficiency requirement below 1.15 THP, and freeze-protection control requirements for DPPP motors greater than and equal to 1.15 THP. TSL 5 represents the two-speed/multi-speed DPPP motor EL 5 level for applicable equipment classes and freeze-protection control requirements for DPPP motors greater than and equal to 0.5 THP. TSL 4 represents the two-speed/multi-speed DPPP motor EL 4 level for applicable equipment classes and freeze protection control requirements for DPPP motors greater than and equal to 0.5 THP. TSL 3 represents the two-speed/multi-speed DPPP motor EL 3 level for applicable equipment classes and freeze-protection control requirements for DPPP motors greater than and equal to 0.5 THP. TSL 2 represents the highest-efficiency single-speed DPPP motor level for all equipment classes. TSL 1 represents the medium-efficiency single-speed DPPP motor level for all equipment classes.

In addition, as discussed in section III.A of this document, for all TSLs, DOE considered a 2-year lead time resulting in a first full year of compliance of 2026, except

[130] Best approximation based on the efficiency level analyzed.

for small-size DPPP motors at TSL 7 where DOE uses a 4-year compliance lead time, resulting in a first full year of compliance year of 2028.

Table V.1 Trial Standard Levels for DPPP Motors – EL mapping

TSL	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5	TSL 6	TSL 7	TSL 8
Extra-small (< 0.5 THP)	EL 1	EL 2	EL 2	EL 2	EL 2	EL 1	EL 1 (2026)	EL 2
Small-size (0.5 ≤ THP < 1.15)	EL 1	EL 2	EL 3*	EL 4*	EL 5*	EL 1	EL 6* (2028)	EL 6*
Standard-size (1.15 ≤ THP ≤ 5)	EL 1	EL 2	EL 3*	EL 4*	EL 5*	EL 6*	EL 6* (2026)	EL 6*

* includes freeze protection control requirements.
Note: the analysis uses 2026 as the first full year of compliance except at TSL 7, where the first full year of compliance varies by equipment class as indicated in the table.

Table V.2 Trial Standard Levels for DPPP Motors - Description

TSL	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5	TSL 6	TSL 7	TSL 8
Extra-small (< 0.5 THP)	Medium Efficiency Single Speed	High Efficiency Single Speed	High Efficiency Single Speed	High Efficiency Single Speed	High Efficiency Single Speed	Medium Efficiency Single Speed	Medium Efficiency Single Speed (2026)	High Efficiency Single Speed
Small-size (0.5 ≤ THP < 1.15)	Medium Efficiency Single Speed	High Efficiency Single Speed	Two and multi-speed EL 3*	Two and multi-speed EL 4*	Two and multi-speed EL 5*	Medium Efficiency Single Speed	Variable-Speed * (2028)	Variable-Speed *
Standard-size (1.15 ≤ THP ≤ 5)	Medium Efficiency Single Speed	High Efficiency Single Speed	Two and multi-speed EL 3*	Two and multi-speed EL 4*	Two and multi-speed EL 5*	Variable-Speed*	Variable-Speed * (2026)	Variable-Speed *
General Description	Medium Efficiency Single Speed	High Efficiency Single Speed	two and multi-speed EL3 where	two and multi-speed EL4 where	two and multi-speed EL5 where	UL 1004-10:2022 requirements	CEC Standards	Max-tech

			applicabl e	applicabl e	applicabl e			

* includes freeze protection control requirements.
Note: the analysis uses 2026 as the first full year of compliance except at TSL 7, where the first full year of compliance varies by equipment class as indicated in the table.

B. Economic Justification and Energy Savings

1. Economic Impacts on Individual Consumers

DOE analyzed the economic impacts on DPPP motors consumers by looking at the effects that potential 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 final rule TSD provides detailed information on the LCC and PBP analyses.

Table V.2 through Table V.7 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, the 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 Extra-Small-Size DPPP Motors

TSL	Efficiency Level	Average Costs 2022$				Simple Payback years	Average Lifetime years
		Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
-	0	\$65	\$72	\$236	\$301	-	3.6
1,6,7	1	\$77	\$59	\$192	\$269	0.9	3.6
2-5,8	2	\$115	\$54	\$177	\$292	2.8	3.6

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 Extra-Small-Size DPPP Motors

TSL	Efficiency Level	Life-Cycle Cost Savings	
		Average LCC Savings* 2022$	Percent of Consumers that Experience Net Cost
1,6,7	1	\$3	0%
2-5,8	2	(\$12)	59%

* The savings represent the average LCC for affected consumers.

Table V.4 Average LCC and PBP Results for Small-Size DPPP Motors

TSL	Efficiency Level	Average Costs *2022$* Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC	Simple Payback *years*	Average Lifetime *years*
-	0	$156	$241	$843	$999	-	3.9
1,6	1	$177	$196	$685	$862	0.5	3.9
2	2	$218	$180	$628	$846	1.0	3.9
3	3	$383	$190	$678	$1,060	4.5	3.9
4	4	$412	$166	$590	$1,001	3.4	3.9
5	5	$443	$158	$561	$1,003	3.4	3.9
7,8	6	$655	$92	$361	$1,017	3.4	3.9

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 Small-Size DPPP Motors

TSL	Efficiency Level	Life-Cycle Cost Savings: Average LCC Savings* *2022$*	Percent of Consumers that Experience Net Cost
1,6	1	$10	0%
2	2	$14	24%
3	3	($54)	52%
4	4	($12)	46%
5	5	($16)	50%
7,8	6	$4	44%

* The savings represent the average LCC for affected consumers.

Table V.6 Average LCC and PBP Results for Standard-Size DPPP Motors

TSL	Efficiency Level	Average Costs *2022$* Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC	Simple Payback *years*	Average Lifetime *years*
-	0	$308	$651	$2,637	$2,945	-	4.8
1	1	$368	$558	$2,264	$2,633	0.7	4.8
2	2	$412	$517	$2,098	$2,510	0.8	4.8
3	3	$574	$319	$1,306	$1,879	0.8	4.8
4	4	$613	$284	$1,163	$1,776	0.8	4.8
5	5	$654	$259	$1,063	$1,717	0.9	4.8
6-8	6	$847	$243	$1,056	$1,903	1.3	4.8

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.7 Average LCC Savings Relative to the No-New-Standards Case for Standard-Size DPPP Motors

TSL	Efficiency Level	Life-Cycle Cost Savings	
		Average LCC Savings* <u>*2022$*</u>	Percent of Consumers that Experience Net Cost
1	1	$26	0%
2	2	$44	2%
3	3	$109	18%
4	4	$141	17%
5	5	$151	19%
6-8	6	$236	2%

* The savings represent the average LCC for affected consumers.

b. Consumer Subgroup Analysis

In the consumer subgroup analysis, DOE estimated the impact of the considered TSLs on senior-only households. Table V.8 through Table V.13 compare the average LCC savings and PBP at each efficiency level for the consumer subgroups with similar metrics for the entire consumer sample for DPPP motors. In most cases, the average LCC savings and PBP for senior-only households at the considered efficiency levels are not substantially different from the average for all households. Chapter 11 of the final rule TSD presents the complete LCC and PBP results for the subgroups.

Table V.8 Comparison of Average LCC Savings and PBP for Consumer Subgroup and All Households for Equipment Class 1 Extra-Small-Size DPPP Motors

TSL	EL	Average Life-Cycle Cost Savings <u>2022$</u>		Simple Payback Period <u>years</u>	
		Senior-Only Households	All Households	Senior-Only Households	All Households
1,6,7	1	$3	$3	0.9	0.9
2-5,8	2	($12)	($12)	2.7	2.8

Table V.9 Comparison of Fraction of Consumers Experiencing Net Benefit and Net Cost for Consumer Subgroup and All Households for Equipment Class 1 Extra-Small-Size DPPP Motors

TSL	EL	Percent of Consumers that Experience Net Cost %		Percent of Consumers that Experience Net Benefit %	
		Senior-Only Households	All Households	Senior-Only Households	All Households
1,6,7	1	0%	0%	8%	8%
2-5,8	2	58%	59%	8%	8%

Table V.10 Comparison of Average LCC Savings and PBP for Consumer Subgroup and All Households for Equipment Class 2 Small-Size DPPP Motors

TSL	EL	Average Life-Cycle Cost Savings <u>2022$</u>		Simple Payback Period <u>years</u>	
		Senior-Only Households	All Households	Senior-Only Households	All Households
1,6	1	$11	$10	0.4	0.5
2	2	$18	$14	0.9	1.0
3	3	($47)	($54)	4.1	4.5
4	4	($0)	($12)	3.1	3.4
5	5	($2)	($16)	3.2	3.4
7,8	6	$33	$4	3.1	3.4

Table V.11 Comparison of Fraction of Consumers Experiencing Net Benefit and Net Cost for Consumer Subgroup and All Households for Equipment Class 2 Small-Size DPPP Motors

TSL	EL	Percent of Consumers that Experience Net Cost %		Percent of Consumers that Experience Net Benefit %	
		Senior-Only Households	All Households	Senior-Only Households	All Households
1,6	1	0%	0%	6%	6%
2	2	23%	24%	25%	24%
3	3	51%	52%	14%	13%
4	4	45%	46%	27%	27%
5	5	48%	50%	27%	26%
7,8	6	42%	44%	29%	27%

Table V.12 Comparison of Average LCC Savings and PBP for Consumer Subgroup and All Households for Equipment Class 3 Standard-Size DPPP Motors

TSL	EL	Average Life-Cycle Cost Savings *2022$*		Simple Payback Period *years*	
		Senior-Only Households	All Households	Senior-Only Households	All Households
1	1	$29	$26	0.6	0.7
2	2	$50	$44	0.7	0.8
3	3	$128	$109	0.7	0.8
4	4	$165	$141	0.8	0.8
5	5	$178	$151	0.8	0.9
6-8	6	$269	$236	1.2	1.3

Table V.13 Comparison of Fraction of Consumers Experiencing Net Benefit and Net Cost for Consumer Subgroup and All Households for Equipment Class 3 Standard-Size DPPP Motors

TSL	EL	Percent of Consumers that Experience Net Cost %		Percent of Consumers that Experience Net Benefit %	
		Senior-Only Households	All Households	Senior-Only Households	All Households
1	1	0%	0%	8%	8%
2	2	2%	2%	17%	17%
3	3	18%	18%	24%	23%
4	4	17%	17%	29%	29%
5	5	18%	19%	29%	29%
6-8	6	2%	2%	17%	18%

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. (42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(2)(B)(iii)) 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 procedures for DPPP motors. In contrast, the PBPs presented in section V.B.1.a were calculated using distributions that reflect the range of energy use in the field.

Table V.14 presents the rebuttable-presumption payback periods for the considered TSLs for DPPP motors. While DOE examined the rebuttable-presumption criterion, it considered whether the standard levels considered for this rule 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.14 Rebuttable-Presumption Payback Periods (years)

	Trial Standard Level							
Equipment Class	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Extra-small-size	0.9	2.7	2.7	2.7	2.7	0.9	0.9	2.7
Small-size	0.4	0.9	3.8	3.0	3.0	0.4	2.7	2.7
Standard-size	0.5	0.6	0.7	0.7	0.8	1.0	1.0	1.0

2. Economic Impacts on Manufacturers

DOE performed an MIA to estimate the impact of new energy conservation standards on manufacturers of DPPP motors. The next section describes the expected impacts on manufacturers at each considered TSL. Chapter 12 of the final rule 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 new standards. The following tables summarize the estimated financial impacts (represented by changes in INPV) of potential new energy conservation standards on manufacturers of DPPP motors, as well as the conversion costs that DOE estimates manufacturers of DPPP motors would incur at each TSL.

As discussed in section IV.J.2.d of this document, DOE modeled two manufacturer markup scenarios to evaluate a range of cash flow impacts on the DPPP motor industry: (1) the preservation of gross margin scenario and (2) the preservation of operating profit scenario. DOE considered the preservation of gross margin scenario by applying a "gross margin percentage" for each equipment 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 1.37 for all DPPP motors. 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 new energy conservation standards.

The preservation of operating profit scenario reflects manufacturers' concerns about their inability to maintain margins as MPCs increase to meet higher efficiency levels. In this scenario, while manufacturers make the necessary investments required to convert their facilities to produce compliant equipment, operating profit remains the same in absolute dollars, but 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 2024 through 2055. 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 standards are required.

Table V.15 and Table V.16 show the MIA results for DPPP motor manufacturers at each TSL using the manufacturer markup scenarios previously described.

Table V.15 Manufacturer Impact Analysis for Dedicated-Purpose Pool Pump Motors – Preservation of Gross Margin Scenario

	Units	No-New-Standards Case	Trial Standard Level*							
			1	2	3	4	5	6	7	8
INPV	*2022$ millions*	661	663	672	684	695	708	675	740	755
Change in INPV	*2022$ millions*	-	2.6	11.3	23.3	34.5	47.0	14.1	79.0	94.1
	%	-	0.4	1.7	3.5	5.2	7.1	2.1	12.0	14.2
Product Conversion Costs	*2022$ millions*	-	0.2	0.9	7.5	7.6	7.9	0.2	10.6	10.7
Capital Conversion Costs	*2022$ millions*	-	0.0	0.0	7.8	7.8	7.8	21.3	45.6	45.6
Total Investment Required	*2022$ millions*	-	0.2	0.9	15.3	15.4	15.7	21.5	56.2	56.4
Free Cash Flow (2025)	*2022$ millions*	31.2	31.1	30.8	23.6	23.6	23.4	19.4	9.9	1.4
Change in Free Cash Flow	*2022$ millions*	-	(0.1)	(0.4)	(7.6)	(7.6)	(7.7)	(11.8)	(21.2)	(29.8)
	%	-	(0.2)	(1.3)	(24.2)	(24.4)	(24.8)	(37.8)	(68.1)	(95.5)

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

Table V.16 Manufacturer Impact Analysis for Dedicated-Purpose Pool Pump Motors – Preservation of Operating Profit Scenario

	Units	No-New-Standards Case	Trial Standard Level*							
			1	2	3	4	5	6	7	8
INPV	*2022$ millions*	661	660	655	622	617	612	559	47	436
Change in INPV	*2022$ millions*	-	(0.8)	(6.2)	(38.9)	(43.4)	(48.5)	(101.4)	(214.2)	(224.4)
	%	-	(0.1)	(0.9)	(5.9)	(6.6)	(7.3)	(15.3)	(32.4)	(34.0)
Product Conversion Costs	*2022$ millions*	-	0.2	0.9	7.5	7.6	7.9	0.2	10.6	10.7
Capital Conversion Costs	*2022$ millions*	-	0.0	0.0	7.8	7.8	7.8	21.3	45.6	45.6
Total Investment Required	*2022$ millions*	-	0.2	0.9	15.3	15.4	15.7	21.5	56.2	56.4
Free Cash Flow (2025)	*2022$ millions*	31.2	31.1	30.8	23.6	23.6	23.4	19.4	9.9	1.4
Change in Free Cash Flow	*2022$ millions*	-	(0.1)	(0.4)	(7.6)	(7.6)	(7.7)	(11.8)	(21.2)	(29.8)
	%	-	(0.2)	(1.3)	(24.2)	(24.4)	(24.8)	(37.8)	(68.1)	(95.5)

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

At TSL 8, DOE estimated that the impact on INPV would range from -$224.4 million to $94.1 million, or a change in INPV of -34.0 percent to 14.2 percent. At TSL 8, industry free cash flow is $1.4 million, which is a decrease of approximately $29.8 million compared to the no-new-standards case value of $31.2 million in 2025, the year leading up to new standards.

TSL 8 will set the energy conservation standards at EL 6 for both the small size and standard size DPPP motor equipment classes and at EL 2 for the extra-small size DPPP motor equipment class. This represents max-tech for all DPPP motor equipment classes. DOE estimated that 33 percent of all extra-small size DPPP motor shipments; 22 percent of all small size DPPP motor shipments; and 62 percent of all standard size DPPP motor shipments will already meet the efficiency levels analyzed at TSL 8 by 2026, in the no-new-standards case.

At TSL 8, DPPP motor manufacturers would need to redesign all small size and standard size DPPP motors that do not use variable-speed controls and would need to redesign all extra-small size DPPP motors not using the most efficient single-speed motors. DOE estimated that this redesign effort would cost manufacturers approximately $10.7 million in product conversion costs. In addition to these product conversion costs, DPPP motor manufacturers would need to increase their variable-speed DPPP motor manufacturing production capacity for both the small size and standard size DPPP motors. DOE estimated that expanding their production capacity would cost manufacturers approximately $45.6 million in capital conversion costs at TSL 8.

At TSL 8, the shipment weighted average MPC for all DPPP motors increases by 60.0 percent relative to the no-new-standards case shipment weighted average MPC for all DPPP motors in 2026. In the preservation of gross margin scenario, manufacturers fully pass on this cost increase to customers. The increase in the shipment weighted average MPC for DPPP motors outweighs the $56.4 million in conversion costs, causing a positive change in INPV at TSL 8 in the preservation of gross margin scenario.

Under the preservation of operating profit 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 60.0 percent shipment weighted average MPC increase results in a reduction in the manufacturer margin after the compliance year. This reduction in the manufacturer margin and the $56.4 million in conversion costs incurred by manufacturers cause a negative change in INPV at TSL 8 in the preservation of operating profit scenario.

At TSL 7, DOE estimated that the impact on INPV would range from -$214.2 million to $79.0 million, or a change in INPV of -32.4 percent to 12.0 percent. At TSL 7, industry free cash flow is $9.9 million, which is a decrease of approximately $21.2 million compared to the no-new-standards case value of $31.2 million in 2025, the year leading up to new standards for standard size and extra-small size DPPP motors.[131]

[131] The analyzed compliance year for small size DPPP motors is 2028. However, DOE presents the year with the largest decrease in manufacturer cash flow, which is still 2025 for TSL 7.

TSL 7 sets the energy conservation standards at EL 6 for both the small size and standard size DPPP motor equipment classes and at EL 1 for the extra-small size DPPP motor equipment class. This represents max-tech for the small size and standard size DPPP motor equipment classes. DOE estimates that 93 percent of all extra-small size DPPP motor shipments; 24 percent of all small size DPPP motor shipments; and 62 percent of all standard size DPPP motor shipments would already meet or exceed the efficiency levels analyzed at TSL 7 by 2026 for the extra-small and standard size DPPP motors and by 2028 for the small size DPPP motors, in the no-new-standards case.

At TSL 7, DPPP motor manufacturers would need to redesign all small size and standard size DPPP motors that do not use variable-speed controls and would need to redesign some extra-small size DPPP motors to meet EL 1. DOE estimated that this redesign effort would cost manufacturers approximately $10.6 million in product conversion costs. In addition to these product conversion costs, DPPP motor manufacturers would need to increase their variable-speed DPPP motor manufacturing production capacity for both the small size and standard size DPPP motors. DOE estimated that expanding their production capacity would cost manufacturer approximately $45.6 million in capital conversion costs at TSL 7.

At TSL 7, the shipment weighted average MPC for all DPPP motors increases by 46.5 percent relative to the no-new-standards case shipment weighted average MPC for all DPPP motors. In the preservation of gross margin scenario, manufacturers can fully pass on this cost increase to customers. The increase in the shipment weighted average

MPC for DPPP motors outweighs the $56.2 million in conversion costs, causing a positive change in INPV at TSL 7 in the preservation of gross margin scenario.

Under the preservation of operating profit 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 46.5 percent shipment weighted average MPC increase results in a reduction in the manufacturer margin after the compliance year. This reduction in the manufacturer margin and the $56.2 million in conversion costs incurred by manufacturers cause a negative change in INPV at TSL 7 in the preservation of operating profit scenario.

At TSL 6, DOE estimated that the impact on INPV would range from -$101.4 million to $14.1 million, or a change in INPV of -15.3 percent to 2.1 percent. At TSL 6, industry free cash flow is $19.4 million, which is a decrease of approximately $11.8 million compared to the no-new-standards case value of $31.2 million in 2025, the year leading up to new standards.

TSL 6 would set the energy conservation standards at EL 6 for the standard size DPPP motor equipment class and at EL 1 for both the extra-small size and small size DPPP motor equipment classes. This represents max-tech for the standard size DPPP motor equipment class. DOE estimates that 93 percent of all extra-small size DPPP motor shipments; 95 percent of all small size DPPP motor shipments; and 62 percent of all standard size DPPP motor shipments would already meet or exceed the efficiency levels analyzed at TSL 6 by 2026, in the no-new-standards case.

At TSL 6, DPPP motor manufacturers would need to redesign all standard size DPPP motors that do not use variable-speed controls and would need to redesign some extra-small size and small size DPPP motors to meet EL 1. DOE estimated that this redesign effort would cost manufacturers approximately $0.2 million in product conversion costs. In addition to these product conversion costs, DPPP motor manufacturers would need to increase their variable-speed DPPP motor manufacturing production capacity for the standard size DPPP motor equipment class. DOE estimated that expanding their production capacity would cost manufacturer approximately $21.3 million in capital conversion costs at TSL 6.

At TSL 6, the shipment weighted average MPC for all DPPP motors increases by 22.0 percent relative to the no-new-standards case shipment weighted average MPC for all DPPP motors. In the preservation of gross margin scenario, manufacturers can fully pass on this cost increase to customers. The increase in the shipment weighted average MPC for DPPP motors outweighs the $21.5 million in conversion costs, causing a positive change in INPV at TSL 6 in the preservation of gross margin scenario.

Under the preservation of operating profit 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 22.0 percent shipment weighted average MPC increase results in a reduction in the manufacturer margin after the compliance year. This reduction in the manufacturer margin and the $21.5 million in conversion costs incurred by manufacturers cause a negative change in INPV at TSL 6 in the preservation of operating profit scenario.

At TSL 5, DOE estimated that the impact on INPV would range from -$48.5 million to $47.0 million, or a change in INPV of -7.3 percent to 7.1 percent. At TSL 5, industry free cash flow is $23.4 million, which is a decrease of approximately $7.7 million compared to the no-new-standards case value of $31.2 million in 2025, the year leading up to new standards.

TSL 5 would set the energy conservation standards at EL 5 for both the small size and standard size DPPP motor equipment classes and at EL 2 for the extra-small size DPPP motor equipment class. DOE estimates that 33 percent of all extra-small size DPPP motor shipments; 23 percent of all small size DPPP motor shipments; and 63 percent of all standard size DPPP motor shipments would already meet or exceed the efficiency levels analyzed at TSL 5 by 2026, in the no-new-standards case.

At TSL 5, DPPP motor manufacturers would need to redesign some small size and standard size DPPP motors to meet EL 5 (which is likely to require the most efficient dual-speed motor) and would need to redesign some extra-small size DPPP motors to meet EL 2. DOE estimated that this redesign effort would cost manufacturers approximately $7.9 million in product conversion costs. In addition to these product conversion costs, DPPP motor manufacturers would need to increase their dual-speed DPPP motor manufacturing production capacity for the small size and standard size DPPP motor equipment classes. DOE estimated that expanding their production capacity would cost manufacturer approximately $7.8 million in capital conversion costs at TSL 5.

At TSL 5, the shipment weighted average MPC for all DPPP motors increases by 20.2 percent relative to the no-new-standards case shipment weighted average MPC for all DPPP motors. In the preservation of gross margin scenario, manufacturers can fully pass on this cost increase to customers. The increase in the shipment weighted average MPC for DPPP motors outweighs the $15.7 million in conversion costs, causing a positive change in INPV at TSL 5 in the preservation of gross margin scenario.

Under the preservation of operating profit 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 20.2 percent shipment weighted average MPC increase results in a reduction in the manufacturer margin after the compliance year. This reduction in the manufacturer margin and the $15.7 million in conversion costs incurred by manufacturers cause a negative change in INPV at TSL 5 in the preservation of operating profit scenario.

At TSL 4, DOE estimated that the impact on INPV would range from -$43.4 million to $34.5 million, or a change in INPV of -6.6 percent to 5.2 percent. At TSL 4, industry free cash flow is $23.6 million, which is a decrease of approximately $7.6 million compared to the no-new-standards case value of $31.2 million in 2025, the year leading up to new standards.

TSL 4 would set the energy conservation standards at EL 4 for both the small size and standard size DPPP motor equipment classes and at EL 2 for the extra-small size DPPP motor equipment class. DOE estimates that 33 percent of all extra-small size DPPP motor shipments; 25 percent of all small size DPPP motor shipments; and 64 percent of all standard size DPPP motor shipments would already meet or exceed the efficiency levels analyzed at TSL 4 by 2026, in the no-new-standards case.

At TSL 4, DPPP motor manufacturers would need to redesign some small size and standard size DPPP motors to meet EL 4 (which is likely to require an intermediate efficient dual-speed motor) and would need to redesign some extra-small size DPPP motors to meet EL 2. DOE estimated that this redesign effort would cost manufacturers approximately $7.6 million in product conversion costs. In addition to these product conversion costs, DPPP motor manufacturers would need to increase their dual-speed DPPP motor manufacturing production capacity for the small size and standard size DPPP motor equipment classes. DOE estimated that expanding their production capacity would cost manufacturer approximately $7.8 million in capital conversion costs at TSL 4.

At TSL 4, the shipment weighted average MPC for all DPPP motors increases by 17.0 percent relative to the no-new-standards case shipment weighted average MPC for all DPPP motors. In the preservation of gross margin scenario, manufacturers can fully pass on this cost increase to customers. The increase in the shipment weighted average MPC for DPPP motors outweighs the $15.4 million in conversion costs, causing a positive change in INPV at TSL 4 in the preservation of gross margin scenario.

Under the preservation of operating profit 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

17.0 percent shipment weighted average MPC increase results in a reduction in the manufacturer margin after the compliance year. This reduction in the manufacturer margin and the $15.4 million in conversion costs incurred by manufacturers cause a negative change in INPV at TSL 4 in the preservation of operating profit scenario.

At TSL 3, DOE estimated that the impact on INPV would range from -$38.9 million to $23.3 million, or a change in INPV of -5.9 percent to 3.5 percent. At TSL 3, industry free cash flow is $23.6 million, which is a decrease of approximately $7.6 million compared to the no-new-standards case value of $31.2 million in 2025, the year leading up to new standards.

TSL 3 would set the energy conservation standards at EL 3 for both the small size and standard size DPPP motor equipment classes and at EL 2 for the extra-small size DPPP motor equipment class. DOE estimates that 33 percent of all extra-small size DPPP motor shipments; 31 percent of all small size DPPP motor shipments; and 66 percent of all standard size DPPP motor shipments would already meet or exceed the efficiency levels analyzed at TSL 3 by 2026, in the no-new-standards case.

At TSL 3, DPPP motor manufacturers would need to redesign some small size and standard size DPPP motors to meet EL 3 (which is likely to require a dual-speed motor) and would need to redesign some extra-small size DPPP motors to meet EL 2. DOE estimated that this redesign effort would cost manufacturers approximately $7.5 million in product conversion costs. In addition to these product conversion costs, DPPP motor manufacturers would need to increase their dual-speed DPPP motor manufacturing production capacity for the small size and standard size DPPP motor equipment classes. DOE estimated that expanding their production capacity would cost manufacturer approximately $7.8 million in capital conversion costs at TSL 3.

At TSL 3, the shipment weighted average MPC for all DPPP motors increases by 14.2 percent relative to the no-new-standards case shipment weighted average MPC for all DPPP motors. In the preservation of gross margin scenario, manufacturers can fully pass on this cost increase to customers. The increase in the shipment weighted average MPC for DPPP motors outweighs the $15.3 million in conversion costs, causing a positive change in INPV at TSL 3 in the preservation of gross margin scenario.

Under the preservation of operating profit 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 14.2 percent shipment weighted average MPC increase results in a reduction in the manufacturer margin after the compliance year. This reduction in the manufacturer margin and the $15.3 million in conversion costs incurred by manufacturers cause a negative change in INPV at TSL 3 in the preservation of operating profit scenario.

At TSL 2, DOE estimated that the impact on INPV would range from -$6.2 million to $11.3 million, or a change in INPV of -0.9 percent to 1.7 percent. At TSL 2, industry free cash flow is $30.8 million, which is a decrease of approximately $0.4 million compared to the no-new-standards case value of $31.2 million in 2025, the year leading up to new standards.

TSL 2 would set the energy conservation standards at EL 2 for all DPPP motor equipment classes. DOE estimates that 33 percent of all extra-small size DPPP motor shipments; 58 percent of all small size DPPP motor shipments; and 78 percent of all standard size DPPP motor shipments would already meet or exceed the efficiency levels analyzed at TSL 2 by 2026, in the no-new-standards case.

At TSL 2, DPPP motor manufacturers would need to redesign some small size and standard size DPPP motors to meet EL 2 (which is likely to require the most efficient single-speed motor) and would need to redesign some extra-small size DPPP motors to meet EL 2. DOE estimated that this redesign effort would cost manufacturers approximately $0.9 million in product conversion costs. DOE estimated that DPPP motor manufacturers have the existing production capacity to manufacturer more efficient single-speed DPPP motors and would not incur any additional capital conversion costs at TSL 2.

At TSL 2, the shipment weighted average MPC for all DPPP motors increases by 3.9 percent relative to the no-new-standards case shipment weighted average MPC for all DPPP motors. In the preservation of gross margin scenario, manufacturers can fully pass on this cost increase to customers. The increase in the shipment weighted average MPC for DPPP motors outweighs the $0.9 million in conversion costs, causing a positive change in INPV at TSL 2 in the preservation of gross margin scenario.

Under the preservation of operating profit 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 3.9 percent shipment weighted average MPC increase results in a reduction in the manufacturer margin after the compliance year. This reduction in the manufacturer margin and the $0.9 million in conversion costs incurred by manufacturers cause a negative change in INPV at TSL 2 in the preservation of operating profit scenario.

At TSL 1, DOE estimated that the impact on INPV would range from -$0.8 million to $2.6 million, or a change in INPV of -0.1 percent to 0.4 percent. At TSL 1, industry free cash flow is $31.1 million, which is a decrease of approximately $0.1 million compared to the no-new-standards case value of $31.2 million in 2025, the year leading up to new standards.

TSL 1 would set the energy conservation standards at EL 1 for all DPPP motor equipment classes. DOE estimates that 93 percent of all extra-small size DPPP motor shipments; 95 percent of all small size DPPP motor shipments; and 86 percent of all standard size DPPP motor shipments would already meet or exceed the efficiency levels analyzed at TSL 1 by 2026, in the no-new-standards case.

At TSL 1, DPPP motor manufacturers would need to redesign some extra-small size, small size, and standard size DPPP motors to meet EL 1 (which is likely to require an intermediate efficient single-speed motor). DOE estimated that this redesign effort would cost manufacturers approximately $0.2 million in product conversion costs. DOE estimated that DPPP motor manufacturers have the existing production capacity to manufacturer more efficient single-speed DPPP motors and would not incur any additional capital conversion costs at TSL 1.

At TSL 1, the shipment weighted average MPC for all DPPP motors increases by 1.2 percent relative to the no-new-standards case shipment weighted average MPC for all DPPP motors. In the preservation of gross margin scenario, manufacturers can fully pass on this cost increase to customers. The increase in the shipment weighted average MPC for DPPP motors outweighs the $0.2 million in conversion costs, causing a positive change in INPV at TSL 1 in the preservation of gross margin scenario.

Under the preservation of operating profit 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 1.2 percent shipment weighted average MPC increase results in a reduction in the manufacturer margin after the compliance year. This reduction in the manufacturer margin and the $0.2 million in conversion costs incurred by manufacturers cause a negative change in INPV at TSL 1 in the preservation of operating profit scenario.

b. Direct Impacts on Employment

To quantitatively assess the potential impacts of new energy conservation standards on direct employment in the DPPP motors industry, DOE used the GRIM to estimate the domestic labor expenditures and number of direct employees in the no-new-standards case and in each of the standards cases during the analysis period.

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 2021 Annual Survey of Manufacturers[132] ("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 DPPP motor production workers by a scaling factor. The scaling factor is calculated by taking the ratio of the total number of employees, and the total number of production workers associated with the industry NAICS code 335312, which covers DPPP motor manufacturing. Using the GRIM, DOE estimates that there

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[132] *www.census.gov/programs-surveys/asm/data/tables.html*

would be approximately 405 domestic production workers and approximately 232 non-production workers for DPPP motors in 2026 in the absence of new energy conservation standards. Table V.17 shows the range of the impacts of energy conservation standards on U.S. production of DPPP motors.

Table V.17 Total Number of Domestic Dedicated-Purpose Pool Pump Motor Production Workers in 2026

	No-New-Standards Case	Trial Standard Level*							
		1	2	3	4	5	6	7	8
Domestic Production Workers in 2026	405	410	421	463	474	487	494	513	648
Domestic Non-Production Workers in 2026	232	235	241	265	272	279	283	294	371
Total Direct Employment in 2026	637	645	662	728	746	766	777	807	1,019
Potential Changes in Total Direct Employment in 2026	-	0 - 8	0 - 25	0 - 91	0 - 109	0 - 129	(163) - 140	(281) - 170	(281) - 382

The direct employment impacts shown in Table V.17 represent the potential changes in direct employment that could result following the compliance date for the DPPP motors covered in this rulemaking. Employment could increase or decrease due to the labor content of the equipment being manufactured domestically or if manufacturers decided to move production facilities abroad because of the new standards. At the less severe end of the range, DOE assumes that all manufacturers continue to manufacture the same scope of the equipment domestically after compliance with the analyzed new standards. The other end of the range assumes that some domestic manufacturing either is eliminated or moves abroad due to the analyzed new standards.

DOE assumes that for DPPP motors, manufacturing is only potentially negatively impacted at TSLs that would most likely require variable-speed DPPP motors. At these TSLs, the maximum number of employees that could be eliminated are the number of domestic employees that would be manufacturing single-speed and dual-speed DPPP motors in the absence of new energy conservation standards. DOE estimated that there would be approximately 76 domestic production employees and 43 non-production employees involved in the production and sale of single-speed and dual-speed small-size DPPP motors (for a total of 119 total employees) in 2026 in the absence of new DPPP motor standards. DOE also estimated that there would be approximately 104 domestic production employees and 59 non-production employees involved in the production and sale of single-speed and dual-speed standard-size DPPP motors (for a total of 163 total employees) in 2026 in the absence of new DPPP motor standards. However, DOE notes that motors used in DPPPs are frequently used in other non-DPPP applications and motor manufacturers may choose to continue to manufacture single-speed and dual-speed motors (even at TSL 6, TSL 7, and TSL 8) that would be allowed to be used in other non-DPPP applications. If manufacturers choose to do this, there would likely not be a significant impact on the overall domestic motor employment.

c. Impacts on Manufacturing Capacity

DOE did not identify any significant capacity constraints for the design options being evaluated for this final rule. The design options evaluated for this final rule are available as equipment that is on the market currently. The materials used to manufacture DPPP motor models at all efficiency levels are widely available on the market. While there were a limited number of small size variable-speed DPPP motor models currently on the market, all manufacturers are capable of manufacturing standard size variable-speed DPPP motor models and would be able to manufacture small size variable-speed DPPP motor models if they choose to make the investments described in section IV.J.2.c of this document. As a result, DOE does not anticipate that the industry would 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 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 335312, "Motor and Generator Manufacturing" a DPPP motor manufacturer and its affiliates may employ a maximum of 1,250 employees. The 1,250-employee threshold includes all employees in a business's parent company and any other subsidiaries. Based on this classification, DOE identified one potential manufacturer that could qualify as domestic small businesses.

e. Cumulative Regulatory Burden

One aspect of assessing manufacturer burden involves looking at the cumulative impact of multiple DOE standards and the regulatory actions of other Federal agencies and States 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. 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.

DOE evaluates product-specific regulations that will take effect approximately 3 years before or after the 2026 compliance date of any new energy conservation standards for DPPP motors. This information is presented in Table V.18.

Table V.18 Compliance Dates and Expected Conversion Expenses of Federal Energy Conservation Standards Affecting Dedicated-Purpose Pool Pump Motor Manufacturers

Federal Energy Conservation Standard	Number of Mfrs*	Number of Manufacturers Affected from this Rule**	Approx. Standards Year	Industry Conversion Costs *(millions)*	Industry Conversion Costs / Product Revenue***
Distribution Transformers 88 FR 1722 (Jan. 11, 2023)†	27	1	2027	$343 (2021$)[133]	2.7%
Electric Motors 88 FR 36066 (Jun. 1, 2023)	74	5	2027	$468 (2021$)	2.6%

* This column presents the total number of manufacturers identified in the energy conservation standard rule contributing to cumulative regulatory burden.
** This column presents the number of manufacturers producing DPPP motors that are also listed as manufacturers in the listed energy conservation standard contributing to cumulative regulatory burden.
*** This column presents industry conversion costs as a percentage of product revenue during the conversion period. Industry conversion costs are the upfront investments manufacturers must make to sell compliant products/equipment. The revenue used for this calculation is the revenue from just the covered product/equipment associated with each row. The conversion period is the time frame over which conversion costs are made and lasts from the publication year of the final rule to the compliance year of the energy conservation standard. The conversion period typically ranges from 3 to 5 years, depending on the rulemaking.
† Indicates a NOPR publications. Values may change on publication of a final rule.

Fluidra identified the following regulations and certification standards that apply to DPPP and DPPP motors that may contribute to the cumulative regulator burden for DPPP motor manufacturers: DOE's January 2017 Final Rule (for DPPPs); DPPP UL 1081; DPPP motor UL 1004-1, 1004-4, and 1004-7; NSF-50; and CEC title 20. (Fluidra, No. 91 at p. 4) As part of the cumulative regulatory burden, DOE specifically looks to mitigate the overlapping effects on manufacturers of new or revised DOE standards and other regulatory actions affecting the same products or equipment (10 CFR part 430 appendix A to subpart C) DOE acknowledges that DPPP manufacturers use DPPP motors

[133] This is the sum of the total conversion costs listed in Table V.46 (TSL 4), which is $270.6 million; Table V.48 (TSL 5), which is $69.4 million; and Table V.50 (TSL 2), which is $3.1 million. 88 FR 1722, 1809-1814.

in their equipment and that change to energy conservation standards to DPPP motors could impact DPPPs. The compliance date for DPPPs was on July 19, 2021. DOE considered these energy conservation standards when determining what energy conservation standards are technologically feasible and economically justified in section V.C. of this document. Specifically, DOE is setting the compliance date for small-size DPPP motors to be 4 years after the publication of this final rule to allow DPPP motor manufacturers additional time to comply with energy conservation standards for those DPPP motors.

3. National Impact Analysis

This section presents DOE's estimates of the national energy savings 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 standards for DPPP motors, 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 first full year of anticipated compliance with amended standards (2026–2055).[134] Table V.15 presents DOE's projections of the national energy savings for each TSL considered for

[134] As discussed in section III.A of this document, for all TSLs DOE considered a 2-year lead time resulting in a first full year of compliance of 2026, except for small-size DPPP motors at TSL 7 where DOE uses a 4-year compliance lead time, resulting in a compliance year of 2028. In this case, DOE considered 28 years of shipments (2028–2055).

DPPP motors. The savings were calculated using the approach described in section IV.H of this document.

Table V.19 Cumulative National Energy Savings for DPPP Motors; 30 Years of Shipments

	Trial Standard Levels							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
	quads							
Primary energy	0.11	0.20	0.68	0.88	0.99	0.93	1.52	1.56
FFC energy	0.11	0.20	0.70	0.90	1.01	0.96	1.56	1.60

Note: the analysis considers 30 years for shipments starting in 2026 (2026–2055) except at TSL 7 for small-size DPPP motors where DOE considers shipments in 2028–2055.

OMB Circular A-4[135] requires agencies to present analytical results, including separate schedules of the monetized benefits and costs that show the type and timing of benefits and costs. Circular A-4 also directs agencies to consider the variability of key elements underlying the estimates of benefits and costs. For this rulemaking, DOE undertook a sensitivity analysis using 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.[136] The review timeframe established in EPCA is generally not synchronized with the product lifetime, product manufacturing cycles, or other factors specific to DPPP motors. Thus, such results are presented for informational purposes

[135] U.S. Office of Management and Budget. *Circular A-4: Regulatory Analysis*. September 17, 2003. *obamawhitehouse.archives.gov/omb/circulars_a004_a-4* (last accessed September 1, 2021).

[136] 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 and for this product, DOE is setting compliance periods of 2 and 4 years.

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.16. The impacts are counted over the lifetime of DPPP motors purchased in 2026–2034, except at TSL 7 for small-size DPPP motors where impacts are counted over the lifetime of DPPP motors purchased in 2028–2036.

Table V.20 Cumulative National Energy Savings for DPPP Motors; 9 Years of Shipments

	Trial Standard Levels							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
	quads							
Primary energy	0.03	0.06	0.21	0.26	0.29	0.28	0.46	0.45
FFC energy	0.03	0.06	0.21	0.27	0.30	0.29	0.47	0.47

Note: the analysis considers 9 years for shipments starting in 2026 (2026–2034) except at TSL 7 for small-size DPPP motors where DOE considers shipments in 2028–2034.

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 DPPP motors. In accordance with OMB's guidelines on regulatory analysis,[137] DOE calculated NPV using both a 7-percent and a 3-percent real discount rate. Table V.17 shows the consumer NPV results with impacts counted over the lifetime of products purchased in 2026–2055 or 2028–2055.

[137] U.S. Office of Management and Budget. *Circular A-4: Regulatory Analysis*. September 17, 2003. *obamawhitehouse.archives.gov/omb/circulars_a004_a-4/* (last accessed July 1, 2021).

Table V.21 Cumulative Net Present Value of Consumer Benefits for DPPP motors; 30 Years of Shipments

Discount Rate	Trial Standard Level							
	1	2	3	4	5	6	7	8
	billion 2022$							
3 percent	0.85	1.27	2.29	3.58	3.92	7.97	10.16	10.06
7 percent	0.48	0.72	1.16	1.87	2.06	4.49	5.37	5.28

Note: the analysis considers 30 years for shipments starting in 2026 (2026–2055) except at TSL 7 for small-size DPPP motors where DOE considers shipments in 2028–2055.

The NPV results based on the aforementioned 9-year analytical period are presented in Table V.18. The impacts are counted over the lifetime of products purchased in 2026–2034 or 2028–2036. 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.22 Cumulative Net Present Value of Consumer Benefits for DPPP Motors; 9 Years of Shipments

Discount Rate	Trial Standard Level							
	1	2	3	4	5	6	7	8
	billion 2022$							
3 percent	0.32	0.50	0.79	1.25	1.39	2.91	3.16	2.96
7 percent	0.25	0.38	0.56	0.91	1.00	2.25	2.35	2.19

Note: the analysis considers 9 years for shipments starting in 2026 (2026–2034) except at TSL 7 for small-size DPPP motors where DOE considers shipments in 2028–2034.

The previous results reflect the use of a default trend to estimate the change in price for DPPP motors over the analysis period (*see* section IV.F.1 of this document). DOE also conducted a sensitivity analysis that considered one scenario with a lower rate of price decline than the reference case and one scenario with a higher rate of price decline than the reference case. The results of these alternative cases are presented in appendix 10C of the final rule TSD. In the high-price-decline case, the NPV of consumer benefits is higher than in the default case. In the low-price-decline case, the NPV of consumer benefits is lower than in the default case.

c. Indirect Impacts on Employment

DOE estimates that amended energy conservation standards for DPPP motors will 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 (2026-2030 or 2028-2030), where these uncertainties are reduced.

The results suggest that the adopted standards are 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 final rule 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 concluded that the standards adopted in this final rule will not lessen the utility or performance of the DPPP motors under consideration in this rulemaking. Manufacturers of these products currently offer units that meet or exceed the adopted 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.F.1.e, EPCA directs the Attorney General of the United States ("Attorney General") to determine the impact, if any, of any lessening of competition likely to result from a proposed standard and to transmit such determination in writing 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. To assist the Attorney General in making this determination, DOE provided the Department of Justice ("DOJ") with copies of the NOPR and the TSD for review. In its assessment letter responding to DOE, DOJ ultimately stated that they do not have sufficient information to conclude that the proposed energy conservation standards for DPPP motor are likely to have a significant adverse impact on competition. DOE is publishing the Attorney General's assessment at the end of this final rule.

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 final rule TSD presents the estimated impacts on electricity generating capacity, relative to the no-new-standards case, for the TSLs that DOE considered in this rulemaking.

Energy conservation resulting from potential energy conservation standards for DPPP motors is expected to yield environmental benefits in the form of reduced emissions of certain air pollutants and greenhouse gases. Table V.19 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 final rule TSD.

Table V.23 Cumulative Emissions Reduction for DPPP Motors; 30 years of Shipments

	Trial Standard Level							
	1	2	3	4	5	6	7	8
Power Sector Emissions								
CO_2 (*million metric tons*)	2.02	3.82	13.04	16.82	18.84	17.94	28.52	29.60
CH_4 (*thousand tons*)	0.16	0.30	1.02	1.31	1.47	1.40	2.21	2.31
N_2O (*thousand tons*)	0.02	0.04	0.14	0.18	0.21	0.19	0.31	0.32
NO_X (*thousand tons*)	1.02	1.94	6.63	8.54	9.56	9.09	14.41	15.00
SO_2 (*thousand tons*)	0.68	1.29	4.40	5.68	6.36	6.05	9.63	10.01
Hg (*tons*)	0.00	0.01	0.03	0.04	0.04	0.04	0.07	0.07
Upstream Emissions								
CO_2 (*million metric tons*)	0.19	0.36	1.22	1.58	1.77	1.69	2.71	2.79
CH_4 (*thousand tons*)	17.21	32.32	110.54	142.86	160.08	152.29	244.97	252.18
N_2O (*thousand tons*)	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
NO_X (*thousand tons*)	2.95	5.54	18.94	24.48	27.43	26.09	41.99	43.22
SO_2 (*thousand tons*)	0.01	0.02	0.08	0.11	0.12	0.11	0.18	0.19
Hg (*tons*)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total FFC Emissions								
CO_2 (*million metric tons*)	2.21	4.18	14.27	18.40	20.61	19.63	31.23	32.39
CH_4 (*thousand tons*)	17.37	32.62	111.56	144.17	161.55	153.69	247.18	254.49
N_2O (*thousand tons*)	0.02	0.04	0.15	0.19	0.21	0.20	0.32	0.34
NO_X (*thousand tons*)	3.97	7.48	25.57	33.02	36.99	35.18	56.40	58.22
SO_2 (*thousand tons*)	0.70	1.32	4.49	5.79	6.48	6.16	9.81	10.20
Hg (*tons*)	0.00	0.01	0.03	0.04	0.04	0.04	0.07	0.07

Note: the analysis considers 30 years for shipments starting in 2026 (2026–2055) except at TSL 7 for small-size DPPP motors where DOE considers shipments in 2028–2055.

As part of the analysis for this rule, DOE estimated monetary benefits likely to result from the reduced emissions of CO_2 that DOE estimated for each of the considered TSLs for DPPP motors. Section IV.L.1.a of this document discusses the estimated SC-CO_2 values that DOE used. Table V.19 presents the value of CO_2 emissions reduction at each TSL for each of the SC-CO_2 cases. The time-series of annual values is presented for the selected TSL in chapter 14 of the final rule TSD.

Table V.24 Present Value of CO_2 Emissions Reduction for DPPP Motors; 30 years of Shipments

TSL	SC-CO_2 Case			
	Discount Rate and Statistics			
	5% Average	3% Average	2.5% Average	3% 95th percentile
	million 2022$			
1	29	112	171	340
2	55	213	324	646
3	187	726	1,106	2,207
4	240	934	1,423	2,840
5	268	1,045	1,593	3,178
6	256	997	1,519	3,030
7	400	1,570	2,397	4,778
8	420	1,638	2,499	4,984

Note: the analysis considers 30 years for shipments starting in 2026 (2026–2055) except at TSL 7 for small-size DPPP motors where DOE considers shipments in 2028–2055.

As discussed in section IV.L.2, DOE estimated the climate benefits likely to result from the reduced emissions of methane and N_2O that DOE estimated for each of the considered TSLs for DPPP motors. Table V.21 presents the value of the CH_4 emissions reduction at each TSL, and Table V.22 presents the value of the N_2O emissions reduction at each TSL. The time-series of annual values is presented for the selected TSL in chapter 14 of the final rule TSD.

Table V.25 Present Value of Methane Emissions Reduction for DPPP Motors; 30 years of Shipments

TSL	SC-CH_4 Case			
	Discount Rate and Statistics			
	5%	3%	2.5%	3%
	Average	Average	Average	95th percentile
	million 2022$			
1	10	27	36	71
2	19	50	68	134
3	65	172	234	457
4	83	222	302	590
5	93	249	338	661
6	89	237	322	628
7	141	379	517	1,007
8	146	391	533	1,040

Note: the analysis considers 30 years for shipments starting in 2026 (2026–2055) except at TSL 7 for small-size DPPP motors where DOE considers shipments in 2028–2055.

Table V.26 Present Value of Nitrous Oxide Emissions Reduction for DPPP Motors; 30 years of Shipments

TSL	SC-N_2O Case			
	Discount Rate and Statistics			
	5%	3%	2.5%	3%
	Average	Average	Average	95th percentile
	million 2022$			
1	0.1	0.4	0.6	1.1
2	0.2	0.8	1.2	2.0
3	0.7	2.6	3.9	6.9
4	0.9	3.4	5.1	8.9
5	1.0	3.8	5.7	10.0
6	1.0	3.6	5.4	9.5
7	1.6	5.6	8.5	14.9
8	1.6	5.9	8.9	15.6

Note: the analysis considers 30 years for shipments starting in 2026 (2026–2055) except at TSL 7 for small-size DPPP motors where DOE considers shipments in 2028–2055.

DOE is 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 global and U.S. economy continues to evolve rapidly. DOE, together with other Federal agencies, will continue to review 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, however, that the adopted 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 NO_X and SO_2 emissions reductions anticipated to result from the considered TSLs for DPPP motors. The dollar-per-ton values that DOE used are discussed in section IV.L of this document. Table V.23 presents the present value for NO_X emissions reduction for each TSL calculated using 7-percent and 3-percent discount rates, and Table V.24 presents similar results for SO_2 emissions reductions. The results in these tables reflect application of EPA's low dollar-per-ton values, which DOE used to be conservative. The time-series of annual values is presented for the selected TSL in chapter 14 of the final rule TSD.

Table V.27 Present Value of NO_X Emissions Reduction for DPPP Motors; 30 years of Shipments

TSL	7% Discount Rate	3% Discount Rate
	million 2022$	
1	116	221
2	222	420
3	759	1,433
4	972	1,847
5	1,086	2,068
6	1,040	1,967
7	1,613	3,139
8	1,698	3,250

Note: the analysis considers 30 years for shipments starting in 2026 (2026–2055) except at TSL 7 for small-size DPPP motors where DOE considers shipments in 2028–2055.

Table V.28 Present Value of SO_2 Emissions Reduction for DPPP Motors; 30 years of Shipments

TSL	3% Discount Rate	7% Discount Rate
	million 2022$	
1	29	54
2	56	102
3	190	348
4	243	449
5	272	502
6	260	477
7	399	756
8	424	789

Note: the analysis considers 30 years for shipments starting in 2026 (2026–2055) except at TSL 7 for small-size DPPP motors where DOE considers shipments in 2028–2055.

Not all the public health and environmental benefits from the reduction of greenhouse gases, NO_X, and SO_2 are captured in the values above, and additional unquantified benefits from the reductions of those pollutants as well as from the reduction of direct PM and other co-pollutants may be significant. DOE has not included monetary benefits of the reduction of Hg emissions because the amount of reduction is very small.

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 Economic Impacts

Table V.25 presents the NPV values that result from adding the estimates of the economic benefits resulting from reduced GHG and NO_X and SO_2 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 equipment, and are measured for the lifetime of products shipped in 2026–2055, except at TSL 7 for small-size DPPP motors where impacts are counted over the lifetime of DPPP motors purchased in 2028–2055.

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 DPPP motors shipped in 2026–2055, except at TSL 7 for small-size DPPP motors where impacts are counted over the lifetime of DPPP motors purchased in 2028–2055.

Table V.29 Consumer NPV Combined with Present Value of Climate Benefits and Health Benefits

Category	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5	TSL 6	TSL 7	TSL 8
3% discount rate for Consumer NPV and Health Benefits (billion 2022$)								
5% Average SC-GHG case	1.2	1.9	4.3	6.2	6.9	10.8	14.6	14.7
3% Average SC-GHG case	1.3	2.1	5.0	7.0	7.8	11.6	16.0	16.1
2.5% Average SC-GHG case	1.3	2.2	5.4	7.6	8.4	12.3	17.0	17.1
3% 95th percentile SC-GHG case	1.5	2.6	6.7	9.3	10.3	14.1	19.9	20.1
7% discount rate for Consumer NPV and Health Benefits (billion 2022$)								
5% Average SC-GHG case	0.7	1.1	2.4	3.4	3.8	6.1	7.9	8.0
3% Average SC-GHG case	0.8	1.3	3.0	4.2	4.7	7.0	9.3	9.4
2.5% Average SC-GHG case	0.8	1.4	3.5	4.8	5.4	7.6	10.3	10.4
3% 95th percentile SC-GHG case	1.0	1.8	4.8	6.5	7.3	9.5	13.2	13.4

C. Conclusion

When considering new or amended energy conservation standards, the standards that DOE adopts for any type (or class) of covered equipment 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. 6316(a); 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. 6316(a); 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. 6316(a); 42 U.S.C. 6295(o)(3)(B))

For this final rule, DOE considered the impacts of standards for DPPP motors 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.

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.

1. Benefits and Burdens of TSLs Considered for DPPP Motor Standards

Table V.26 and Table V.27 summarize the quantitative impacts estimated for each TSL for DPPP motors. The national impacts are measured over the lifetime of DPPP motors purchased in the 30-year period that begins in the anticipated year of compliance with amended standards (2026–2055).[138] The energy savings, emissions reductions, and value of emissions reductions refer to full-fuel-cycle results. DOE is presenting monetized benefits of GHG emissions reductions in accordance with the 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 interim estimates presented by the Interagency Working Group. The efficiency levels contained in each TSL are described in section V.A of this document.

[138] As discussed in section III.A of this document, for all TSLs DOE considered a 2-year lead time resulting in a first full year of compliance of 2026, except for small-size DPPP motors at TSL 7 where DOE uses a 4-year compliance lead time, resulting in a compliance year of 2028. In this case, DOE considered 28 years of shipments (2028–2055).

Table V.30 Summary of Analytical Results for DPPP Motors TSLs: National Impacts

Category	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5	TSL 6	TSL 7	TSL 8
Cumulative FFC National Energy Savings								
Quads	0.11	0.20	0.70	0.90	1.01	0.96	1.56	1.60
Cumulative FFC Emissions Reduction								
CO_2 (million metric tons)	2.2	4.2	14.3	18.4	20.6	19.6	31.2	32.4
CH_4 (*thousand tons*)	17.4	32.6	111.6	144.2	161.6	153.7	247.2	254.5
N_2O (*thousand tons*)	0.02	0.04	0.15	0.19	0.21	0.20	0.32	0.34
SO_2 (*thousand tons*)	0.7	1.3	4.5	5.8	6.5	6.2	9.8	10.2
NO_X (*thousand tons*)	4.0	7.5	25.6	33.0	37.0	35.2	56.4	58.2
Hg (*tons*)	0.00	0.01	0.03	0.04	0.04	0.04	0.07	0.07
Present Value of Benefits and Costs (*3% discount rate, billion 2022$*)								
Consumer Operating Cost Savings	1.0	1.9	6.4	8.2	9.2	8.8	14.0	14.5
Climate Benefits*	0.1	0.3	0.9	1.2	1.3	1.2	2.0	2.0
Health Benefits**	0.3	0.5	1.8	2.3	2.6	2.4	3.9	4.0
Total Benefits†	1.4	2.7	9.1	11.7	13.1	12.4	19.9	20.6
Consumer Incremental Product Costs	0.1	0.6	4.1	4.7	5.3	0.8	3.9	4.4
Consumer Net Benefits	0.8	1.3	2.3	3.6	3.9	8.0	10.2	10.1
Total Net Benefits	1.3	2.1	5.0	7.0	7.8	11.6	16.0	16.1
Present Value of Benefits and Costs (*7% discount rate, billion 2022$*)								
Consumer Operating Cost Savings	0.6	1.1	3.7	4.8	5.3	5.1	7.9	8.3
Climate Benefits*	0.1	0.3	0.9	1.2	1.3	1.2	2.0	2.0
Health Benefits**	0.1	0.3	0.9	1.2	1.4	1.3	2.0	2.1
Total Benefits†	0.8	1.6	5.6	7.1	8.0	7.6	11.9	12.5
Consumer Incremental Product Costs	0.1	0.4	2.5	2.9	3.3	0.6	2.6	3.0
Consumer Net Benefits	0.5	0.7	1.2	1.9	2.1	4.5	5.4	5.3
Total Net Benefits	0.8	1.3	3.0	4.2	4.7	7.0	9.3	9.4

Note: This table presents the costs and benefits associated with DPPP motors shipped in 2026−2055, except at TSL 7 for small-size DPPP motors where shipments in 2028-2055 are considered. These results include benefits to consumers which accrue after 2055 from the products shipped in 2026−2055 (or 2028-2055).
* Climate benefits are calculated using four different estimates of the SC-CO_2, SC-CH_4 and SC-N_2O. Together, these represent the global 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. To monetize the benefits of reducing GHG emissions this analysis uses the interim 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).
** Health benefits are calculated using benefit-per-ton values for NO_X and SO_2. DOE is currently only monetizing (for NO_X and SO_2) $PM_{2.5}$ 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. 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 DOE does not have a single central SC-GHG point estimate. DOE emphasizes the importance and value of considering the benefits calculated using all four sets of SC-GHG estimates.
‡ Costs include incremental equipment costs as well as installation costs.

Table V.31 Summary of Analytical Results for DPPP Motors TSLs: Manufacturer and Consumer Impacts

Category	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5	TSL 6	TSL 7	TSL 8
Manufacturer Impacts								
Industry NPV (*million* 2022$) (No-new-standards case INPV = 661)	660 - 663	655 - 672	622 - 684	617 - 695	612 - 708	559 - 675	447 - 740	436 – 755
Industry NPV *(% change*)	(0.1) – 0.4	(0.9) – 1.7	(5.9) – 3.5	(6.6) – 5.2	(7.3) – 7.1	(15.3) – 2.1	(32.4) – 12.0	(34.0) – 14.2
Consumer Average LCC Savings (2022$)								
Extra-Small-Size	$3	($12)	($12)	($12)	($12)	$3	$3	($12)
Small-Size	$10	$14	($54)	($12)	($16)	$10	$4	$4
Standard-Size	$26	$44	$109	$141	$151	$236	$236	$236
Shipment-Weighted Average*	$19	$31	$44	$79	$83	$144	$141	$141
Consumer Simple PBP (years)								
Extra-Small-Size	0.9	2.8	2.8	2.8	2.8	0.9	0.9	2.8
Small-Size	0.5	1.0	4.5	3.4	3.4	0.5	3.4	3.4
Standard-Size	0.7	0.8	0.8	0.8	0.9	1.3	1.3	1.3
Shipment-Weighted Average*	0.6	0.9	2.2	1.9	1.9	1.0	2.1	2.1
Percent of Consumers that Experience a Net Cost								
Extra-Small-Size	0.5%	59%	59%	59%	59%	0.5%	0.5%	59%
Small-Size	0.0%	24%	52%	46%	50%	0%	44%	44%
Standard-Size	0.1%	2%	18%	17%	19%	2%	2%	2%
Shipment-Weighted Average*	0.1%	12%	32%	29%	32%	1%	18%	19%

Parentheses indicate negative (-) values.
* Weighted by shares of each equipment class in total projected shipments in 2026.

DOE first considered TSL 8, which represents the max-tech efficiency levels for all equipment classes and freeze protection control requirements for DPPP motors greater than and equal to 0.5 THP. TSL 8 would save an estimated 1.60 quads of energy, an amount DOE considers significant. Under TSL 8, the NPV of consumer benefit would be $5.3 billion using a discount rate of 7 percent, and $10.1 billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 8 are 32.4 Mt of CO_2, 10.2 thousand tons of SO_2, 58.2 thousand tons of NO_X, 0.07 tons of Hg, 254.5 thousand tons of CH_4, and 0.34 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 8 is $2.0 billion. The estimated monetary value of the health benefits from reduced SO_2 and NO_X emissions at TSL 8 is $2.1 billion using a 7-percent discount rate and $4.0 billion using a 3-percent discount rate.

Using a 7-percent discount rate for consumer benefits and costs, 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 NPV at TSL 8 is $9.4 billion. Using a 3-percent discount rate for all benefits and costs, the estimated total NPV at TSL 8 is $16.1 billion. The estimated total NPV is provided for additional information, however DOE primarily relies upon the NPV of consumer benefits when determining whether a standard level is economically justified.

At TSL 8, the average LCC impact is a loss of $12 for extra-small-size DPPP motors, a saving of $4 for small-size DPPP motors, and $236 for standard-size DPPP motors. The simple payback period is 2.8 years for extra-small-size DPPP motors, 3.4 years for small-size DPPP motors, and 1.3 years for standard-size DPPP motors. The fraction of consumers experiencing a net LCC cost is 59 percent for extra-small-size DPPP motors, 44 percent for small-size DPPP motors, and 2 percent for standard-size DPPP motors.

At TSL 8, the projected change in INPV ranges from a decrease of $224.4 million to an increase of $94.1 million, which corresponds to a decrease of 34.0 percent and an increase of 14.2 percent, respectively. DOE estimates that industry must invest $56.4 million to comply with standards set at TSL 8. DOE estimates that approximately 33 percent of extra-small size DPPP motor shipments, 22 percent of small size DPPP motors shipments, and 62 percent of standard size DPPP motor shipments would meet the efficiency levels analyzed at TSL 8, in the no-new-standards case. At TSL 8, most DPPP motor manufacturers would be required to redesign all of their small size DPPP motor models to be variable-speed motors covered by this rulemaking. It is unclear if most manufacturers would have the engineering capacity to complete the necessary redesigns within a 2-year compliance period (between the publication of this final rule and the analyzed compliance date of 2028 for this TSL). If manufacturers require more than 2 years to redesign all of their covered DPPP motor models, they will likely prioritize redesigns based on sales volume. There is a risk that some small size DPPP motor models will become either temporarily or permanently unavailable after the analyzed compliance date for this TSL, given a 2-year compliance period.

The Secretary concludes that at TSL 8 for DPPP motors, the benefits of energy savings, positive NPV of consumer benefits, emission reductions, and the estimated monetary value of the emissions reductions are outweighed by the economic burden on many consumers and the impacts on manufacturers, including the lack of manufacturers currently offering small size DPPP motor models meeting the efficiency levels required at this TSL and the potential for most DPPP motor manufacturers to redesign their entire small size DPPP motors models in the analyzed 2 year compliance period for this TSL.

A majority of extra-small-size DPPP motor consumers (59 percent) would experience a net cost and the average LCC savings would be negative. The potential reduction in INPV could be as high as 34.0 percent. Consequently, the Secretary has concluded that TSL 8 is not economically justified.

DOE then considered TSL 7, which represents the California CEC standards[139] and includes a variable-speed requirement for DPPP motors at or above 0.5 THP, an EL 1 efficiency requirement below 0.5 THP, and freeze-protection control requirements for DPPP motors greater than and equal to 0.5 THP. In addition, as discussed in section III.A of this document, this TSL uses a 4-year compliance lead time for small-size DPPP motors, resulting in a first full year of compliance year of 2028 (for all other equipment classes, a compliance lead time of 2 years is applied). TSL 7 would save an estimated 1.56 quads of energy, an amount DOE considers significant. Under TSL 7, the NPV of consumer benefit would be $5.4 billion using a discount rate of 7 percent, and $10.2 billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 7 are 31.2 Mt of CO_2, 9.8 thousand tons of SO_2, 56.4 thousand tons of NO_X, 0.07 tons of Hg, 247.2 thousand tons of CH_4, and 0.32 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 7 is $2.0 billion. The estimated monetary value of the health

[139] Best approximation based on the efficiency level analyzed.

benefits from reduced SO_2 and NO_X emissions at TSL 7 is $2.0 billion using a 7-percent discount rate and $3.9 billion using a 3-percent discount rate.

Using a 7-percent discount rate for consumer benefits and costs, 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 NPV at TSL 7 is $9.3 billion. Using a 3-percent discount rate for all benefits and costs, the estimated total NPV at TSL 7 is $16.0 billion. The estimated total NPV is provided for additional information, however DOE primarily relies upon the NPV of consumer benefits when determining whether a standard level is economically justified.

At TSL 7, the average LCC impact is a savings of $3 for extra-small-size DPPP motors, $4 for small-size DPPP motors, and $236 for standard-size DPPP motors. The simple payback period is 0.9 years for extra-small-size DPPP motors, 3.4 years for small-size DPPP motors, and 1.3 years for standard-size DPPP motors. The fraction of consumers experiencing a net LCC cost is 0.5 percent for extra-small-size DPPP motors, 4 percent for small-size DPPP motors, and 2 percent for standard-size DPPP motors.

At TSL 7, the projected change in INPV ranges from a decrease of $214.2 million to an increase of $79.0 million, which correspond to a decrease of 32.4 percent and an increase of 12.0 percent, respectively. DOE estimates that industry must invest $56.2 million to comply with standards set at TSL 7. DOE estimates that approximately 93 percent of extra-small size DPPP motor shipments, 24 percent of small size DPPP motors shipments, and 62 percent of standard size DPPP motor shipments would meet the efficiency levels analyzed at TSL 7, in the no-new-standards case. At TSL 7, most DPPP motor manufacturers would be required to redesign almost all of their small size DPPP motor models to be variable-speed motors covered by this rulemaking. However, as previously stated DPPP motor manufacturers would have 4 years to complete this redesign process for the small size DPPP motor models.

After considering the analysis and weighing the benefits and burdens, the Secretary has concluded that a standard set at TSL 7 for DPPP motors is economically justified. At this TSL, the average LCC savings are positive for each equipment classes for which a new standard is considered. An estimated 18 percent of all DPPP motor consumers experience a net cost. The FFC national energy savings are significant and the NPV of consumer benefits is positive at TSL 7 using both a 3-percent and 7-percent discount rate. Notably, the benefits to consumers vastly outweigh the cost to manufacturers. At TSL 7, the NPV of consumer benefits, even measured at the more conservative discount rate of 7 percent, is over 25 times higher than the maximum estimated manufacturers' loss in INPV. The standard levels at TSL 7 are economically justified even without weighing the estimated monetary value of emissions reductions. When those emissions reductions are included—representing $2.0 billion in climate benefits (associated with the average SC-GHG at a 3-percent discount rate), and $3.9 billion (using a 3-percent discount rate) or $2.0 billion (using a 7-percent discount rate) in health benefits—the rationale becomes stronger still.

As stated, DOE conducts the 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, which would be contrary to the statute. 86 FR 70892, 70908. Although DOE has not conducted a comparative analysis to select the new energy conservation standards, DOE notes while the average LCC savings for extra-small-size DPPP motors are negative at TSL 8, they are positive at TSL 7 and the average LCC savings for standard-size and small size DPPP motors are the same at TSL 7 and TSL 8. In addition, as compared to TSL 8, TSL 7 has smaller percentages of electric motor consumers experiencing a net cost, a lower maximum decrease in INPV, lower manufacturer conversion costs and allow manufacturers 4 years to redesign their small size DPPP motor models to meet the efficiency levels required at TSL 7, compared to 2 years at TSL 8. Across all consumers, TSL 7 represents the largest average LCC savings for each equipment class of any TSL.

Although DOE considered new standard levels for DPPP motors by grouping the efficiency levels for each equipment class into TSLs, DOE evaluates all analyzed efficiency levels in its analysis. For standard-size and small-size DPPP motors, TSL 7 *(i.e.*, the adopted TSL) includes the max-tech efficiency levels, which is the maximum level determined to be technologically feasible. For extra-small-size DPPP motors, TSL 7 represents the efficiency level that is one level below the max-tech efficiency level. As discussed previously, the max-tech efficiency levels for extra-small-size DPPP motor would result in negative LCC savings and a majority of consumers experiencing a net LCC cost. The benefits of max-tech efficiency levels for extra-small-size DPPP motors do not outweigh the negative impacts to consumers and manufacturers. Therefore, DOE has concluded that the max-tech efficiency levels are not justified. The ELs at the adopted TSL result in average positive LCC savings for each equipment class, reduce the number of consumers experiencing a net cost, and reduce the decrease in INPV and conversion costs to the point where DOE has concluded they are economically justified, as discussed for TSL 7 in the preceding paragraphs.

Therefore, based on the previous considerations, DOE adopts the energy conservation standards for DPPP motors at TSL 7. The new energy conservation standards for DPPP motors, which are expressed in full-load efficiency and design requirements, are shown in Table V.28.

Table V.28 Energy Conservation Standards for DPPP Motors (TSL 7)

Motor Total Horsepower (THP)	Performance Standard: Full-load efficiency (%)	Design Requirement: Speed Capability	Design Requirement: Freeze Protection	Compliance Date
THP < 0.5	69%	None	None	**[INSERT DATE *2 YEARS* AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]**
0.5 ≤ THP < 1.15	-	Variable speed control*	Only for DPPP motors with freeze protection controls**	**[INSERT DATE *4* YEARS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]**
1.15 ≤ THP ≤5	-	Variable speed control*	Only for DPPP motors with freeze protection controls**	**[INSERT DATE *2* YEARS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]**

* A variable speed motor is a DPPP motor that meets the definition of "variable-speed control dedicated-purpose pool pump motor" as defined by UL 1004-10:2022.
** DPPP motors with freeze protection controls are to be shipped with the freeze protection feature disabled, or with the following user-adjustable default settings: (a) the dry-bulb air temperature setting shall be no greater than 40 °F; (b) the run time setting shall be no greater than 1 hour (before the temperature is rechecked); and (c) the motor speed in freeze protection mode shall not be more than half of the maximum operating speed.

2. Annualized Benefits and Costs of the Adopted Standards

The benefits and costs of the adopted standards can also be expressed in terms of annualized values. The annualized net benefit is (1) the annualized national economic value (expressed in 2022$) of the benefits from operating products that meet the adopted 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 climate and health benefits.

Table V.29 shows the annualized values for DPPP motors under TSL 7, expressed in 2022$. The results under the primary estimate are as follows.

Using a 7-percent discount rate for consumer benefits and costs and NO_X and SO_2 reductions, and the 3-percent discount rate case for GHG social costs, the estimated cost of the adopted standards for DPPP motors is $221 million per year in increased equipment installed costs, while the estimated annual benefits are $684 million from reduced equipment operating costs, $103 million in GHG reductions, and $173 million from reduced NO_X and SO_2 emissions. In this case, the net benefit amounts to $739 million per year.

Using a 3-percent discount rate for consumer benefits and costs and NO_X and SO_2 reductions, and the 3-percent discount rate case for GHG social costs, the estimated cost of the adopted standards for DPPP motors is $204 million per year in increased equipment installed costs, while the estimated annual benefits are $738 million from reduced equipment operating costs, $103 million in GHG reductions, and $205 million from reduced NO_X and SO_2 emissions. In this case, the net benefit amounts to $841 million per year.

Table V.29 Annualized Monetized Benefits and Costs of Adopted Standards (TSL 7) for DPPP Motors

	Million 2022$/year		
	Primary Estimate	**Low-Net-Benefits Estimate**	**High-Net-Benefits Estimate**
3% discount rate			
Consumer Operating Cost Savings	738	721	760
Climate Benefits*	103	103	103
Health Benefits**	205	205	205
Total Monetized Benefits†	1,046	1029	1,068
Consumer Incremental Equipment Costs	204	235	173
Monetized Net Benefits	841	793	895
Change in Producer Cashflow (INPV††)	(17) - 6	(17) - 6	(17) - 6
7% discount rate			
Consumer Operating Cost Savings	684	671	703
Climate Benefits* (3% discount rate)	103	103	103
Health Benefits**	173	173	173
Total Monetized Benefits†	960	947	979
Consumer Incremental Equipment Costs	221	250	190
Monetized Net Benefits	739	696	790
Change in Producer Cashflow (INPV††)	(17) - 6	(17) - 6	(17) - 6

Note: This table presents the costs and benefits associated with DPPP motors shipped in 2026–2055, except for small-size DPPP motors where shipments in 2028-2055 are considered. These results include benefits to consumers which accrue after 2055 from the products shipped in 2026–2055 (or 2028–2055). The Primary, Low Net Benefits, and High Net Benefits Estimates utilize projections of energy prices from the *AEO2023* Reference case, Low Economic Growth case, and High Economic Growth case, respectively. In addition, incremental equipment costs reflect a medium decline rate in the Primary Estimate, an increasing rate in the Low Net Benefits Estimate, and a high decline rate in the High Net Benefits Estimate. The methods used to derive projected price trends are explained in sections IV.F.1 and IV.H.3 of this document. Note that the Benefits and Costs may not sum to the Net Benefits due to rounding.

* Climate benefits are calculated using four different estimates of the global SC-GHG (*see* section IV.L of this document). 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 sets of SC-GHG estimates. To monetize the benefits of reducing GHG emissions this analysis uses the interim 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).

** Health benefits are calculated using benefit-per-ton values for NO_X and SO_2. 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. *See* section IV.L of this document for more details.

† Total 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.

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

†† Operating Cost Savings are calculated based on the life cycle costs analysis and national impact analysis as discussed in detail below. See sections IV.F and IV.H of this document. DOE's NIA includes all impacts (both costs and benefits) along the distribution chain beginning with the increased costs to the

manufacturer to manufacture the equipment and ending with the increase in price experienced by the consumer. DOE also separately conducts a detailed analysis on the impacts on manufacturers (the MIA). See section IV.J of this document. In the detailed MIA, DOE models manufacturers' pricing decisions based on assumptions regarding investments, conversion costs, cashflow, and margins. The MIA produces a range of impacts, which is the rule's expected impact on the INPV. The change in INPV is the present value of all changes in industry cash flow, including changes in production costs, capital expenditures, and manufacturer profit margins. Annualized change in INPV is calculated using the industry weighted average cost of capital value of 7.2% that is estimated in the manufacturer impact analysis (see chapter 12 of the Final Rule TSD for a complete description of the industry weighted average cost of capital). For DPPP motors, those values are -$17 million and $6 million. DOE accounts for that range of likely impacts in analyzing whether a TSL is economically justified. See section V.C of this document. DOE is presenting the range of impacts to the INPV under two markup scenarios: the Preservation of Gross Margin scenario, which is the manufacturer markup scenario used in the calculation of Consumer Operating Cost Savings in this table, and the Preservation of Operating Profit Markup scenario, where DOE assumed manufacturers would not be able to increase per-unit operating profit in proportion to increases in manufacturer production costs. DOE includes the range of estimated annualized change in INPV in the above table, drawing on the MIA explained further in section IV.J of this document, to provide additional context for assessing the estimated impacts of this rule to society, including potential changes in production and consumption, which is consistent with OMB's Circular A-4 and E.O. 12866. If DOE were to include the INPV into the annualized net benefit calculation for this final rule, the annualized net benefits would range from $824 million to $847 million at 3-percent discount rate and range from $722 million to $745 million at 7-percent discount rate.

VI. Procedural Issues and Regulatory Review

A. Review Under Executive Orders 12866, 13563, and 14904

Executive Order ("E.O.") 12866, "Regulatory Planning and Review," as supplemented and reaffirmed by E.O. 13563, "Improving Regulation and Regulatory Review," 76 FR 3821 (Jan. 21, 2011), and amended by E.O. 14094, "Modernizing Regulatory Review," 88 FR 21879 (April 11, 2023), requires agencies, to the extent permitted by law, 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, the Office of Information and Regulatory Affairs ("OIRA") in the Office of Management and Budget ("OMB") 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 final regulatory action is consistent with these principles.

Section 6(a) of E.O. 12866 also requires agencies to submit "significant regulatory actions" to OIRA for review. OIRA has determined that this final regulatory action constitutes a "significant regulatory action" within the scope of section 3(f)(1) of E.O. 12866, as amended by E.O. 14094. Accordingly, pursuant to section 6(a)(3)(C) of E.O. 12866, DOE has provided to OIRA an assessment, including the underlying analysis, of benefits and costs anticipated from the final 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 final rule.

B. Review Under the Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq*.) requires preparation a final regulatory flexibility analysis ("FRFA") 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 has prepared the following FRFA for the products that are the subject of this final rule.

For manufacturers of DPPP motors, 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 DPPP motors is classified under NAICS 335312, "Motor and Generating Manufacturing." The SBA sets a threshold of 1,250 employees or fewer for an entity to be considered as a small business for this category.

1. Need for, Objectives of, and Legal Basis for, Rule

The need for, and objective of this final rule are stated elsewhere in the preamble and not repeated here.

2. Significant Comments in Response to the IRFA

DOE received one comment with respect to the initial regulatory flexibility analysis. PHTA and NEMA commented that are not aware of any domestic DPPP motor manufacturer that qualifies as a small business. (PHTA and NEMA, No. 92 at p.13) However, based on information gathered from DPPP motor manufacturer websites, DOE identified one DPPP motor manufacturer that sells DPPP motors covered by this rulemaking and has fewer than 1,250 employees. Additionally, PHTA and NEMA commented that they are aware of one domestic DPPP manufacturer that is a small business and encouraged DOE to verify any impacts of the DPPP motors energy conservation standards on that DPPP small business. (PHTA and NEMA, No. 92 at p.13) DOE conducted an MIA on the manufacturers of the equipment that are being regulated by this rulemaking, which is DPPP motors. DOE did not conduct a MIA on manufacturers of products or equipment that use DPPP motors in the products or equipment they manufacture.

3. Comments Filed by the Chief Counsel for Advocacy

The SBA's Chief Counsel for Advocacy did not submit comments on this rulemaking.

4. Description on Estimated Number of Small Entities Regulated

DOE reviewed the standard levels considered in this final rule 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 DPPP motors.

As previously stated, manufacturing of DPPP motors is classified under NAICS 335312, "Motor and Generator Manufacturing," for which the SBA sets a threshold of 1,250 employees or fewer for an entity to be considered as a small business. 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 five companies that manufacture DPPP motors for the domestic market, of those DOE determined that one company met the SBA definition of a small business. DOE contacted this small business regarding a discussion of potential DPPP motor standards, but the small business was not interested in discussing potential impacts of energy conservation standards on DPPP motors.

5. Description and Estimate of Compliance Requirements Including Differences in Cost, if Any, for Different Groups of Small Entities

DOE reviewed the website and catalog offerings of the identified small business and determined that the manufacturer offers extra-small size DPPP motors and standard size DPPP motors that would meet requirements under the adopted standards. However, the small business does not manufacturer any small size DPPP motors that would meet the requirements under the adopted standard for small size DPPP motors. Therefore, if the manufacturer chooses to continue to sell small size DPPP motors, this small business is expected to need to introduce at least one variable-speed, small size DPPP motor model in order to comply with the energy conservation standards adopted in this final rule.

There are two types of costs the small business could incur due to the adopted standards for DPPP motors: 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 equipment designs comply with new 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 equipment designs can be fabricated and assembled.

DOE anticipates that the small business will incur approximately $1.1 million in product conversion costs—accounting for the compensation of four full-time engineers for 24 months of product design and testing work—and approximately $2.5 million in capital conversion costs to build a suitable production line to manufacture one small size

DPPP motor model that would comply with the energy conservation standards for the small size DPPP motors adopted in this final rule. Therefore, this small business would incur a total of approximately $3.6 million in conversion costs. DOE was able to identify an annual revenue estimate of approximately $28.2 million for the small business. The $3.6 million in conversion cost represents approximately 12.8 percent of the estimated annual revenue of the small business.

DOE assumes that this small DPPP motor manufacturer would spread these costs over the four-year compliance timeframe, as standards require compliance for the small size DPPP motors four years after the publication of this final rule. Therefore, DOE assumes that this small business would incur on average about $900,000 or approximately 3.2 percent of its annual revenue in each of the four years leading up to the compliance date for small size DPPP motors.

6. Significant Alternatives to the Rule

The discussion in the previous section analyzes impacts on small businesses that would result from the adopted standards, represented by TSL 7. In reviewing alternatives to the adopted standards, DOE examined energy conservation standards set at lower efficiency levels. While TSL 1 through TSL 6 would reduce the impacts on small business manufacturers, it would come at the expense of a reduction in energy savings and consumer NPV. TSL 1 achieves 93 percent lower energy savings and 91 percent lower consumer net benefits compared to the energy savings and consumer net benefits at TSL 7. TSL 2 achieves 87 percent lower energy savings and 87 percent lower consumer net benefits compared to the energy savings and consumer net benefits at TSL 7. TSL 3 achieves 55 percent lower energy savings and 78 percent lower consumer net benefits compared to the energy savings and consumer net benefits at TSL 7. TSL 4 achieves 42 percent lower energy savings and 65 percent lower consumer net benefits compared to the energy savings and consumer net benefits at TSL 7. TSL 5 achieves 35 percent lower energy savings and 62 percent lower consumer net benefits compared to the energy savings and consumer net benefits at TSL 7. TSL 6 achieves 39 percent lower energy savings and 16 percent lower consumer net benefits compared to the energy savings and consumer net benefits at TSL 7.

DOE believes that establishing standards at TSL 7 balances the benefits of the energy savings at TSL 7 with the potential burdens placed on DPPP motors manufacturers, including the one small business manufacturer. Accordingly, DOE is not adopting 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 final rule TSD.

C. Review Under the Paperwork Reduction Act

Manufacturers of DPPP motors 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 DPPP motors, 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 DPPP motors. (*See generally* 10 CFR part 429). 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.

Certification data will be required for DPPP motors; however, DOE is not adopting certification or reporting requirements for DPPP motors in this final rule. Instead, DOE will consider proposals to establish certification requirements and reporting for DPPP motors under a separate rulemaking regarding appliance and equipment certification. DOE will address changes to OMB Control Number 1910-1400 at that time, as necessary.

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

D. Review Under the National Environmental Policy Act of 1969

Pursuant to the National Environmental Policy Act of 1969 ("NEPA"), DOE has analyzed this action rule in accordance with NEPA and DOE's NEPA implementing regulations (10 CFR part 1021). DOE has determined that this rule qualifies for categorical exclusion under 10 CFR part 1021, subpart D, appendix B5.1 because it is a rulemaking that establishes energy conservation standards for consumer products or industrial equipment, none of the exceptions identified in B5.1(b) apply, no extraordinary circumstances exist that require further environmental analysis, and it meets the requirements for application of a categorical exclusion. *See* 10 CFR 1021.410. Therefore, DOE has determined that promulgation of this rule is not a major Federal action significantly affecting the quality of the human environment within the meaning of NEPA, and does not require an environmental assessment or an environmental impact statement.

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. For the reasons described below, DOE has examined this final rule and has determined that this rule meets the relevant standards of E.O. 13132.

E.O. 13132 includes special requirements for preemption, including that Federal agencies must only construe a Federal statute to preempt State law where the statute includes express preemption or some other clear evidence that Congress intended preemption of State law, or where the exercise of State authority conflicts with the exercise of Federal authority under the Federal statute. EPCA governs and prescribes express Federal preemption of State regulations as to energy conservation for the equipment that are the subject of this final rule. As such, any State regulation regarding the energy efficiency or use of DPPP motors will be preempted on the compliance dates listed in the **DATES** section. States can petition DOE for exemption from such preemption to the extent, and based on criteria, set forth in EPCA. (42 U.S.C. 6316(a) and (b); 42 U.S.C. 6297)

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 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 E.O. 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 final 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. Pub. L. 104-4, sec. 201 (codified at 2 U.S.C. 1531). For a 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 "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.*

DOE has concluded that this final rule may require expenditures of $100 million or more in any one year by the private sector. Such expenditures may include (1) investment in research and development and in capital expenditures by DPPP motors manufacturers in the years between the final rule and the compliance date for the new standards and (2) incremental additional expenditures by consumers to purchase higher-efficiency DPPP motors, starting at the compliance date for the applicable standard.

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

Under section 205 of UMRA, the Department is obligated to identify and consider a reasonable number of regulatory alternatives before promulgating a rule for which a written statement under section 202 is required. (2 U.S.C. 1535(a)) DOE is required to select from those alternatives the most cost-effective and least burdensome alternative that achieves the objectives of the rule unless DOE publishes an explanation for doing otherwise, or the selection of such an alternative is inconsistent with law.

As required by 42 U.S.C. 6295(o)(A) through 42 U.S.C. 6316(a), this final rule establishes new energy conservation standards for DPPP motors that are designed to achieve the maximum improvement in energy efficiency that DOE has determined to be both technologically feasible and economically justified. A full discussion of the alternatives considered by DOE is presented in chapter 17 of the TSD for this final rule.

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

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

I. Review Under Executive Order 12630

Pursuant to E.O. 12630, "Governmental Actions and Interference with Constitutionally Protected Property Rights," 53 FR 8859 (March 18, 1988), DOE has determined that this rule would not result in any takings that might require compensation under the Fifth Amendment to the U.S. Constitution.

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

Section 515 of the Treasury and General Government Appropriations Act, 2001 (44 U.S.C. 3516, note) provides for Federal agencies to review most disseminations of information to the public under information quality guidelines established by each agency pursuant to general guidelines issued by OMB. OMB's guidelines were published at 67 FR 8452 (Feb. 22, 2002), and DOE's guidelines were published at 67 FR 62446 (Oct. 7, 2002). 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 final rule 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 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 at OIRA as a significant energy action. For any 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 concluded that this regulatory action, which sets forth new energy conservation standards for DPPP motors, is not a significant energy action because the 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 final 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 prepared a report describing that peer review.[140] Generation of this report involved a rigorous, formal, and documented evaluation using objective criteria and qualified and independent reviewers to make a judgment as to the technical/scientific/business merit, the actual or anticipated results, and the productivity and management effectiveness of programs and/or projects. Because available data, models, and technological understanding have changed since 2007, DOE has engaged

[140] The 2007 "Energy Conservation Standards Rulemaking Peer Review Report" is available at the following website: *energy.gov/eere/buildings/downloads/energy-conservation-standards-rulemaking-peer-review-report-0* (last accessed 2/6/2023).

with the National Academy of Sciences to review DOE's analytical methodologies to ascertain whether modifications are needed to improve the Department's analyses. DOE is in the process of evaluating the resulting report.[141]

M. Congressional Notification

As required by 5 U.S.C. 801, DOE will report to Congress on the promulgation of this rule prior to its effective date. The report will state that it has been determined that the rule is a "major rule" as defined by 5 U.S.C. 804(2).

N. Description of Materials Incorporated by Reference

In this final rule, DOE incorporates by reference UL 1004-10:2022. UL 1004-10:2022 establishes scope and definition requirements for certain DPPP motors and describes methods to verify the product-specific enforcement requirements. UL 1004-10:2022 is readily available at UL's website at *https://www.shopulstandards.com/ProductDetail.aspx?productId=UL1004-10_1_S_20200228*.

VII. Approval of the Office of the Secretary

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

[141] The report is available at *www.nationalacademies.org/our-work/review-of-methods-for-setting-building-and-equipment-performance-standards*.

List of Subjects

10 CFR Part 429

Administrative practice and procedure, Confidential business information, Energy conservation, Household appliances, Incorporation by reference, Reporting and recordkeeping requirements.

10 CFR Part 431

Administrative practice and procedure, Confidential business information, Energy conservation test procedures, Incorporation by reference, and Reporting and recordkeeping requirements.

Signing Authority

This document of the Department of Energy was signed on July 27, 2023, by Francisco Alejandro Moreno, Acting 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 July 27, 2023

FRANCISCO MORENO

Digitally signed by FRANCISCO MORENO
Date: 2023.07.27 17:15:05 -04'00'

Francisco Alejandro Moreno
Acting Assistant Secretary for Energy Efficiency and Renewable Energy
U.S. Department of Energy

For the reasons set forth in the preamble, DOE amends parts 429 and 431 of chapter II, subchapter D, of title 10 of the Code of Federal Regulations, 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. Amend §429.4 by adding paragraph (h) to read as follows:

§429.4 Materials incorporated by reference.

* * * * *

(h) *UL*. Underwriters Laboratories. 333 Pfingsten Road, Northbrook, IL 60062, (841) 272–8800. *www.ul.com*.

(1) UL 1004-10 (“UL 1004–10:2022”), “*Standard for Safety for Pool Pump Motors*,” First Edition, Dated March 24, 2022; IBR approved for §429.134.

(2) [Reserved]

3. Amend §429.134 by adding paragraph (ee) to read as follows:

§429.134 Product-specific enforcement provisions.

* * * * *

(ee) *Dedicated-purpose pool pump motors*. (1) To verify the dedicated-purpose pool pump motor variable speed capability, a test in accordance with section 5 of UL 1004-10:2022 (incorporated by reference, see §429.4) will be conducted.

(2) To verify that dedicated-purpose pool pump motor comply with the applicable freeze protection design requirements, a test in accordance with section 6 of UL 1004-10:2022 will be conducted.

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

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

Authority: 42 U.S.C. 6291-6317; 28 U.S.C. 2461 note.

5. Amend §431.481 by revising paragraph (b) to read as follows:

§431.481 Purpose and scope.

* * * * *

(b) *Scope*. The requirements of this subpart apply to dedicated-purpose pool pump motors, as specified in paragraphs 1.2, 1.3 and 1.4 of UL 1004-10:2022 (incorporated by reference, see §431.482).

* * * * *

6. Amend §431.482 by revising paragraphs (a) and (c)(1) to read as follows:

§431.482 Materials incorporated by reference.

(a) Certain material is incorporated by reference into this subpart with the approval of the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. To enforce any edition other than that specified in this section, the Department of Energy (DOE) must publish a document in the *Federal Register* and the material must be available to the public. All approved incorporation by reference (IBR) material is available for inspection at DOE, and at the National Archives and Records Administration (NARA). Contact DOE at: the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Program, 1000 Independence Ave SW, EE-5B, Washington, DC 20585, (202) 586–9127, *Buildings@ee.doe.gov*, *https://www.energy.gov/eere/buildings/building-technologies-office.* For information on the availability of this material at NARA, visit *www.archives.gov/federal-register/cfr/ibr-locations.html* or email *fr.inspection@nara.gov*. The material may be obtained from the sources in the following paragraphs of this section:

*   *   *   *   *

(c) *   *   *

(1) UL 1004-10 (“UL 1004-10:2022”), “Standard for Safety for Pool Pump Motors,” Revised First Edition, Dated March 24, 2022; IBR approved for §§431.481 and 431.483.

*   *   *   *   *

7. Revise §431.483 to read as follows:

§431.483 Definitions.

The definitions applicable to this subpart are defined in section 2 “Glossary” of UL 1004–10:2022 (incorporated by reference, see §431.482). In addition, the following definition applies:

Basic model means all units of dedicated purpose pool pump motors manufactured by a single manufacturer, that are within the same equipment class, have electrical characteristics that are essentially identical, and do not have any differing physical or functional characteristics that affect energy consumption or efficiency.

8. Add §431.485 to subpart Z to read as follows:

§431.485 Energy conservation standards. (a) For the purpose of paragraphs (b), (c) and (d) of this section, "THP" means dedicated-purpose-pool pump motor total horsepower.

(a) Each dedicated-purpose pool pump motor manufactured starting on [**INSERT DATE 2 YEARS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER***] with a THP less than 0.5 THP, must have a full-load efficiency that is not less than 69 percent.

(b) Each dedicated-purpose pool pump motor manufactured starting on the dates provided in the following table with a THP greater than or equal to 0.5 THP must be a variable speed control dedicated-purpose pool pump motor, and must follow the requirements in paragraph (d).

Equipment Class	Compliance Date
Small-size (0.5 ≤ THP <1.15)	[**INSERT DATE 4 YEARS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER***]
Standard-size (1.15 ≤ THP ≤ 5)	[**INSERT DATE 2 YEARS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER***]

(c) All dedicated-purpose pool pump motors with a THP greater than or equal to 0.5 THP and distributed in commerce with freeze protection controls, must be shipped with freeze protection disabled or with the following user-adjustable settings:

(1) The default dry-bulb air temperature setting is no greater than 40 °F;

(2) The default run time setting shall be no greater than 1 hour (before the temperature is rechecked); and

(3) The default motor speed (in revolutions per minute, or rpm) in freeze protection mode shall not be more than half of the maximum operating speed.