DEPARTMENT OF ENERGY

10 CFR Part 430

[EERE–2021–BT–STD–0029]

RIN 1904–AE64

Energy Conservation Program: Energy Conservation Standards for Consumer Furnace Fans

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

ACTION: Notification of proposed determination and request for comment.

SUMMARY: The Energy Policy and Conservation Act, as amended (''EPCA''), prescribes energy conservation standards for various consumer products and certain commercial and industrial equipment, including consumer furnace fans. EPCA also requires the U.S. Department of Energy (''DOE'') to periodically determine whether more-stringent, amended standards would be technologically feasible and economically justified, and would result in significant energy savings. In this notification of proposed determination (''NOPD''), DOE has initially determined that it could not conclude that amended standards would be cost effective, and thus, is not proposing to amend its energy conservation standards for these products. DOE requests comment on this proposed determination and the associated analyses and results.

DATES:

Meeting: DOE will hold a webinar upon request. Please request a public webinar no later than October 20, 2023. *See* section VII, ''Public Participation,'' for webinar registration information, participant instructions, and information about the capabilities available to webinar participants.

Comments: Written comments and information are requested and will be accepted on or before December 5, 2023.

ADDRESSES: Interested persons are encouraged to submit comments using the Federal eRulemaking Portal at *www.regulations.gov* under docket number EERE–2021–BT–STD–0029. Follow the instructions for submitting comments.

Alternatively, interested persons may submit comments, identified by docket number EERE–2021–BT–STD–0029, by any of the following methods:

(1) *Email: ConsumerFurnFan2021STD0029@ee.doe.gov.* Include the docket number EERE–2021–BT–STD–0029 in the subject line of the message.

(2) *Postal Mail:* Appliance and Equipment Standards Program, U.S. Department of Energy, Building Technologies Office, Mailstop EE–5B, 1000 Independence Avenue SW, Washington, DC 20585–0121. Telephone: (202) 287–1445. If possible, please submit all items on a compact disc (''CD''), in which case it is not necessary to include printed copies.

(3) *Hand Delivery/Courier:* Appliance and Equipment Standards Program, U.S. Department of Energy, Building Technologies Office, 950 L'Enfant Plaza SW, 6th Floor, Washington, DC 20024. Telephone: (202) 287–1445. If possible, please submit all items on a CD, in which case it is not necessary to include printed copies.

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

Docket: The docket, 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 web page can be found at *www.regulations.gov/docket/EERE-2021-BT-STD-0029.* The docket web page contains instructions on how to access all documents, including public comments, in the docket. *See* section VII, ''Public Participation,'' for further information on how to submit comments through *www.regulations.gov.*

FOR FURTHER INFORMATION CONTACT:

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

Mr. Matthew Schneider, U.S. Department of Energy, Office of the General Counsel, GC–33, 1000 Independence Avenue SW, Washington, DC 20585–0121. Telephone: (240) 597–6265. Email: *matthew.schneider@hq.doe.gov.*

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

SUPPLEMENTARY INFORMATION:

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I. Synopsis of the Proposed Determination

The Energy Policy and Conservation Act, Public Law 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 B of EPCA [2] established the Energy Conservation Program for Consumer Products Other Than Automobiles. (42 U.S.C. 6291–6309) These products include consumer furnace fans, the subject of this NOPD. (42 U.S.C. 6295(f)(4)(D))

DOE is issuing this NOPD pursuant to the EPCA requirement that not later than 6 years after issuance of any final rule establishing or amending a standard, DOE must publish either a notification of determination that standards for the product do not need to be amended, or a notice of proposed rulemaking (''NOPR'') including new proposed energy conservation standards (proceeding to a final rule, as appropriate). (42 U.S.C. 6295(m))

For this proposed determination, DOE analyzed consumer furnace fans subject to standards specified in 10 CFR 430.32(y). DOE first analyzed the technological feasibility of more energy efficient consumer furnace fans. For those consumer furnace fans for which DOE determined higher standards to be technologically feasible, DOE evaluated whether higher standards would be cost effective by conducting life-cycle cost (''LCC'') and payback period (''PBP'') analyses. In addition, DOE estimated energy savings that would result from potential energy conservation standards by conducting a national impacts analysis (''NIA''), in which it estimated the net present value (''NPV'') of the total costs and benefits experienced by consumers.

Based on the results of the analyses, summarized in section V of this document, DOE has tentatively determined that current standards for consumer furnace fans do not need to be amended.

II. Introduction

The following section briefly discusses the statutory authority underlying this proposed determination, as well as some of the historical background relevant to the establishment of standards for consumer furnace fans.

A. Authority

EPCA authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment. Title III, Part B of EPCA established the Energy Conservation Program for Consumer Products Other Than Automobiles. These products include consumer furnace fans, the subject of this document. (42 U.S.C. 6295(f)(4)(D)) Specifically, EPCA authorized DOE to establish energy conservation standards for electricity used for purpose of circulating air through duct work. (*Id.*)

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 specifically include definitions (42 U.S.C. 6291), test procedures (42 U.S.C. 6293), labeling provisions (42 U.S.C. 6294), energy conservation standards (42 U.S.C. 6295), and the authority to require information and reports from manufacturers (42 U.S.C. 6296).

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

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

Pursuant to the amendments contained in the Energy Independence and Security Act of 2007 (EISA 2007), Public Law 110–140, any final rule for new or amended energy conservation standards promulgated after July 1, 2010, is required to address standby mode and off mode energy use. (42 U.S.C. 6295(gg)(3)) Specifically, when DOE adopts a standard for a covered product after that date, it must, if justified by the criteria for adoption of standards under EPCA (42 U.S.C. 6295(o)), incorporate standby mode and off mode energy use into a single standard, or, if that is not feasible, adopt a separate standard for such energy use for that product. (42 U.S.C. 6295(gg)(3)(A)–(B)) However, DOE has previously determined that there is no need to address standby and off mode energy use in the standards for consumer furnace fans, as the standby mode and off mode energy use associated with furnace fans is accounted for by the standards and test procedures for the products in which furnace fans are used (*i.e.,* consumer furnaces and consumer central air conditioners and heat pumps). 79 FR 499, 504. DOE maintained the same approach in the proposed amended test procedure for consumer furnace fans (the ''May 2022 TP NOPR''). 87 FR 29576.

DOE must periodically review its already established energy conservation standards for consumer furnace fans no later than 6 years from the issuance of a final rule establishing or amending a standard for consumer furnace fans. (42

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

U.S.C. 6295(m)) This 6-year look-back provision requires that DOE publish either a determination that standards do not need to be amended or a NOPR, including new proposed standards (proceeding to a final rule, as appropriate). (42 U.S.C. 6295(m)(1)) EPCA further provides that, not later than 3 years after the issuance of a final determination not to amend standards, DOE must publish either a notification of determination that standards for the product do not need to be amended, or a NOPR including new proposed energy conservation standards (proceeding to a final rule, as appropriate). (42 U.S.C. 6295(m)(3)(B)) DOE must make the analysis on which a determination is based publicly available and provide an opportunity for written comment. (42 U.S.C. 6295(m)(2))

A determination that amended standards are not needed must be based on consideration of whether amended standards will result in significant conservation of energy, are technologically feasible, and are cost effective. (42 U.S.C. 6295(m)(1)(A) and 42 U.S.C. 6295(n)(2)) Under 42 U.S.C. 6295(o)(2)(B)(i)(II), an evaluation of cost-effectiveness requires DOE to consider 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. (42 U.S.C. 6295(n)(2) and 42 U.S.C. 6295(o)(2)(B)(i)(II)) DOE is publishing this NOPD in satisfaction of the 6-year review requirement in EPCA. (42 U.S.C. 6295(m))

B. Background

1. Current Standards

In a final rule published on July 3, 2014 (''July 2014 Final Rule''), DOE prescribed the current energy conservation standards for consumer furnace fans manufactured on and after July 3, 2019. 79 FR 38130. These standards are set forth in DOE's regulations at 10 CFR 430.32(y) and are repeated in Table II.1.

TABLE II.1—FEDERAL ENERGY CONSERVATION STANDARDS FOR CONSUMER FURNACE FANS

Furnace fan product class	Fan energy rating (''FER'') (watts/1000 cubic feet per minute (''cfm''))
Non-Weatherized, Non-Condensing Gas (''NWG–NC'')	FER = 0.044 * Q_{max} + 182.
Non-Weatherized, Condensing Gas (''NWG–C'')	FER = 0.044 * Q_{max} + 195.
Weatherized, Non-Condensing Gas (''WG–NC'')	FER = 0.044 * Q_{max} + 199.
Non-Weatherized, Non-Condensing Oil Furnace Fan (''NWO–NC'')	FER = 0.071 * Q_{max} + 382.
Non-Weatherized Electric Furnace/Modular Blower Fan (''NWEF/NWMB'')	FER = 0.044 * Q_{max} + 165.
Mobile Home Non-Weatherized, Non-Condensing Gas Furnace Fan (''MH–NWG–NC'')	FER = 0.071 * Q_{max} + 222.
Mobile Home Non-Weatherized, Condensing Gas Furnace Fan (''MH–NWG–C'')	FER = 0.071 * Q_{max} + 240.
Mobile Home Electric Furnace/Modular Blower Fan (''MH–EF/MB'')	FER = 0.044 * Q_{max} + 101.
Mobile Home Non-Weatherized Oil Furnace Fan (''MH–NWO'')	Reserved.
Mobile Home Weatherized Gas Furnace Fan (''MH–WG'')	Reserved.

2. History of Standards Rulemakings for Consumer Furnace Fans

DOE established energy conservation standards at 10 CFR 430.32(y) for furnace fans through a final rule published in the **Federal Register** on July 3, 2014 (''July 2014 Final Rule''). 79 FR 38130. As discussed in section II.A of this document, EPCA authorized DOE to establish energy conservation standards for electricity used for purpose of circulating air through duct work. (42 U.S.C. 6295(f)(4)(D)) While the statutory language allows for regulation of the electricity use of any electrically-powered device applied to residential central heating, ventilation, and air conditioning (''HVAC'') systems for the purpose of circulating air through duct work, in the July 2014 Final Rule DOE established standards only for certain furnace fans used in furnaces and modular blowers. 79 FR 38130, 38146. Compliance with the prescribed standards established for consumer furnace fans in the July 2014 Final Rule was required as of July 3, 2019. DOE's energy conservation standards for furnace fans use the fan energy rating (''FER'') metric, which is the ratio of the electrical energy consumption to airflow, expressed as watts per 1,000 cubic feet per minute of airflow (''W/1000 cfm''). 10 CFR 430.32(y). In evaluating whether amended standards for furnace fans are warranted, DOE used the test procedure for determining FER is established at 10 CFR part 430 subpart B appendix AA, *Uniform Test Method for Measuring the Energy Consumption of Furnace Fans* (''appendix AA''). In parallel to this rulemaking, DOE is considering whether amendments are warranted for the current test procedure for furnace fans. On May 13, 2022, DOE published a notice of proposed rulemaking (''NOPR'') concerning the test procedure for furnace fans (''May 2022 TP NOPR''). 87 FR 29576.

In support of the present review of the consumer furnace fans energy conservation standards, DOE published a request for information (''RFI''), which identified various issues on which DOE sought comment to inform its determination of whether the standards need to be amended on November 23, 2021 (the ''November 2021 RFI''). 86 FR 66465. The following year, on November 1, 2022, DOE published a notice of availability of the preliminary technical support document (the ''November 2022 Preliminary Analysis'') in the **Federal Register**. 87 FR 65687. In the November 2022 Preliminary Analysis, DOE assessed potential amended standard levels for consumer furnace fans.

On September 20, 2022, a consent decree was issued for *NRDC et al.* v. *DOE* and *New York et al.* v. *DOE* that mandated that a final agency action pertaining to energy conservation standards (*i.e.,* a final rule amending energy conservation standards or a final determination not to amend standards) must be issued by October 31, 2024.

DOE received comments in response to the November 2022 Preliminary Analysis from the interested parties listed in Table II.2.

TABLE II.2—NOVEMBER 2022 PRELIMINARY ANALYSIS COMMENTS

Commenter(s)	Reference in this NOPD	Comment No. in the docket	Commenter type
Air Conditioning, Heating and Refrigeration Institute	AHRI	23	Trade Association.
Appliance Standards Awareness Project, American Council for an Energy-Efficient Economy, National Consumer Law Center, Natural Resources Defense Council.	Joint Commenters	20	Efficiency Organization.
Carrier Global Corporation	Carrier	19	Manufacturer.
Charles Beach	Beach	16	Individual.
Daikin Comfort Technologies	Daikin	*26	Manufacturer.
Lennox International Inc	Lennox	24	Manufacturer.
Morrison Products Inc	Morrison	27	Manufacturer.
Nidec Motors	Nidec	*26	Manufacturer.
Northwest Energy Efficiency Alliance	NEEA	25	Efficiency Organization.
Pacific Gas and Electric Company, San Diego Gas and Electric, Southern California Edison.	CA IOUs	21	Utility.
Rheem Manufacturing Company	Rheem	*26	Manufacturer.
Trane Technologies	Trane	22	Manufacturer.
Weil-McLain Technologies	Weil-McLain	*26	Manufacturer.

*Comment No. 26 corresponds to the transcript for the webinar held December 5, 2022. These commenters made oral comments during the public meeting that are summarized and discussed in this document.

Any oral comments provided during the webinar that are not substantively addressed by written comments are summarized and cited separately throughout this NOPD. A parenthetical reference at the end of a comment quotation or paraphrase provides the location of the item in the public record.[3]

C. Deviation From Appendix A of the Process Rule

In accordance with section 3(a) of 10 CFR part 430, subpart C, appendix A (''appendix A''), DOE notes that it is deviating from the provision in the appendix A regarding the pre-NOPR and NOPR stages for an energy conservation standards rulemaking.

Section 6(f)(2) of the appendix A specifies that the length of the public comment period for a NOPR will be not less than 75 calendar days. For this NOPD, DOE has opted instead to provide a 60-day comment period, as required by EPCA. 42 U.S.C. 6295(p). DOE is opting to deviate from the 75-day comment period because stakeholders have already been afforded an opportunity to provide comments on this rulemaking. As noted previously, DOE requested comment on various issues pertaining to this standards rulemaking in the November 2021 RFI, a November 2022 preliminary analysis, and collectively provided stakeholders with more than a 90 days to comment. 86 FR 66465 and 87 FR 65687. Therefore, DOE believes a 60-day comment period is appropriate and will provide interested parties with a meaningful opportunity to comment on the proposed determination.

[3] The parenthetical reference provides a reference for information located in the docket. (Docket No., which is maintained at *www.regulations.gov*). The references are arranged as follows: (commenter name, comment docket ID number, page of that document).

III. General Discussion

DOE developed this proposed determination after considering comments, data, and information from interested parties that represent a variety of interests. This notice addresses issues raised by these commenters.

A. General Comments

1. Comments Opposing Amended Standards for Furnace Fans

In response to the November 2022 Preliminary Analysis, several commenters expressed opposition to amending standards for consumer furnace fans.

Trane commented that it does not support adopting efficiency level (''EL'') 1 for consumer furnace fan standards because the assumptions used in the TSD are flawed and when corrected will result in much smaller energy savings, higher consumer costs, and undue burden to manufacturers who will need to redesign all furnaces to adopt backward-inclined impellers. (Trane, No. 22 at p. 1) Trane commented that EL 1 analyzed in the November 2022 Preliminary Analysis fails to meet: (1) the energy savings threshold because the energy savings outlined in the TSD are overstated; (2) the technological feasibility requirement because there is a need for additional technology development before EL 1 is feasible; and (3) the economic justification criteria. Specifically, Trane stated that EL 1 is not economically justified for the following reasons: (1) the negative economic impact will be significant in terms of manufacturer redesign costs (for relatively small energy savings); (2) consumers will face higher product and installation costs; (3) consumers will encounter negative lifetime operating cost savings and energy savings will be lower than DOE predicted; (4) there will be negative impacts on safety and efficiency due to changes in airflow patterns (impacting utility or performance); and (5) the potential for lessening of competition will be increased because units with backward-inclined impellers do not currently exist. Trane therefore commented that the use of EL 1 should not be considered for furnace fans. (*Id.* at p. 4) Morrison commented that DOE's values for the product cost increase were undercounted, the energy savings were overestimated, and the resulting benefit to consumers would be half of the values that DOE projects. Therefore, Morrison concluded that DOE underestimated the LCC and PBP in the November 2022 Preliminary Analysis, and that the actual numbers will reflect a net cost for more consumers than currently projected. (Morrison, No. 27 at p. 4) Lennox recommended DOE conclude that no new furnace fan standards are warranted for the NWG–NC, NWG–C, and WG–NC product classes due to very high levels of consumers experiencing net costs from potential amended standards. Lennox noted that for NWG–NC and NWG–C, 44 percent and 48 percent, respectively, of consumers experience a net cost, while for WG–NC, 26 percent of consumers experience a net cost. Lennox also commented that for the NWO–NC product class, although the payback period and percent of consumers experiencing a net cost are favorable for

EL 1, the energy savings associated with these products is minimal (0.00003 quads) and does not meet the criteria of significant energy savings, and therefore amended standards are not likely warranted. (Lennox, No. 24 at p. 2) Lennox also commented that the feasible technologies available for furnace fans have not changed since the last furnace fan standards rulemaking in 2019, but equipment costs have increased over the same time period due to inflation and supply chain issues. Lennox stated that many consumers have been adversely impacted by the COVID–19 pandemic, and increasing furnace fan equipment costs with new efficiency standards is both ill-advised and economically unjustified at this time. (*Id.* at p. 2)

AHRI stated that while the simple payback period of many maximum technology feasible (''max-tech'') furnace fans appears to be favorable, almost every class of fan provides minimal average cost savings to consumers and projections showing that, in all but one case, over 44 percent of consumers will experience a net cost. AHRI commented that this cost, combined with AHRI's concerns about the misrepresentation of the cost of products with a backward-inclined impeller, lead AHRI to expect that the true percentage of affected consumers will be higher than stated. (AHRI, No. 23 at p. 3)

Morrison recommended that DOE consider the timing and length of analysis periods for complex rulemaking documents, as the public comment period for this rulemaking was at a time of year in which under-staffing is common, and, as a result, Morrison stated that it is unable to guarantee the thoroughness and attention to detail of its response to this rulemaking. (Morrison, No. 27 at p. 6)

As discussed in section II.A of this document, DOE must periodically review its already established energy conservation standards for consumer furnace fans no later than 6 years from the issuance of a final rule establishing or amending a standard for consumer furnace fans. This 6-year look-back provision requires that DOE publish either a determination that standards do not need to be amended or a NOPR, including new proposed standards (proceeding to a final rule, as appropriate). (42 U.S.C. 6295(m)(1)) Additionally, EPCA provides specific statutory criteria for amending energy conservation standards. EPCA generally requires a public notice-and-comment process (*see* 42 U.S.C. 6295(p)), which affords members of the public the opportunity to comment on the rulemaking and all documents are made publicly available at *www.regulations.gov.* As part of the process for this rulemaking, DOE carefully considers the benefits and burdens of amended standards to determine whether the amended standards are the maximum standard levels that are technologically feasible and economically justified, and would conserve a significant amount of energy, as required by EPCA (see 42 U.S.C. 6295(o)(2)–(3)). Section IV of this document outlines DOE's approach to analyzing various potential amended standard levels, which was conducted in accordance with the statutory requirements outlined in EPCA (and described above) for determining whether to establish or amend standards. Section V of this document provides the results of those analyses, as well as a detailed explanation of DOE's weighing of the benefits and burdens and the rationale for proposing not to amend standards for consumer furnace fans at this time based on the criteria specified in EPCA. Morrison stated that having separate measures of energy efficiency for furnaces and furnace fans may risk confusing consumers as to which efficiency label they should choose when purchasing equipment, in turn increasing the potential for wasted energy. (Morrison, No. 27 at p. 2) Lennox similarly commented that when consumers consider energy efficiency while purchasing residential furnaces, they evaluate the annual fuel utilization efficiency (''AFUE'') metric for consumer furnaces. Lennox commented that furnace fans typically account for less than 2 percent of the overall energy use of a residential furnace system in heating operation, and DOE furnace fan standards are not a focus of the consumer purchase decision. (Lennox, No. 24 at p. 8)

In response, DOE notes that EPCA directed DOE to consider and prescribe energy conservation standards or energy use standards for electricity used for the purposes of circulating air through ductwork. (42 U.S.C. 6295(f)(4)(D)) The AFUE metric used for furnaces does not account for the electricity used by the furnace fan to move air through ductwork. Therefore, to satisfy the requirements of EPCA, DOE established the FER test method and metric to account for the electrical energy consumption for circulating air through ductwork and will maintain AFUE and FER as separate metrics for consumer furnaces and consumer furnace fans, respectively.

2. Comments Expressing Support for Amended Standards for Furnace Fans

In response to the November 2022 Preliminary Analysis, several commenters encouraged DOE to amend standards for consumer furnace fans.

The CA IOUs commented that DOE's analyses show significant lifetime-operating-cost savings and short-payback periods for the NWO–NC, MH–NWG–NC, MH–NWG–C, and MH–NWO–NC product classes. (CA IOUs, No. 21 at p. 1) The CA IOUs stated that they support DOE's finding that brushless permanent magnet (''BPM'') motors are cost-effective for all product classes. (*Id.* at p. 1)

NEEA recommended that DOE adopt a BPM standard level for all equipment classes, including those DOE proposed in the expansion and for any additional classes that DOE could cover. NEEA commented that by raising the standard to BPM motors beyond non-weatherized gas furnaces, DOE would ensure that there are fewer applications where inefficient furnace fans are being used in the market. NEEA further commented that the market for BPM motors is mature, and the adoption of additional product classes should not negatively impact manufacturers. (NEEA, No. 24 at p. 3)

As part of the rulemaking process, DOE carefully considers the benefits and burdens of potential amended standards to determine whether the potential amended standards are the maximum standard levels that are technologically feasible and economically justified, and would conserve a significant amount of energy, as required by EPCA (see 42 U.S.C. 6295(o)(2)–(3)). Section IV of this document outlines DOE's approach to analyzing various potential amended standard levels, and section V of this document provides the results of those analyses, as well as a detailed explanation of DOE's weighing of the benefits and burdens and the rationale for proposing not to amend standards for consumer furnace fans.

B. Product Classes and Scope of Coverage

When evaluating and establishing energy conservation standards, DOE divides covered products into product classes by the type of energy used or by capacity or other performance-related features that justify differing standards. In 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.

6295(q)) The scope of coverage and product classes for this proposed determination are discussed in further detail in section IV.A.1 and IV.A.4, respectively. This proposed determination covers consumer furnace fans defined as an electrically-powered device used in a consumer product for the purpose of circulating air through ductwork. 10 CFR 430.2.

C. Test Procedure

EPCA sets forth generally applicable criteria and procedures for DOE's adoption and amendment of test procedures. (42 U.S.C. 6293) Manufacturers of covered products must use these test procedures to certify to DOE that their product complies with energy conservation standards and to quantify the efficiency of their product. (42 U.S.C. 6295(s) and 42 U.S.C. 6293(c)) The test procedure for determining FER is established at 10 CFR part 430 subpart B appendix AA, *Uniform Test Method for Measuring the Energy Consumption of Furnace Fans* (''appendix AA''). On May 13, 2022, DOE published the May 2022 TP NOPR, which proposed to amend the test procedure for consumer furnace fans. 87 FR 29576. Specifically, the May 2022 TP NOPR proposed the following changes: (1) Specify testing instructions for furnace fans incapable of operating at the required external static pressure (''ESP''). (2) Incorporate by reference the most recent versions of industry standards, ASHRAE 103–2017 and ASHRAE 37–2009 (RA 2019), in 10 CFR 430.3. (3) Define dual-fuel furnace fans and exclude them from the scope of appendix AA. (4) Change the term ''default airflow control settings'' to ''specified airflow control settings.'' (5) Add provisions to directly measure airflow. (6) Revise the ambient temperature conditions allowed during testing to between 65 degrees Fahrenheit (''°F'') and 85 °F for all units (both condensing and non-condensing). (7) Assign an allowable range of relative humidity during testing to be between 20 percent and 80 percent. *Id.* at 25979. DOE is still considering comments received in response to the May 2022 TP NOPR and has not yet finalized any updates to the test procedure.

D. Technological Feasibility

1. General

In evaluating potential amendments to energy conservation standards, DOE conducts a screening analysis based on information gathered on all current technology options and prototype designs that could improve the efficiency of the products or equipment that are the subject of the determination. 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. Sections 6(b)(3)(i) and 7(b)(1) of appendix A to 10 CFR part 430 subpart C (''Process Rule'').

After DOE has determined that particular technology options are technologically feasible, it further evaluates each technology option in light of the following additional screening criteria: (1) practicability to manufacture, install, and service; (2) adverse impacts on product utility or availability; (3) adverse impacts on health or safety; and (4) unique-pathway proprietary technologies. Sections 6(b)(3)(ii)–(v) and 7(b)(2)–(5) of the Process Rule. Section IV.A.4 of this document discusses the results of the screening analysis for consumer furnace fans, particularly the designs DOE considered, those it screened out, and those that are the basis for the standards considered in this proposed determination.

2. Maximum Technologically Feasible Levels

As when DOE proposes to adopt a new or amended standard for a type or class of covered product, in this analysis it must determine the maximum improvement in energy efficiency or maximum reduction in energy use that is technologically feasible for such a product. (42 U.S.C. 6295(p)(1)) Accordingly, in the engineering analysis, DOE determined the maximum technologically feasible improvements in energy efficiency for consumer furnace fans, 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 analysis are described in section IV.B of this proposed determination.

E. Cost Effectiveness

In making a determination of whether amended energy conservation standards are needed, EPCA requires DOE to consider the cost effectiveness of amended standards in the context of the savings in operating costs throughout the estimated average life of the covered product compared to any increase in the price of, or in the initial charges for, or maintenance expenses of, the covered product that are likely to result from a standard. (42 U.S.C. 6295(o)(2)(B)(i)(II))

In determining cost effectiveness of amending standards for consumer furnace fans, DOE conducted LCC and PBP analyses that estimate the costs and benefits to users from potential standards. To further inform DOE's consideration of the cost effectiveness of potential amended standards, DOE considered the NPV of total costs and benefits estimated as part of the NIA. 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.

F. Energy Savings

1. Determination of Savings

For each efficiency level (''EL'') evaluated, DOE projected energy savings from application of the EL to the consumer furnace fans purchased in the 30-year period that begins in the assumed year of compliance with the potential standards (2030–2059). The savings are measured over the entire lifetime of the consumer furnace fans purchased in the previous 30-year period. DOE quantified the energy savings attributable to each EL as the difference in energy consumption between each standards case and the no-new-standards case. The no-new-standards case represents a projection of energy consumption that reflects how the market for a product would likely evolve in the absence of amended energy conservation standards. DOE used its NIA spreadsheet model to estimate national energy savings (NES) from potential amended or new standards for consumer furnace fans. The NIA spreadsheet model (described in section IV.G 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 NES in terms of primary energy savings, which is the savings in the energy that is used to generate and transmit the site electricity. DOE also calculates NES in terms of full-fuel-cycle (FFC) energy savings. The FFC metric includes the energy consumed in extracting, processing, and transporting primary fuels (*i.e.,* coal, natural gas, petroleum fuels), and thus presents a more complete picture of the impacts of energy conservation standards.[4] 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.G of this document.

2. Significance of Savings

In determining whether amended standards are needed, DOE must consider whether such standards will result in significant conservation of energy. (42 U.S.C. 6295(m)(1)(A)) 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.[5] 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.

G. Additional Considerations

Pursuant to EPCA, absent DOE publishing a notification of determination that energy conservation standards for furnace fans do not need to be amended, DOE must issue a NOPR that includes new proposed standards. (42 U.S.C. 6295(m)(1)(B)). The new proposed standards in any such NOPR must be based on the criteria established under 42 U.S.C. 6295(o) and follow the procedures established under 42 U.S.C. 6295(p). (42 U.S.C. 6295(m)(1)(B)). The criteria in 42 U.S.C. 6295(o) require that standards be designed to achieve the maximum improvement in energy efficiency, which the Secretary determines is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A)). In deciding whether a proposed standard is economically justified, DOE must determine whether the benefits of the standard exceed its burdens. (42 U.S.C. 6295(o)(2)(B)(i)). DOE must make this determination after receiving comments on the proposed standard, and by considering, to the greatest extent practicable, the following seven statutory factors:

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

(2) The savings in operating costs throughout the estimated average life of the covered products in the type (or class) compared to any increase in the price, initial charges for, or maintenance expenses of 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. 6295(o)(2)(B)(i)(I)–(VII))

IV. Methodology and Discussion of Related Comments

This section addresses the analyses DOE has performed for this proposed determination with regard to consumer furnace fans. Separate subsections address each component of DOE's analyses. DOE used several analytical tools to estimate the impact of potential energy conservation standards. The first tool is a spreadsheet that calculates the LCC savings and PBP of potential energy conservation standards. The NIA uses a second spreadsheet set that provides shipments projections and calculates NES and net present value of total consumer costs and savings expected to result from potential energy conservation standards. These spreadsheet tools are available on the website: *www.regulations.gov/docket/EERE-2021-BT-STD-0029.*

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 proposed determination include (1) a determination of the scope and product classes, (2) manufacturers and industry structure, (3) existing efficiency programs, (4) shipments information, (5) market and industry trends, and (6) technologies or design options that could improve the energy efficiency of consumer furnace fans. The key findings of DOE's market assessment are summarized in the following sections.

1. Scope of Coverage

In this analysis, DOE relied on the definition of consumer furnace fans in 10 CFR 430.2, which defines a consumer furnace fan as an electrically-powered device used in a consumer product for the purpose of circulating air through ductwork. Any product meeting the definition of consumer furnace fans is included in DOE's scope of coverage, though not all products within the scope of coverage may be subject to standards.

For this NOPD, DOE evaluated products within the same scope as those products for which DOE initially established energy conservation standards in the final rule published on July 3, 2014 (''July 2014 Final Rule''). 79 FR 38130. Products evaluated in this NOPD include:

- Furnace fans used in weatherized and non-weatherized gas furnaces, oil furnaces, and electric furnaces; and
- Modular blowers.

Consistent with the approach taken in the July 2014 Final Rule, products not addressed in this rulemaking include:

- Furnace fans used in other products, such as split-system central air conditioner (''CAC'') and heat pump indoor units, through-the-wall indoor units, small duct high-velocity indoor units, energy recovery ventilators, heat recovery ventilators, draft inducer fans, exhaust fans, or hydronic air handlers; and
- Fans used in any non-ducted products, such as whole-house ventilation systems without ductwork, CAC condensing unit fans, room fans, and furnace draft inducer fans because these products do not circulate air through ductwork.

DOE has previously determined that the DOE test procedure for furnace fans is not currently equipped to address fans contained in CACs, heat pumps, or other products. 79 FR 38130, 38149. Therefore, DOE has not established standards covering such products. (42 U.S.C. 6295(o)(3)) Any products that are non-ducted or that do not move air through ductwork (*e.g.,* draft inducer fans) would not meet the definition of a furnace fan and are therefore out of scope of the existing regulations.

In response to the November 2022 Preliminary Analysis, AHRI commented that fans used in packaged units should be excluded from the analysis as the energy use is already accounted for in the products' seasonal energy efficiency

[4] 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).

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

ratio (''SEER'') rating. AHRI stated that including these products in the analysis of the overall quad savings would double count their contribution because they are accounted for in prior rulemakings. (AHRI, No. 23 at p. 4) Morrison commented that it does not see the need for DOE to include fans used in packaged units within the furnace fans rulemaking, as their energy use is already accounted for in SEER and heating seasonal performance factor (''HSPF'') ratings and excluding them from the rulemaking would prevent unnecessary repetition across rulemaking documents. (Morrison, No. 27 at p. 2) In response, DOE notes that for certain packaged units—WG–NC—there are existing standards at 10 CFR 430.32. In the July 2014 Final Rule, DOE assessed these products and established energy conservation standards for them. 79 FR 38130, 38209. As discussed in section II.A of this document, DOE must periodically review its already established energy conservation standards for consumer furnace fans no later than 6 years from the issuance of a final rule establishing or amending a standard for consumer furnace fans. (42 U.S.C. 6295(m)) In accordance with these provisions, DOE evaluated these products for this NOPD. DOE notes that the base-case efficiency distribution of fans used in the analysis includes presence of more-efficient furnace fans (*e.g.,* with BPM motors) in homes with higher-efficiency packaged units due to impacts from previous rulemakings. Because the energy savings considered from the furnace fan efficiency levels are measured relative to the base-case efficiencies, the savings calculated in this analysis are over and above those counted in previous rulemakings. Therefore, savings have not been double counted.

The CA IOUs further commented that DOE has previously noted that the provisions in 42 U.S.C. 6295(f)(4)(D) can encompass any electrically-powered devices used in residential HVAC products, including furnaces, and recommended that DOE investigate the savings opportunity for regulating furnace fans in air handlers. (*Id.*) Finally, the CA IOUs commented that many residential air handlers are offered for sale with permanent split-capacitor-equipped fans and are likely unable to meet the current rating for fan energy conservation standards applicable to furnace fans. They added that manufacturers readily offer air handlers with BPM motors and, therefore, a baseline technology option incorporating a BPM motor is likely feasible for air handlers. (*Id.* at pp. 5–6)

For the reasons discussed in the May 2022 TP NOPR, DOE is not proposing to include fans used in other types of HVAC products, including air-handlers, within the scope of coverage of appendix AA. 87 FR 29576, 29580. In the May 2022 TP NOPR, DOE tentatively concluded that the electrical energy consumption of fans used in the aforementioned types of HVAC products are accounted for by the seasonal energy efficiency ratio 2 (''SEER2'') and heating seasonal performance factor 2 (''HSPF2'') metrics measured by the test procedure for CACs and heat pumps at appendix M1 to subpart B of part 430 (''appendix M1''). 87 FR 29576, 29580. Therefore, DOE did not include air handlers in the scope of the test procedure rulemaking and likewise did not include them in this furnace fans rulemaking.

NEEA commented that it supported expanding coverage of furnace fans to include NWO–NC products in the analysis because of the persistence of this product class on the market and so the regulations would be more inclusive of the entire market and prevent any unfair advantage due to a gap in the regulations. NEEA also recommended that DOE include mobile home non-weatherized, non-condensing furnace fans as a covered product class, which, along with including NWO–NC, would encourage the transition to BPM motors across the furnace fan market. (NEEA, No. 24 at pp. 1–2) NEEA recommended that DOE add additional classes, such as non-weatherized, condensing oil (''NWO–C'') and weatherized, condensing gas (''WG–C''), to cover the entire consumer furnace fans market. (*Id.* at p. 2) Lennox commented that it finds the market impact of MH–NWO or WG–C furnace fans to be extremely low with minimal energy saving potential. (Lennox, No. 24 at p. 4)

DOE notes that, because it is not proposing amended standards at this time, it is not proposing to assign new standards to any product classes and will retain those classes for which standards currently exist, as shown in Table II.1. For NWO–NC furnace fans, standards currently exist and these products were included in this analysis. DOE also analyzed MH–NWO–NC furnace fans for the purposes of making this proposed determination. For other types of furnace fans, such as NWO–C and WG–C furnace fans, DOE is only aware of a very small number of products on the market. DOE has tentatively concluded that given the nascent and developing state of these products it would be premature to analyze proposed energy conservation standards at this time. Additional information on the product classes analyzed for this NOPD is included in section IV.A.4 of this document.

2. Technology Options

In the November 2022 Preliminary Analysis, DOE identified several technology options that would be expected to improve the efficiency of consumer furnace fans, as measured by the DOE test procedure. Specifically, DOE identified the following technology options as having the potential to improve the FER rating of consumer furnace fans (as measured in accordance with appendix AA), and considered these technology options further in the screening analysis:

- Housing design modifications
- Multi-stage heating components and controls [6]
- Airflow path design
- Constant-torque BPM (''CT–BPM'') and constant-airflow BPM (''CA–BPM'') motors
- Inverter controls for permanent split capacitor (''PSC'') motors
- Higher-efficiency fan blades

These technology options are described in detail in section 3.3.2 of the TSD accompanying the November 2022 Preliminary Analysis. In response to the November 2022 Preliminary Analysis, DOE received several comments related to these technology options. Several commenters supported DOE's tentative decision to analyze CT–BPM and CA–BPM motors together as a single design option because these motors appear to have comparable efficiency as measured by DOE's test procedure.

Lennox commented that CT–BPM and CA–BPM motors have similar efficiencies. Lennox stated that while there can be minor differences in the efficiency of BPM motors, they fall within a very narrow band for potential improvement. Lennox commented that the primary differences in performance are that a CT–BPM motor will result in reduced airflow as static pressure increases, whereas a CA–BPM motor will increase speed and power consumption to maintain airflow up to the limit of the motor capability. Lennox commented that motor efficiency as applied is more of a topographical map than a single point of operation and that BPM motors maintain efficiency

[6] Although multi-stage heating components and controls were included in the list of technologies that can improve FER, DOE stated that DOE has tentatively found that multi-stage heating controls may not significantly improve furnace fan efficiency as measured by FER. *See* chapter 3 and chapter 5 of the Preliminary Analysis TSD.

performance over their operating range. (Lennox, No. 24 at p. 5)

Additionally, AHRI commented that constant torque and constant airflow motors are similarly constructed but operate differently. AHRI commented that, given consistent external static pressure and airflow, AHRI assumes the two motor types would perform comparably within the expected margins of error. (AHRI, No. 23 at pp. 4–5) Carrier also commented that it agrees with DOE's assumption that CT–BPM and CA–BPM motors have comparable efficiencies and stated that the motors use similar construction despite being operated differently. Carrier commented that if a furnace with a CT–BPM motor were compared to a furnace with a similarly sized CA–BPM motor where both were operated at the same external static pressure and airflow, these motor types would consume the same amount of energy. (Carrier, No. 19 at p. 2) In response to Lennox, AHRI, and Carrier, DOE notes that it continued to analyze CT–BPM and CA–BPM motors together as a single design option for this current analysis.

Beach recommended that DOE include efficiency testing and standards in rudimentary equipment configuration descriptions. Beach recommended that DOE outline where and how the fan motor is placed within the equipment to avoid efficiency degradation at the spot where full furnace air flow deposits airstream dust and material on the motor windings. Beach commented that filter bypass, at a minimum, applies. (Beach, No. 16 at p. 1)

In response to comments from Beach, DOE notes that its energy conservation standards are in terms of FER, which is a performance-based metric that captures the estimated annual electrical energy consumption of the furnace fan normalized by: (a) the estimated total number of annual fan operating hours and (b) the airflow in the maximum airflow-control setting. DOE does not prescribe any design requirements for furnace fans and therefore specifying the placement and installation of the furnace fan within a furnace unit is out of the scope of DOE's regulations.

In the November 2022 Preliminary Analysis TSD, DOE stated that it tentatively did not consider two-stage and multi-stage technology options as a design pathway for improving FER in the engineering analysis based on manufacturer feedback, certification data, and testing. DOE requested data or comment regarding the relationship between staging and FER.

In response, AHRI commented that without performing a controlled study, it is difficult to properly compare a single-stage product to a two-stage product. AHRI commented that variables such as airflow design and temperature rise can affect the comparison, adding that it would be incorrect to generalize that one control type would have a distinct advantage over another. (AHRI, No. 23 at p. 5) Carrier commented that there is not adequate data to conclude whether single-stage and multi-stage controls result in different FER ratings. Carrier commented that comparison between the two control types is not straightforward due to multiple design characteristics that make each furnace model unique. Carrier stated that a controlled study is needed to eliminate variables that are unique to each model, such as airflow design and temperature rise selected. (Carrier, No. 19 at p. 2) Carrier also commented that it generally has not found multi-staging to improve FER ratings and that it does not believe one control type has a distinct advantage over the other. (*Id.*)

Trane commented that the assumption that FER values for a multi-stage furnace and a single-stage furnace are equal contradicts the 2014 TSD (EERE–2010–BT–STD–001–0111), which states that multi-staging was a technology option that significantly differed from the single-stage furnace. Trane commented that this difference affects the energy use equations, as the FER was calculated with a multi-stage furnace and energy use was calculated with a single-stage furnace. (Trane, No. 22 at p. 3)

Morrison questioned whether the lack of a benefit from multi-staging is due to FER not appropriately capturing real energy use. Morrison commented that, based on research presented in Canada's C823 efforts, average furnaces are oversized and rarely run at full capacity, leading them to use more fan energy than necessary. Morrison stated that part load operation would reduce the energy impact from oversizing and hence reduce fan energy use, and stated it is unclear why this option has been deemed not to be of benefit. (Morrison, No. 27 at p. 2)

DOE agrees with commenters that there are uncertainties related to the effectiveness of two-stage or multi-stage in improving FER. However, DOE has not received any additional data to support or disprove any impacts on FER between single and multi-stage units. Therefore, DOE has retained multi-stage heating components and controls as a technology option in the current analysis but, as discussed in section IV.B.1.a of this document, DOE did not consider two-stage or multi-stage operation as a design pathway for improving FER in the engineering analysis.

3. Impact From Other Rulemakings

Lennox commented that DOE needs to consider the total cumulative regulatory burden for consumer furnaces, as there are multiple concurrent DOE, EPA, and other regulatory actions undergoing updates. (Lennox, No. 24 at pp. 8–9) Lennox stated that DOE's consideration of cumulative regulatory burden has often been cursory and provided a list of relevant regulations: ''2023 DOE Energy Conservation Standards (''ECS'') change for central air conditioners; 2023 DOE Energy Conservation Standard change for commercial air conditioners; 2023 DOE ECS for commercial warm air furnaces (''CWAFs''); EPA phase-down to lower GWP refrigerants to meet the American Innovation and Manufacturing (''AIM'') Act objectives; DOE ECS Furnace Standards rulemaking; National and Regional Cold Climate Heat Pump Specifications; DOE ECS for Three-Phase, Below 65,000 Btu/h; DOE Test Procedure for VRF Systems; EPA Energy Star 6.0+ for Residential HVAC; and EPA Energy Star 4.0 for Light Commercial HVAC.'' (*Id.*) Lennox stated that proposing amended consumer furnace fan standards would contribute to the significant cumulative regulatory burden. (*Id.* at p. 9) Lennox commented that DOE needs to thoroughly consider the total cumulative regulatory burden association with any consideration of amended FER standards. Lennox commented that furnace manufacturers are in the midst of unprecedented regulatory change regarding equipment they manufacture. Lennox commented that these significant cumulative regulatory burdens provide another reason why DOE should not add additional burden by tightening consumer furnace fan regulations. Lennox reiterated that the fans are components in furnaces already regulated by DOE. (*Id.* at pp. 8–9)

AHRI asserted that DOE did not consider the impact of other ongoing rulemakings (*e.g.,* the notice of proposed rulemaking for consumer furnaces). (AHRI, No. 23 at p. 1) Morrison stated that it supports the comments submitted by AHRI advocating for the HVAC industry, as the burden for furnace manufacturers to meet compliance will be high. Morrison commented that the added burden of furnace fan ratings will challenge imminent regulations and an industry overloaded with regulations already underway, and that the schedule of regulations impedes manufacturers from attempting new product development and innovation. (Morrison, No. 27 at pp. 1–2)

DOE is not proposing to amend the energy conservation standards for consumer furnace fans and therefore does not expect this rulemaking to contribute to the cumulative regulatory burden of manufactures.

Lennox also commented that it opposes DOE expanding the regulatory scope for electric motors into air-over motors, synchronous motors and inverter-only motors, and expanded scope electric motors (ESEMs), in particular when those motors are contained in already-regulated heating, ventilation, air conditioning, and refrigeration (''HVACR'') products. Lennox commented that DOE should continue to exempt air-over and inverter-only motors (including AC and synchronous motors) from component-level energy conservation standards regulation when these motors are used in HVACR equipment already regulated at the systems level. Lennox stated that DOE notes in the October 2022 Electric Motor Test Procedure Final Rule (87 FR 63588) that an industry test procedure DOE incorporated by reference is ''not applicable to air-over electric motors that are synchronous electric motors and to air-over electric motors that are inverter-only'' (10 CFR 431.25(I)). AHRI commented that DOE should refer to the comments made by NEMA on the energy conservation standards for Fans and Blowers on the issues surrounding setting multiple standards for the same product under different rulemakings in regards to the interaction between the furnace fan rulemaking and the ESEMs rulemaking. (AHRI, No. 23 at p. 5)

In the ESEM rulemaking, DOE is considering including expanded scope electric motors including certain permanent split capacitor (PSC) motors that exceed 0.25 horsepower and are single-speed. DOE understands that the vast majority of furnace fans use either electrically commutated motors (*i.e.,* ''ECMs'' which are also referred to as BPM motors in this rulemaking) or are multiple-speed PSC motors, both of which are out of the preliminary scope of the ESEM rulemaking. Thus, furnace fans using BPM motors or multiple-speed PSC motors will not be impacted by the ESEM rulemaking.[7]

Screening Analysis

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

(1) *Technological feasibility.* Technologies that are not incorporated in commercial products or in 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 result in the unavailability of any covered product type with performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially the same as products generally available in the United States at the time, it will not be considered further.

(4) *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 efficiency level, it will not be considered further, due to the potential for monopolistic concerns.

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

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

a. Screened-Out Technologies

In the November 2022 Preliminary Analysis, DOE tentatively screened out housing design modifications and changes to airflow path designs from its analysis. In response, Lennox agreed with DOE's determination to screen out housing designs and airflow paths that could impact the thermal performance of the furnace and decrease consumer utility. (Lennox, No. 24 at p. 5) Carrier also indicated agreement with DOE's decision to screen out improved housing designs and airflow path designs due to their impact on overall product size, stating that they could adversely impact consumer utility and the practicality of making replacement installations. Additionally, Carrier agreed there is no quantitative data suggesting specific housing design changes provide efficiency improvements in the same cabinet width. (Carrier, No. 19 at p. 3)

The Joint Commenters commented that additional design options that increase efficiency beyond a backward-inclined impeller are currently available on the market. The Joint Commenters stated that airflow path and fan housing improvements represent potential options for improving furnace fan efficiency but noted that DOE screened out these design modifications since they could impact the thermal performance of the furnace. The Joint Commenters acknowledged this concern, but noted that one of the models exceeding EL 1 is used in a condensing furnace with an AFUE of 97 percent, suggesting manufacturers may be able to optimize the furnace fan efficiency without negatively impacting the efficiency of the furnace itself. The Joint Commenters recommended that DOE continue investigating furnace fan efficiencies and how certain design features on the current market permit furnace fan FER levels below those analyzed in the TSD. (Joint Commenters, No. 20 at pp. 2–3)

As discussed in section IV.A.2 of this document, airflow path and fan housing improvements can improve furnace fan efficiencies. However, as discussed in chapter 4 of the November 2022 Preliminary Analysis TSD, DOE does not have data that quantifies the impact of housing design modifications on FER. Additionally, DOE has found that the airflow path design can impact the performance of the larger furnace system with possible changes to the furnace efficiency as measured in AFUE. Though condensing furnaces can achieve lower FERs, DOE currently lacks the data necessary to conclude that these options will not reduce utility to consumers, and therefore has continued to screen out these technologies for this analysis.

Several commenters also suggested that backward-inclined impeller should be screened out of the current analysis. AHRI, Trane, Lennox, and Daikin raised concerns about the technological feasibility of backward-inclined impellers. AHRI commented that further analysis of backward-inclined impellers is needed, stating that while backward-inclined impellers can be considered a

[7] See Docket EERE–2020–BT–STD–0007.

mature technology in some products, it is nascent at best for consumer furnaces. AHRI commented that the analysis performed in the TSD does not capture the current state of this technology. (AHRI, No. 23 at pp. 2–3) Trane commented that the necessary backward-inclined impeller is not available for purchase and is therefore unavailable to furnace manufacturers for use in testing. (Trane, No. 22 at p. 2) Lennox commented that backward-inclined impellers are nascent technology for consumer furnaces and may not be practical for many installations. Lennox commented that DOE's analysis does not accurately portray the current state of this technology regarding residential furnace fans. Lennox stated that current furnace designs are much more compact than when DOE conducted research regarding backward-inclined impellers and there is now less space to accommodate furnace fans. Lennox commented that including backward-inclined impellers would require changes to the housing design and airflow patterns, which DOE screened out in the TSD. Lennox further commented that backward-inclined impellers are not a one-size-fits-all application. Lennox stated that changing the airflow design would require redesign and retesting on a model-by-model basis to ensure proper operation, compliance with safety standards, and product reliability. (Lennox, No. 24 at pp. 5–6) Daikin commented that replacing a forward-curved impeller with a backward-curved impeller may change the ESP of the unit and require that the unit use a larger blower wheel. Daikin commented that increasing the blower wheel diameter requires a change to the blower housing design, which was a technology option DOE screened out in the preliminary analysis. Daikin recommended that DOE evaluate the impact of backward-inclined impellers on furnace ESP. (Daikin, No. 26 at pp. 21–22) Rheem requested to know whether DOE had considered the impact of the backward-inclined impeller system on other furnace components, such as the evaporator coil or other accessories. (Rheem, No. 26 at p. 23) In contrast to these comments, Carrier stated that it uses backward-inclined impellers in non-weatherized gas furnaces that have 14-inch cabinets and AFUE ratings of 95 percent or higher. (Carrier, No. 19 at p. 1)

Manufacturers also raised concerns about potential impacts on the utility and safety of furnaces if backward-inclined impellers are used as a technology option. Carrier commented that its experiences suggest backward-inclined impellers significantly change the air profile through the furnace and, to maintain safety and reliability, the airflow must be redirected, adding that this can reduce the performance improvement from the impeller change. Carrier further commented that in applications where a larger impeller diameter cannot be accommodated, the increased rotational speed increases the operation noise of the furnace, adding that the noise generated from fan operation is an important performance selection criterion to consumers. (Carrier, No. 19 at p. 3) Lennox commented that backward-inclined impellers present many design challenges. Lennox noted that backward-inclined impellers must have significantly higher tip speeds, which require either a larger impeller diameter or higher rotational speed. However, Lennox commented that the required speed increase is outside the normal range of motors applied in furnace fans and would be likely to increase sound levels and reduce consumer utility. (Lennox, No. 24 at p. 6)

In response to these concerns, DOE notes that, even if there are only a limited number of commercially available product designs that incorporate backward-inclined impellers, they are sufficient to demonstrate technological feasibility as defined by EPCA. 10 CFR part 430, subpart C, appendix A, sections 6(b)(3)(i). Similarly, because these technologies are used in commercialized designs, DOE has determined that they can be implemented safely and reliably and with a noise level that is acceptable to consumers. DOE agrees, however, that there may be potential costs associated with potential redesign and retesting to ensure safety and to ensure acceptable noise levels, and this issue is discussed further in section IV.H of this document.

Therefore, for the current analysis, DOE tentatively screened out housing design modifications and changes to airflow path designs from its analysis but did not screen out backward-inclined impellers.

b. Remaining Technologies

After reviewing each technology, DOE did not screen out the following technology options and considers them as design options in the engineering analysis:

(1) Multi-stage heating components and controls
(2) High-efficiency fan motors (*i.e.,* use of BPM fan motors for product classes that currently use PSC motors)
(3) Inverter controls for PSC motors
(4) Higher-efficiency fan blades (backward-inclined impellers)

DOE determined that these technology options are technologically feasible because they are being used or have previously been used in commercially available products or working prototypes. DOE also finds that all of the remaining technology options meet the other screening criteria (*i.e.,* practicable to manufacture, install, and service and do not result in adverse impacts on consumer utility, product availability, health, or safety).

4. Product Classes

In general, when evaluating and establishing energy conservation standards, DOE divides the covered product into classes by (1) the type of energy used, (2) the capacity of the product, or (3) any other performance-related feature that affects energy efficiency and justifies different standard levels, considering factors such as consumer utility. (42 U.S.C. 6295(q))

DOE currently categorizes furnace fans into 10 product classes. EPCA specifies criteria for product class separation which include: (1) the type of energy consumed; (2) capacity; or (3) other performance-related features that justify a higher or lower energy conservation standard. 42 U.S.C. 6295(q) The 10 product classes currently established by DOE are differentiated by performance related features, including internal structure and application-specific design differences, as presented in Table IV.1. For this NOPD, DOE maintained these 10 classes, with the exception of a change to the mobile home non-weatherized oil furnace fan (MH–NWO) class discussed hereinafter.

TABLE IV.1—EXISTING FURNACE FAN PRODUCT CLASSES

Product class
Non-weatherized, Non-condensing Gas Furnace Fan (NWG–NC).
Non-weatherized, Condensing Gas Furnace Fan (NWG–C).
Mobile Home Non-Weatherized, Non-condensing Gas Furnace Fan (MH–NWG–NC).
Mobile Home Non-Weatherized, Condensing Gas Furnace Fan (MH–NWG–C).
Mobile Home Electric Furnace/Modular Blower Fan (MH–EF/MB).
Non-Weatherized, Non-Condensing Oil Furnace Fan (NWO–NC).
Weatherized Non-Condensing Gas Furnace Fan (WG–NC).
Electric Furnace/Modular Blower Fan (EF/MB).
Mobile Home Weatherized Non-Condensing Gas Furnace Fan (MH–WG).*
Mobile Home Non-Weatherized Oil Furnace Fan (MH–NWO).*

* DOE created the MH–NWO and MH–MG product classes in the July 2014 Final Rule, but these classes do not currently have energy conservation standards.

Each product class title includes descriptors that indicate the internal structure and application-specific performance related features of its included products. As directed by EPCA, 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. 6295(q)(1)) Weatherized and non-weatherized are descriptors that indicate whether the HVAC product is installed outdoors or indoors, respectively. Design constraints are different for products installed indoors compared to outdoors, which impact furnace fan performance because furnace fan energy consumption is dependent on clearances and airflow path Weatherized products are packaged products that also include an internal evaporator coil, while non-weatherized products are not shipped with an evaporator coil but may be designed to be paired with one. The presence of an evaporator coil increases internal static pressure and impacts furnace fan performance and energy consumption. Weatherization (*i.e.,* the ability to be installed outdoors) is therefore a performance-related feature as outlined by EPCA.

Condensing refers to the presence of a secondary, condensing heat exchanger in addition to the primary combustion heat exchanger in certain furnaces. The presence of a secondary heat exchanger improves the AFUE of a consumer furnace but also increases internal static pressure. As a result, DOE expects that furnace fans used in condensing units will consume more electrical energy than similar, non-condensing units, and therefore use with condensing technology constitutes a performance-related feature for this product. Mobile home products meet certain design requirements that allow them to be installed in mobile homes. They require direct venting and are typically installed without return air ducting. As a result, furnace fans used in mobile home products consume a different amount of electric energy than furnace fans installed in similar HVAC products that are designed for site-built applications. Therefore, the ability to be installed in mobile home applications is a performance-related feature under EPCA.

Descriptors like gas, oil, or electric indicate the type of fuel that the HVAC product uses to produce heat, which determines the type and geometry of the primary heat exchanger used in the HVAC product. Each heat exchanger geometry could result in a unique internal static pressure and therefore, have differing impacts on furnace fan performance and energy consumption and are considered performance-related features.

In the July 2014 Final Rule, DOE created product classes for MH–NWO furnace fans and MH–WG furnace fans, but DOE did not analyze or prescribe standards for either product class because of the lack of available data for those product classes. 79 FR 38130, 38150. DOE is not aware of any products that would be considered MH–WG furnace fans at this time. However, DOE has become aware of a limited number of MH–NWO furnace fans that have been introduced to the market. The MH–NWO furnace fans that DOE identified are all used in non-condensing furnaces, so DOE analyzed a subset of the previously established but unanalyzed class—mobile home non-weatherized, oil, non-condensing (MH–NWO–NC) furnace fans. DOE specifically considered MH–NWO–NC furnace fans because, as with furnace fans used in gas-fired products, DOE tentatively concluded that suitability for use with condensing technology would be a performance related feature that would justify further separating MH–NWO furnace fans into condensing and non-condensing classes. Furnace fans used in oil-fired products that are non-condensing as compared to those that are condensing would have different performance due to likely differences in internal structure of condensing products (if any were to be developed). As such, suitability for use with condensing technology in a furnace fan is a performance-related feature under EPCA. As DOE is not aware of any condensing MH–NWO products, DOE did not analyze them for this NOPD analysis and instead focused on MH–NWO–NC furnace fans. In summary, DOE considered the product classes shown in the following list in its analysis.

(1) Non-weatherized, Non-condensing Gas Furnace Fan (NWG–NC)
(2) Non-weatherized, Condensing Gas Furnace Fan (NWG–C)
(3) Mobile Home Non-weatherized, Non-condensing Gas Furnace Fan (MH–NWG–NC)
(4) Mobile Home Non-weatherized, Condensing Gas Furnace (MH–NWG–C)
(5) Mobile Home Electric Furnace/Modular Blower Fan (MH–EF/MB)
(6) Non-weatherized, Non-condensing Oil Furnace Fan (NWO–NC)
(7) Weatherized Non-Condensing Gas Furnace Fan (WG–NC)
(8) Electric Furnace/Modular Blower (EF/MB)
(9) Mobile Home Non-Weatherized, Non-Condensing Oil Furnace Fan (MH–NWO–NC)

B. Engineering Analysis

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

Although FER data exists in DOE's Compliance Certification Database (''CCD'') for furnace fans currently subject to efficiency standards, DOE has determined through testing that for many furnace fan models, the rated FER values may not be representative of the model's actual performance. During confidential manufacturer interviews, several manufacturers confirmed that they rate the FER of their furnace fan products conservatively. Therefore, an efficiency level approach was not possible because the FER ratings of products currently available are largely not representative of their actual performance. Thus, DOE chose a design option approach to identify efficiency levels for the analysis in this proposed determination.

a. Baseline Efficiency Level

For each product class, DOE generally selects a baseline model as a reference point for each class, and measures changes resulting from potential energy conservation standards against the baseline. The baseline model in each product class represents the characteristics of a product typical of that class (*e.g.,* capacity, physical size). Generally, a baseline model is one that just meets current energy conservation standards, or, if no standards are in place, the baseline is typically the most common or least efficient unit on the market. For consumer furnace fans, the energy conservation standard sets a maximum energy usage requirement and therefore a baseline furnace fan's rated FER is just below or at the maximum FER threshold.

DOE used baseline units for comparison in several analyses, including the engineering analysis, LCC analysis, PBP analysis, and NIA. To determine energy savings that will result from an amended energy conservation standard, DOE compared energy use at each of the higher efficiency levels to the energy consumption of the baseline unit. Similarly, to determine the changes in price to the consumer that will result from an amended energy conservation standard, DOE compared the prices of baseline units to the prices of units at each higher efficiency level.

The identification of baseline units requires establishing the baseline efficiency level. In cases where there is an existing standard, DOE defines baseline units as units with efficiencies equal to the current Federal energy conservation standards. For MH–NWO–NC furnace fan product class, which does not currently have energy conservation standards, DOE developed the baseline equation by modifying the current energy conservation standards for the NWO–NC product class to account for the lower ESP experienced by mobile home units compared to other units. Specifically, DOE multiplied the y-intercept (382) by 0.75, which was the conversion factor determined in the analysis for the July 2014 Final Rule that was previously used to calculate the MH–NWG–NC baseline based on the NWG–NC baseline.[8]

Table IV.2 presents the maximum FER (*i.e.,* the baseline level) for each product class of consumer furnaces analyzed in this preliminary analysis, as well as the typical characteristics of products at that level.

TABLE IV.2—BASELINE EFFICIENCY LEVEL FER AND ASSOCIATED DESIGN OPTION FOR EACH PRODUCT CLASS

Product class	Maximum FER	Design option
Non-Weatherized, Non-Condensing Gas Furnace Fan	$0.044 * Q_{Max} + 182$	BPM Motor w/Forward Inclined Impeller.
Non-Weatherized, Condensing Gas Furnace Fan	$0.044 * Q_{Max} + 195$	BPM Motor w/Forward Inclined Impeller.
Weatherized, Non-Condensing Gas Furnace Fan	$0.044 * Q_{Max} + 199$	BPM Motor w/Forward Inclined Impeller.
Non-Weatherized, Non-Condensing Oil Furnace Fan	$0.071 * Q_{Max} + 382$	Improved PSC Motor w/Forward Inclined Impeller.
Non-Weatherized Electric Furnace Fan/Modular Blower Fan	$0.044 * Q_{Max} + 165$	BPM Motor w/Forward Inclined Impeller.
Manufactured Home, Non-Weatherized, Non-Condensing Gas Furnace Fan.	$0.071 * Q_{Max} + 222$	Improved PSC Motor w/Forward Inclined Impeller.
Manufactured Home, Non-Weatherized, Condensing Gas Furnace Fan	$0.071 * Q_{Max} + 240$	Improved PSC Motor w/Forward Inclined Impeller.
Manufactured Home, Non-Weatherized Electric Furnace Fan/Modular Blower Fan.	$0.044 * Q_{Max} + 101$	BPM Motor w/Forward Inclined Impeller.

[8] Chapter 5 of the TSD accompanying the July 2014 Final Rule includes additional details about how this conversion factor was calculated. *See* docket no. EERE–2010–BT–STD–0011.

TABLE IV.2—BASELINE EFFICIENCY LEVEL FER AND ASSOCIATED DESIGN OPTION FOR EACH PRODUCT CLASS—Continued

Product class	Maximum FER	Design option
Manufactured Home, Non-Weatherized Non-Condensing Oil Furnace Fan.	$0.071 * Q_{Max} + 287$ ...	Improved PSC Motor w/Forward Inclined Impeller.

Products in the NWG–NC, NWG–C, WG–NC, NWEF/NWMB, and MH–EF/MB products classes are currently subject to the standards set in the July 2014 Final Rule, in which the efficiency levels adopted were understood at that time to reflect models with CT–BPM motors and multi-stage operation. Products in the NWO–NC and MH–NWG–NC product classes are currently subject to the standards set in the July 2014 Final Rule in which the efficiency level adopted were understood to correspond to the performance associated with models including improved PSC motors and single-stage operation. Baseline products in the MH–NWO–NC product class were also found to correspond to performance associated with models including improved PSC motors and single-stage operation, based on DOE's market findings for mobile-home oil-fired units certified in DOE's CCD for consumer furnaces.

Many furnaces include multi-stage or modulating heating controls. However, based on current furnace fan market data as well as feedback received during manufacturer interviews, it is unclear if these features impact furnace fan efficiency as measured by FER (*see* section IV.A.2). Therefore, DOE did not include the costs of multi-stage or modulating heating controls in the baseline design (*i.e.,* DOE's MPC estimates reflect single-stage units). However, DOE did develop separate cost values for multi-stage or modulating heating controls that can be applied to the above costs to represent the addition of multi-stage or modulating heating controls (*see* section IV.B.2.b of this document). These additional cost values are used in DOE's LCC and PBP analyses in order to represent typical furnace fan cost distributions.

In addition, the baseline motor technology is either BPM or PSC, depending on the product class. Manufacturers may choose a CABPM motor instead of a CTBPM, despite its relatively higher cost, to add comfort utility to their product. This additional comfort may be marketed as a premium feature. Therefore, DOE included the cost of a CT–BPM motor in the MPCs for furnace fans with BPM motors. DOE also developed cost values to represent the cost increase for CA–BPM motors relative to CT–BPM motors (*see* section IV.B.2.b of this document). These values were applied in the LCC analysis to represent the distribution of BPM blower motor technologies expected on the market because, although DOE is not differentiating between CA–BPM motors and CT–BPM motors in terms of furnace fan efficiency, manufacturers and consumers may consider CA–BPM motors to be a premium feature that may offer comfort-related consumer utility benefits.

In developing the cost-efficiency relationship, teardowns of baseline units were used as a reference point for determining the cost-efficiency relationship of units with lower (more efficient) FERs. DOE compared the design features incorporated into products at the baseline efficiency to the features of units with higher energy efficiencies in order to determine the changes in manufacturing, installation, and operating costs that occur as FER decreases.

In response to the November 2022 Preliminary Analysis, Morrison commented that DOE's estimation of FER values is conservative, based on data from OEMs and DOE, both of which indicate that analysis from 2014 is not representative of current furnace fan function and composition. (Morrison, No. 27 at p. 2) Lennox commented that the use of BPM motors is required to meet current furnace fan efficiency standards for most consumer furnace fan categories and use of BPM motors is identified by DOE as the current baseline. (Lennox, No. 24 at p. 8)

AHRI commented that baseline mobile home non-weatherized gas furnace fan technology is not representative of the market. AHRI stated that, in many cases, the current FER rating for mobile home non-weatherized gas furnace fans cannot be met using a PSC motor, adding that these products already incorporate a BPM motor to meet Federal minimum standards. AHRI added that because mobile home non-weatherized gas furnace fans already incorporate BPM motors to meet the current levels, BPM motors will not be able to meet the FER minimums proposed at EL 1. (AHRI, No. 23 at p. 3) AHRI recommended that DOE validate the analysis performed for mobile home non-weatherized gas furnace fan to ensure the baseline and subsequent ELs are correct. (*Id.*)

The Joint Commenters stated that current standards for both weatherized and non-weatherized non-condensing gas furnace fans were intended to effectively require use of efficient BPM motors, but stated that DOE's analysis shows some non-condensing gas furnace fans utilizing PSC motors can meet the current standards. The Joint Commenters noted that one currently available furnace/furnace fan model utilizes a PSC motor and is marketed as having a small footprint and DOE should investigate how this model and others are able to meet the current standards with presumably less efficient motors. (Joint Commenters, No. 20 at p. 2)

The CA IOUs commented that they agree with DOE's decision to use the costs associated with constant-torque BPM and single-stage controls for its cost analysis for EL 1, adding that DOE has found several furnace fans on the market that meet EL 1. (CA IOUs, No. 21 at p. 2) The CA IOUs also noted that a 2017 California Codes and Standards Enhancement report evaluated air handlers sold with heat pumps and confirmed that while cabinet and blower design can affect internal resistance to airflow, a PSC motor can adversely affect fan efficacy. (*Id.* at p. 5)

In response, DOE notes that it has developed baseline efficiency levels that are representative of the baseline technologies used in the current furnace fan market. While the FER ratings reported in CCMS are generally likely to be conservative estimates, DOE has conducted testing to understand the impacts of the technology options identified in section IV.A.2 on furnace fan efficiency, and has developed efficiency levels that reflect those impacts. DOE agrees with commenters that the use of BPM motors is necessary to meet the baseline for some product classes, as outlined in Table IV.2, but notes that some product classes can meet the baseline efficiency level using an improved PSC motor. In response to AHRI's comments, although DOE recognizes that many mobile home furnaces use BPM motors, DOE is aware of mobile home furnaces on the market that use an improved PSC motor and meet the current FER standards. DOE thus concludes that FER standards can be achieved using this technology and has maintained improved PSC motors as a part of the baseline design option for mobile home furnaces. Conversely, DOE's market data shows that no non-weatherized gas furnaces currently on the market use PSC motors; DOE therefore concludes that a BPM motor continues to be an appropriate baseline motor design for this class.

b. Intermediate Efficiency Levels

DOE analyzed intermediate efficiency levels for NWO–NC, MH–NWG–NC, MH–NWG–C, and MH–NWO–NC classes of consumer furnace fans. As discussed in section IV.B.1.c, DOE did not identify any efficiency levels between baseline and max-tech for the NWG–NC, NWG–C, WG–NC, NWEF/NWMB, and MH–EF/MB classes. The intermediate efficiency levels identified are representative of efficiency levels where major technological changes occur (*i.e.,* replacing PSC motors with BPM motors). As discussed in section IV.B.1.a of this document, DOE has tentatively found that CT–BPM motors and CA–BPM motors have comparable impacts on FER ratings, and DOE has therefore only analyzed a single efficiency level reflecting the implementation of BPM motors. Additionally, DOE has tentatively used the assumption of a 12-percent reduction in FER for improved PSC motors and a 46-percent reduction in FER for models with a CT–BPM and multi-staging from the baseline used in the 2014 Final Rule (79 FR 38130, 38159) to calculate a 39-percent reduction in FER from improved PSC (the current baseline) to CT–BPM with multi-staging. The 39-percent reduction in FER is implemented into the current analysis to represent the reduction in FER from improved PSC to a model with a CT–BPM (regardless of staging) because DOE has tentatively decided not to include staging as a technology option that improves FER.

In response to the November 2022 Preliminary Analysis, Lennox commented that the efficiency levels and design options associated with the use of forward curved impellers and BPM motors are reasonable. (Lennox, No. 24 at p. 7)

The Joint Commenters commented that models with lower FERs than EL 1 are available in each of the major furnace fan product classes. The Joint Commenters commented that, based on results in the CCD, both condensing and non-condensing non-weatherized furnace fans with efficiencies exceeding EL 1 are available across a broad range of airflows. The Joint Commenters stated that, as DOE acknowledged in the TSD, many manufacturers rate their furnace fans conservatively, which suggests the number of higher-efficiency furnace fans available on the market is understated. (Joint Commenters, No. 20 at pp. 1–2) Additionally, the Joint Commenters encouraged DOE to analyze an EL associated with improved BPM motor efficiency. The Joint Commenters stated that a range of BPM motor efficiencies currently exist on the market but added that DOE did not analyze improved motor efficiency as a potential design option. The Joint Commenters encouraged DOE to gather additional information from motor manufacturers to characterize the FER reductions achievable with the most efficient BPM motors available, and to analyze an EL associated with these higher efficiency BPM motors for the next stage of the rulemaking. (*Id.* at p. 3)

DOE is not aware of any data showing the relationship between improved motor efficiency and FER ratings. DOE welcomes data exploring this relationship and may include efficiency levels corresponding to the use of more efficient BPM motors in a future analysis but did not include this additional efficiency level in the current analysis due to the lack of data.

c. Maximum Technology Efficiency Levels

As part of DOE's analysis, the maximum available efficiency level 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. DOE identified the max-tech design for all consumer furnace fans product types as incorporating a BPM motor with a backward-inclined impeller.

BPM motors are described in sections IV.B.1.a and IV.B.1.b of this chapter. For furnace fan models that use PSC motors, BPM motors can offer an improvement in efficiency and reduce FER. Backward-inclined impellers, in comparison to forward-inclined impellers used in the majority of furnace fans on the market, have been found to have a higher efficiency under certain operating conditions. In chapter 5 of the TSD accompanying the November 2022 Preliminary Analysis, DOE explained that it has tentatively used the same assumptions about the percent reduction in FER associated with implementing backward-inclined impellers as in the July 2014 Final Rule (*i.e.,* a 10-percent reduction in FER compared to models that include forward-inclined impellers). 79 FR 38130, 38159.

In response to the November 2022 Preliminary Analysis, several commenters raised concerns about the assumption that a backward-inclined impellers will reduce FER by 10 percent. Several commenters suggested that the impact of backward-inclined impellers on FER may vary by application. Carrier commented that DOE correctly concluded in the TSD that the efficiency improvement of a backward-inclined impeller is not uniform across the entire range of operation. Carrier stated that this lack of uniformity can require limiting the operating range, which reduces the furnace utility, or leads to unrealized efficiency improvements in application. Carrier stated that it believes backward-inclined impellers are not a technologically feasible design option in some models because they do not improve efficiency and in other models they reduce furnace utility. Carrier stated that its non-weatherized 95-percent-plus AFUE 14-inch-width gas furnaces use backward-inclined impellers to meet the current FER standards. (Carrier, No. 19 at pp. 3–4) Carrier commented that it completed extensive research and evaluated the impact of this technology in many furnace variations and suggested that DOE's technology assessment does not fully account for the design challenges of using backward-inclined impellers in consumer furnaces. Carrier commented that the improvement in fan efficiency is not uniform across model sizes within a product family due to design changes needed to address the safety and reliability [9] of the furnaces. Carrier requested that DOE continue its study of backward-inclined impeller technology to better understand the efficiency improvement variation across product sizes before concluding a uniform reduction in FER for a product class. Carrier also stated that because its models that incorporate backward-inclined impeller use the maximum technology design options, any reduction in the FER limit would eliminate them from the market. (*Id.* at pp. 1–3)

AHRI commented that it is aware of products on the market which use proprietary backward-inclined impeller designs that are not capable of meeting the FER that DOE has associated with

[9] Carrier's comments related to safety and reliability concerns are discussed in section IV.A.4.a of this document.

that design option. AHRI further commented that these products are some of the highest-efficiency products on the market and stated that if the FER requirement is moved to a max-tech level, both furnace fan availability and high-efficiency furnace availability will be affected. (AHRI, No. 23 at pp. 5–6)

The CA IOUs requested that DOE conduct additional research on backward-inclined fan performance to ensure the projected energy savings. The CA IOUs further requested that DOE collect current data on the performance of backward-inclined impellers in furnaces to compare with forward-curved fans available in 2023. The CA IOUs commented that DOE's calculations appeared to be based on research that may not reflect the current performance of forward-curved fans and instead overstates the performance of backward-inclined fans on the market. The CA IOUs commented that DOE's findings of 10-percent energy savings expected from backward-inclined fans were first presented in the 2014 TSD and were based on 2003 GE testing of a single backward-inclined prototype against a single forward curved fan. The CA IOUs commented that a follow-up LBNL report found that the construction of the forward-curved fan tested in 2003 was substandard and contained large gaps between the impeller and housing and misalignment between the impeller and inlet. The CA IOUs pointed out that furnace fans in 2003 had no performance requirements and that with the advent of furnace fan regulation, forward-curved fan design has improved while backward-inclined fans currently available are not noticeably better than the prototype tested in 2003. The CA IOUs presented data showing the performance of one manufacturer's forward-curved and backward-inclined fans and commented that additional research is needed to confirm the efficiency difference before DOE considers using backward-inclined fans. (CA IOUs, No. 21 at pp. 2–5)

Morrison stated that the GE fan referenced by DOE (as the basis of the backward inclined impeller analysis) was used in LBNL research and had limited benefit when compared to a forward-curved fan. Furthermore, Morrison commented that more information was needed regarding claims in the TSD that the use of EBM fans resulted in a 15–30-percent improvement. Morrison stated that DOE used an estimated 10-percent FER improvement from the 2014 rulemaking, but that would be relative to older designs made prior to changes seen in furnace fans since 2019. Morrison stated that consumer furnace fans have been improved since then to improve energy use. (Morrison, No. 27 at p. 2) No commenters submitted data supporting an alternative FER reduction value to associate with backward-inclined impellers. Therefore, DOE continued to rely on the best data available, which is what DOE used to arrive at the assumption that backward-inclined impellers uniformly reduce the FER of consumer furnace fans by a 10-percent reduction in the July 2014 Final Rule. With respect to Morrison's comments that the furnace fan designs have changed since 2014, DOE notes that the estimate of a 10-percent reduction is not relative to the baseline design, but instead is relative to an equivalent furnace fan with a forward curved impeller and thus still applies. In other words, in the July 2014 Final Rule, DOE estimated that implementing a backward-inclined impeller in place of a forward-inclined impeller would reduce FER by 10 percent in a furnace fan with a constant-airflow BPM motor and multi-staging; it was not relative to a baseline furnace with a PSC motor and single-stage operation. 79 FR 38130, 38159. (As previously discussed, for this analysis DOE did not find evidence of significant differentiation in FER among multi-stage models as compared to single-stage models, or between constant-airflow and constant-torque BPM motors.) However, the concerns and uncertainties raised by commenters in the above paragraphs contribute to DOE's tentative decision not to adopt standards at max-tech levels for furnace fans at this time. For additional discussion regarding backward-inclined impellers, *see* section IV.H of this document.

In response to DOE's consideration of backward-inclined impellers at the max-tech level in the November 2022 Preliminary Analysis, commenters discussed a number of concerns with implementing the technology.

AHRI commented that there is no one-size-fits-all design for incorporating backward-inclined impellers into current products. AHRI stated that changes in the airflow design will require redesign and retesting on a model-by-model basis to ensure both proper operation and compliance with safety standards. (AHRI, No. 23 at p. 5) AHRI commented that the issues associated with moving from a forward-inclined impeller to a backward-inclined impeller will require safety testing and redesign. AHRI further commented that these additional costs are not accounted for in the analysis. (*Id.* at p. 3)

Trane commented that, based on its research, a backward-inclined impeller is not compatible with current furnace dimensions, which are not large enough to accommodate a backward-inclined impeller. Trane added that it cannot be assumed that furnace design changes will have no impact on energy use and equipment utility when a backward-inclined impeller is used in the existing housing. Furthermore, Trane commented that, based on its research, the issues of the inlet cone design and clearances to the moving impeller remain a concern and require attention. (Trane, No. 22 at p. 2)

Trane commented that adopting EL 1 would require replacing the current forward-inclined impeller with a backward-inclined impeller. Trane added that its research showed a 7-year development cycle for the blower system technology needed to adopt EL 1. Trane commented that this same research surfaced concerns with the ability to manufacture a high-speed (~1800 RPM max) blower wheel with close tolerances with the inlet cones, and significant leakage of high-pressure air from the exhaust portion of the housing back into the low-pressure input region if typical 0.25-in gaps are implemented. Trane commented that improvements from only retrofitting the impeller were less than 10 percent unless blower housing modifications were made. Trane commented that its determination regarding the impellers was based on a study completed more than 20 years ago, ''Final Report for the Variable Speed Integrated Intelligent HVAC Blower, Final Report for BP–2'' (June 1, 2003). (Trane, No. 22 at p. 2)

Trane acknowledged that DOE's findings were based on the EBM-Papst furnace model, which has a backward-inclined impeller blower system. Trane commented that the EBM-Papst system is not an impeller change, but a different blower system that produces a different air flow pattern from the forward-inclined impeller and is thus not able to be tested according to the same standards as a furnace fan with a forward-inclined impeller. Trane commented that for all manufacturers to adopt this system would require all safety, performance, and AFUE testing to be performed in order to put it into production, and furthermore, due to its need for an inlet orifice, this system limits the furnace's return air location to a single location (*i.e.,* left side, right side, or bottom). Trane added that higher air flow furnaces often need more than a single side return to perform properly for CFM and watts, and therefore adopting the EBM-Papst approach would not be possible for many furnace fan manufacturers. Trane commented that, for the reasons stated above and because it would reduce the utility of the furnace, the EBM-Papst system is unsuitable as a basis for comparison for adopting EL 1 among furnace fan manufacturers. (*Id.*) Furthermore, Trane commented that adapting all furnace fans to accommodate the EBM-Papst system would reduce the utility of the furnace and increase the installation time needed to move components to reach the return air location required by the system. Trane commented that the EBM-Papst system should have been analyzed as a separate EL level. (Trane, No. 22 at pp. 2–3)

Trane commented that testing would be required ahead of introducing the impeller change in order to determine the effects this difference would have on heat exchanger temperatures, furnace efficiency, and safety limit operation. Trane commented that according to DOE, housing design modifications were eliminated from consideration due to the resulting reduction in utility that such a change produces. Trane commented that the same logic should apply to an impeller change that creates a substantially different discharge velocity distribution. (Trane, No. 22 at p. 3)

Lennox commented that the application of backward-inclined impellers would require changes in the housing design and airflow patterns that DOE has already screened out in the TSD. Lennox further commented that changes in the airflow design will require redesign and retesting on a model-by-model basis to ensure proper operation, compliance with safety standards, and product reliability. (Lennox, No. 24 at p. 7)

AHRI commented that backward-inclined impellers require a larger diameter than the forward-inclined impellers they are intended to replace, stating that backward-inclined impellers will not fit in the cabinet of a fan with a forward-inclined impeller. They further commented that most all models will have to be redesigned to accommodate the larger impeller, adding that it will lead to housing design and airflow path modifications. AHRI stated DOE has acknowledged that modifications of housing design and airflow path have an adverse impact on furnace efficiency. (AHRI, No. 23 at p. 3)

AHRI commented that furnace cabinets are limited in size due to the dimensions of the installation space. AHRI stated that smaller-sized furnaces are at a disadvantage when it comes to meeting the required FER level because of the relationship between the furnace input level and the width of the furnace. AHRI commented that a change to the efficiency level to include backward-inclined impellers, coupled with the proposed future change to the minimum AFUE, would likely eliminate the smallest cabinet sizes from the marketplace without replacement furnace options or with reduced choices for consumers in cases where the smallest size model is required. (AHRI, No. 23 at p. 6)

The CA IOUs suggested that DOE refrain from implementing energy conservation standards that would require the use of backward inclined fans, as the CA IOUs could not identify furnaces incorporating backward-inclined fans available for purchase. (CA IOUs, No. 21 at p. 2)

In response, as discussed previously and as several commenters acknowledge, DOE is aware of backward-inclined impellers being used in other sectors of the HVAC industry and also in a small number of consumer furnace fan models available today. Therefore, DOE has found this design option to be technologically feasible. DOE identified and examined the models that currently use backward inclined impellers and did not identify any significant differences in cabinet dimensions, overall construction, or any indication of installation constraints as compared to similar models using a forward-curved impeller. As a result, DOE maintained backward-inclined impellers as a design option at max-tech for this analysis. However, given the limited number of consumer furnace fan models that this technology is currently used in, DOE recognizes that there are some uncertainties with applying it to the entire consumer furnace fans market and across the entire range of capacities, as pointed out by several commenters. As discussed in section V.C of this document, DOE is proposing not to amend standards and therefore use of a backward inclined impeller would not be required. While this decision is primarily based on the cost effectiveness of this design option at this time, DOE has also considered some analytical uncertainties, as discussed in sections IV.H and V.C of this document.

d. Summary of Efficiency Levels Analyzed

The efficiency levels and associated technologies analyzed for each class of consumer furnace fan are shown in Table IV.3 through Table IV.11.

TABLE IV.3—EFFICIENCY LEVELS AND TECHNOLOGIES USED AT EACH EFFICIENCY LEVEL FOR NWG–NC FANS

EL	FER equation	Description of technologies typically incorporated	Percent reduction in FER from baseline
0—Baseline	$0.044 * Q_{Max} + 182$	BPM Motor w/Forward-Curved Impeller	N/A
1—Max-tech	$0.04 * Q_{Max} + 164$	BPM Motor w/Backward-Inclined Impeller	10

TABLE IV.4—EFFICIENCY LEVELS AND TECHNOLOGIES USED AT EACH EFFICIENCY LEVEL FOR NWG–C FANS

EL	FER equation	Description of technologies typically incorporated	Percent reduction in FER from baseline
0—Baseline	$0.044 * Q_{Max} + 195$	BPM Motor w/Forward-Curved Impeller	N/A
1—Max-tech	$0.04 * Q_{Max} + 176$	BPM Motor w/Backward-Inclined Impeller	10

TABLE IV.5—EFFICIENCY LEVELS AND TECHNOLOGIES USED AT EACH EFFICIENCY LEVEL FOR WG–NC FANS

EL	FER equation	Description of technologies typically incorporated	Percent reduction in FER from baseline
0—Baseline	$0.044 * Q_{Max} + 199$	BPM Motor w/Forward-Curved Impeller	N/A
1—Max-tech	$0.04 * Q_{Max} + 179$	BPM Motor w/Backward-Inclined Impeller	10

TABLE IV.6—EFFICIENCY LEVELS AND TECHNOLOGIES USED AT EACH EFFICIENCY LEVEL FOR NWEF/NWMB FANS

EL	FER equation	Description of technologies typically incorporated	Percent reduction in FER from baseline
0—Baseline	$0.044 * Q_{Max} + 165$	BPM Motor w/Forward-Curved Impeller	N/A
1—Max-tech	$0.04 * Q_{Max} + 149$	BPM Motor w/Backward-Inclined Impeller	10

TABLE IV.7—EFFICIENCY LEVELS AND TECHNOLOGIES USED AT EACH EFFICIENCY LEVEL FOR MH–EF/MB FANS

EL	FER equation	Description of technologies typically incorporated	Percent reduction in FER from baseline
0—Baseline	$0.044 * Q_{Max} + 101$	BPM Motor w/Forward-Curved Impeller	N/A
1—Max—Tech	$0.04 * Q_{Max} + 91$	BPM Motor w/Backward-Inclined Impeller	10

TABLE IV.8—EFFICIENCY LEVELS AND TECHNOLOGIES USED AT EACH EFFICIENCY LEVEL FOR MH–NWG–NC FANS

EL	FER equation	Description of technologies typically incorporated	Percent reduction in FER from baseline
0—Baseline	$0.071 * Q_{Max} + 222$	Improved PSC Motor	N/A
1	$0.044 * Q_{Max} + 137$	BPM Motor w/Forward-Curved Impeller	39
2—Max-tech	$0.04 * Q_{Max} + 123$	BPM Motor w/Backward-Inclined Impeller	45

TABLE IV.9—EFFICIENCY LEVELS AND TECHNOLOGIES USED AT EACH EFFICIENCY LEVEL FOR MH–NWG–C FANS

EL	FER equation	Description of technologies typically incorporated	Percent reduction in FER from baseline
0—Baseline	$0.071 * Q_{Max} + 240$	Improved PSC Motor	N/A
1	$0.044 * Q_{Max} + 148$	BPM Motor w/Forward-Curved Impeller	39
2—Max-tech	$0.04 * Q_{Max} + 133$	BPM Motor w/Backward-Inclined Impeller	45

TABLE IV.10—EFFICIENCY LEVELS AND TECHNOLOGIES USED AT EACH EFFICIENCY LEVEL FOR NWO–NC FANS

EL	FER equation	Description of technologies typically incorporated	Percent reduction in FER from baseline
0—Baseline	$0.071 * Q_{Max} + 382$	Improved PSC Motor	N/A
1	$0.044 * Q_{Max} + 236$	BPM Motor w/Forward -Curved Impeller	39
2—Max-tech	$0.04 * Q_{Max} + 212$	BPM Motor w/Backward-Inclined Impeller	45

TABLE IV.11—EFFICIENCY LEVELS AND TECHNOLOGIES USED AT EACH EFFICIENCY LEVEL MH–NWO–NC FANS

EL	FER equation	Description of technologies typically incorporated	Percent reduction in FER from baseline
0—Baseline	$0.071 * Q_{Max} + 287$	Improved PSC Motor	N/A
1	$0.044 * Q_{Max} + 176$	BPM Motor w/Forward -Curved Impeller	39

TABLE IV.11—EFFICIENCY LEVELS AND TECHNOLOGIES USED AT EACH EFFICIENCY LEVEL MH–NWO–NC FANS—Continued

EL	FER equation	Description of technologies typically incorporated	Percent reduction in FER from baseline
2—Max-tech	0.04 * Q_{Max} + 158	BPM Motor w/Backward-Inclined Impeller	45

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 consumer furnace fans 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 present case, DOE conducted its cost analysis using a combination of physical and catalog teardowns to assess how manufacturing costs change with increased product efficiency. DOE estimated the MPC associated with each efficiency level to characterize the cost-efficiency relationship of improving consumer furnace fan performance. The MPC estimates are not for the entire HVAC product. Because consumer furnace fans are a component of the HVAC product in which they are integrated, the MPC estimates include costs only for the components of the HVAC product that impact FER.

Products were selected for physical teardown analysis that have characteristics of typical products on the market at a representative input capacity of 80,000 Btu/h for the NWG–NC, NWG–C, WG–NC, NWEF/NWMB, MH–NWG–NC, MH–NWG–C, MH–EF/MB, and MH–WG product classes and 105,000 Btu/h for the NWO–NC and MH–NWO product classes (determined based on market data and discussions with manufacturers). Selections spanned a range of FER efficiency levels and designs and included most manufacturers. The resulting bill of materials provides the basis for the manufacturer production cost (''MPC'') estimates.

To account for manufacturers' non-production costs and profit margin, DOE applies a multiplier (the manufacturer markup) to the MPC. The resulting manufacturer selling price (''MSP'') is the price at which the manufacturer distributes a unit into commerce. DOE developed an average manufacturer markup by examining the annual Securities and Exchange Commission (''SEC'') 10–K reports filed by publicly-traded manufacturers primarily engaged in HVAC manufacturing and whose combined product range includes consumer furnace fans. DOE refined its understanding of manufacturer mark-ups by using information obtained during manufacturer interviews. The manufacturer mark-ups were used to convert the MPCs into MSPs. Further information on this analytical methodology is presented in the following subsections.

a. Teardown Analysis

To assemble bills of materials (''BOMs'') and to calculate manufacturing costs for the different components in consumer furnace fans, multiple units were disassembled into their base components, and DOE estimated the materials, processes, and labor required to manufacture each individual component, a process referred to as a ''physical teardown.'' Using the data gathered from the physical teardowns, each component was characterized according to its weight, dimensions, material, quantity, and the manufacturing processes used to fabricate and assemble it.

For supplementary catalog teardowns, product data were gathered, such as dimensions, weight, and design features from publicly available information, such as manufacturer catalogs. Such ''virtual teardowns'' allowed DOE to estimate the major physical differences between a product that was physically disassembled and a similar product that was not. For this NOPD, data from a total of 61 physical and virtual teardowns of consumer furnace fans were used to calculate industry MPCs in the engineering analysis.

The manufacturers of units chosen for teardowns have large market shares in the particular product classes for which their teardown units are categorized. Whenever possible, DOE examined multiple models from a given manufacturer that capture different design options and used them as direct points of comparison. DOE examined products with PSC, CT–BPM, and CA–BPM indoor blower motors, as well as products using single-stage, two-stage, and modulating combustion systems. As further discussed in section IV.B.2.b of this document, cost values were developed for some of these technologies to estimate the manufacturing cost of changing designs from one technology to another (*i.e.,* using a CA–BPM instead of a CT–BPM, or two-stage combustion instead of single-stage combustion).

b. Cost Estimation Method

The costs of individual models are estimated using the content of the BOMs (*i.e.,* relating to materials, fabrication, labor, and all other aspects that make up a production facility) to generate MPCs. The resulting MPCs include costs such as overhead and depreciation, in addition to materials and labor costs. DOE collected information on labor rates, tooling costs, raw material prices, and other factors to use as inputs into the cost estimates. For purchased parts, DOE estimates the purchase price based on volume-variable price quotations and detailed discussions with manufacturers and component suppliers. Furnace fans are a component of HVAC products that include other products not associated with the cost and/or efficiency of the furnace fan. Therefore, DOE focused its engineering analysis on the components that comprise the furnace fan assembly, including:

- Fan motor and integrated controls (as applicable);
- HVAC product control board;
- Impeller;
- Single-staging or multi-staging components and controls;
- Fan housing; and
- Components used to direct or guide airflow.

For parts fabricated in-house, the prices of the underlying ''raw'' metals (*e.g.,* tube, sheet metal) are estimated on the basis of 5-year averages to smooth out spikes in demand. For purchased parts, DOE estimated the purchase prices paid to the OEMs of these parts, based on discussions with manufacturers during confidential interviews. Whenever possible, DOE obtained price quotes directly from the component suppliers used by furnace fan manufacturers whose products were examined in the engineering analysis. DOE determined that the components in Table IV.12 are generally purchased from outside suppliers.

TABLE IV.12—PURCHASED FURNACE FAN COMPONENTS

Assembly	Purchased sub-assemblies or components
Fan Assembly.	Fan motor.
	Motor capacitor (when applicable).
	Impeller.
Controls	PCB.
	Multi-Staging Components (when applicable).

Raw materials, such as plastic resins and insulation materials, are estimated on a current-market basis. The costs of raw materials are determined based on manufacturer interviews, quotes from suppliers, and secondary research. Past results are updated periodically and/or inflated to present-day prices using indices from resources such as MEPS Intl.,[10] PolymerUpdate,[11] the U.S. geologic survey (''USGS''),[12] and the Bureau of Labor Statistics (''BLS'').[13] To smooth out spikes in demand, these prices are estimated on the basis of 5-year averages spanning from 2018 through 2022. Other ''raw'' materials such as plastic resins, insulation materials, etc. are estimated on a current-market basis. For non-metal raw material prices, DOE used prices based on current market data, rather than a 5-year average, because non-metal raw materials typically do not experience the same level of price volatility as metal raw materials.

Certain factory parameters, such as fabrication rates, labor rates, and wages, also affect the cost of each unit produced. DOE factory parameter assumptions were based on internal expertise and manufacturer feedback. Table IV.13 lists the factory parameter assumptions used in the cost model for both high-volume and low-volume manufacturers. For the engineering analysis, these factory parameters, including production volume, are the same at every efficiency level. The production volume used at each efficiency level corresponds with the average production volume, per manufacturer. These assumptions are generalized to represent typical production and are not intended to model a specific factory. For the NWG–NC, NWG–C, WG–NC, NWEF/NWMB, MH–NWG–NC, MH–NWG–C, and MH–EF/MB product classes, high production volume parameters were assumed due to these classes having generally high production volumes or using enough of the same major components as other high production volume classes. For NWO–NC and MH–NWO product classes, low production parameters were assumed.

TABLE IV.13—FACTORY PARAMETER ASSUMPTIONS

Parameter	High-volume furnace fan estimate	Low-volume furnace fan estimate
Actual Annual Production Volume (units/year)	1,250,000	5,000.
Purchased Parts Volume	500,000 units/ year.	5,000 units/year.
Work Days Per Year (days)	250	250.
Assembly Shifts Per Day (shifts)	2	1.
Fabrication Shifts Per Day (shifts)	2	2.
Fabrication Labor Wages ($/h)	16	16.
Assembly Labor Wages ($/h)	16	16.
Length of Shift (hrs)	8	8.
Average Equipment Installation Cost (% of purchase price)	10%	10%.
Fringe Benefits Ratio	50%	50%.
Indirect to Direct Labor Ratio	33%	33%.
Average Scrap Recovery Value	30%	30%.
Worker Downtime	10%	10%.
Building Life (in years)	25	25.
Burdened Assembly Labor Wage ($/h)	24	24.
Burdened Fabrication Labor Wage ($/h)	24	24.
Supervisor Span (workers/supervisor)	25	25.
Supervisor Wage Premium (over fabrication and assembly wage)	30%	30%.

In response to the November 2022 Preliminary Analysis, Morrison commented that labor costs and supervisory costs are not reflective of the current reality, adding that basic factory jobs pay well over $20/hour.

[10] For more information on MEPS Intl, please visit *www.mepsinternational.com/gb/en* (Last accessed March 21, 2023).

[11] For more information on PolymerUpdate, please visit *www.polymerupdate.com* (Last accessed March 21, 2023).

[12] For more information on USGS metal price statistics, please visit *www.usgs.gov/centers/national-minerals-information-center/commodity-statistics-and-information* (Last accessed March 21, 2023).

[13] For more information on the BLS producer price indices, please visit *www.bls.gov/ppi/* (Last accessed March 21, 2023).

Morrison commented that development, testing, and requalification costs need to be added. Morrison further commented that the costs from the engineering results are only for the fan components, adding that fan and housing changes will change heat exchanger performance/safety controls. (Morrison, No. 27 at p. 3)

In response to the comments from Morrison, DOE notes that the factory parameters outlined in chapter 5 of the November 2022 Preliminary Analysis TSD, including labor and supervisory costs, are developed based on manufacturer feedback. Available data indicates that the values provided in Table IV.13 are representative of the industry average, but DOE acknowledges that they may vary depending on a variety of factors. DOE welcomes additional feedback and data regarding these costs that would better reflect the current market. With respect to development, testing, and requalification costs, DOE notes that those costs are typically accounted for in the manufacturer impact analysis portion of DOE rulemakings. However, because DOE is not proposing to amend standards in this rulemaking, the manufacturer impact analysis was not conducted for this NOPD.

Constant Airflow BPM Blower Motor Cost Values

As discussed in section IV.B.1.a of this document, for the NWG–NC, NWG–C, WG–NC, MWEF/NWMB, and MH–WF/MB product classes, the current baseline motor technology is a BPM motor, and specifically a CT–BPM motor. DOE's research suggests that the predominant BPM indoor blower motors sold on the market today are either a constant-torque or constant-airflow design. Both types of motors rely on electronic variable-speed motor systems that are typically mounted in an external chassis to the back of the motor. CA–BPM motors utilize feedback control to adjust torque based on ESP in order to maintain a desired airflow. This differentiates them from CT–BPM motors that will maintain torque and likely decrease airflow output in environments with high ESPs. Additionally, CA–BPM motors use feedback control to vary their output to maintain pre-programmed air flows. DOE has tentatively found that there are no significant differences in measured FER performance between furnace fans using CA–BPM and CT–BPM motors; however, CA–BPM motors are sometimes chosen for other benefits, such as increased consumer comfort. CA–BPM fan motors typically cost more than CT–BPM motors while not improving FER. Therefore, as discussed in section IV.B.1.a, DOE considered the baseline design to include CT–BPM motors for the NWG–NC, NWG–C, WG–NC, NWEF/NWMB, and MH–EF/MB classes. However, to better represent costs to consumers, DOE has developed cost values for CA–BPM that are applied in the LCC analysis to a portion of furnace fan installations.

TABLE IV.14—INCREMENTAL COST ADDERS FOR BPM MOTORS

Product class	Incremental cost increase for CT–BPM to CA–BPM *(2022$)*
NWG–C, NWG–NC, WG–NC, NWEF/NWMB, MH–NWG–NC, MH–NWG–C, and MH–EF/MB	$28.07
NWO–NC, MH–NWO–NC	83.67

Multi-Stage Furnaces

As discussed in section IV.A.2 of this document, DOE has identified a number of furnace fans in two-stage and modulating furnaces that are rated at the same relative FER as single-stage furnaces. DOE has tentatively determined consumers choose to purchase multi-stage products for the additional thermal comfort offered by furnaces with multiple stages of heating output. During teardowns, DOE examined multi-stage furnace designs to analyze the production cost differential for manufacturers to switch from single-stage to two-stage or modulating combustion. DOE determined a market-share weighted-average marginal cost increase of $21.07 for the NWG–C, NWG–NC, WG–NC, NWEF/NWMB, MH–NWG–NC, MH–NWG–C, and MH–EF/MB classes to change a furnace from a single-stage to a two-stage design. DOE determined that oil units with multi-staging were rare and thus not representative of the market, so adders were not developed for the NWO–NC and MH–NWO–NC product classes. Where applicable, the additional cost to change to a two-stage furnace includes the added cost of a two-stage gas valve, two-speed inducer assembly, additional pressure switch, and additional controls and wiring. As with the blower motor costs discussed above, the additional cost of a multi-stage burner is accounted for in the LCC analysis based on the market penetration of such designs for furnaces.

Scaling to Alternative Input Capacities

DOE also developed equations generate adders for scaling the MPC results at the representative capacity to the full range of input capacities available on the market for each motor type. DOE performed regression analyses on the discrete MPCs for each teardown and their respective input capacities—which spanned a range of capacities and airflows and encompassed a range of motor sizes—to generate an equation for each motor technology that reflects the relationship between these parameters. These parameters were derived separately for high-volume (NWGF–C, NWGH–NC, MH–NWGF–NC, MH–NWGF–C, and WGF–NC) and low-volume (NWOF–NC and MH–NWOF–NC) product classes These equations, which are presented in Table IV.15, are used in the LCC analysis (*see* section IV.E of this document) to analyze the impacts on furnace fans over the full range of input capacities. To estimate the MPC at a given input, first the appropriate adder is calculated using the equation and then the result added to or subtracted from (as applicable) the MPC at the representative input capacity.

In the November 2022 Preliminary Analysis, DOE also estimated the relationship between consumer furnace fan cost and furnace fan motor airflow. However, DOE did not do so for this NOPD analysis because, upon reviewing market data, DOE found that scaling only by input capacity sufficiently represented the entire furnace fan market (including across the range of airflows) so it was unnecessary to also scale by airflow.

TABLE IV.15—EQUATIONS FOR SCALING MPCS TO ADDITIONAL INPUT CAPACITIES

Input capacity MPC adder equation: MPC adder = slope * (representative capacity (kBtu/h)—input capacity (kBtu/h))

	NWGF–C, NWGF–NC, MH–NWGF–NC, MH–NWGF–C, WGF–NC	NWOF–NC and MH–NWOF–NC
Motor Technology	Slope	Slope
PSC	0.0650	0.7031
Constant-torque BPM	0.1395	0.6272
Constant-airflow BPM	0.1603	1.0069

Backward-Inclined Impellers

For the max-tech efficiency levels, DOE estimated the cost to manufacture a backward inclined impeller by using manufacturer feedback along with photographs and specifications found in research reports to determine cost model inputs to estimate the MPCs of the backward-inclined impeller. These costs were scaled to different capacities by evaluating the impact of the backward-inclined impeller on the overall furnace system, depending on the average cabinet width at that capacity. DOE estimated the manufacturing cost of implementing a backward inclined impeller and compared it to the cost of using the forward inclined impellers that are ubiquitous in furnace fans currently on the market to develop ''adders'' for backward inclined impellers. The cost adder for backward-inclined impellers at each capacity were applied at the max-tech level to estimate the MPC and are outlined in Table IV.16 of this document.

TABLE IV.16—BACKWARD-INCLINED IMPELLER ADDER

Input capacity (kBtu/h)	High volume (2022$)	Low volume (2022$)
40	28.60	34.15
60	34.93	41.71
80	37.21	44.43
100	55.18	65.89
120	59.09	70.56

In response to the November 2022 Preliminary Analysis, Morrison requested clarification on how DOE concluded that the additional MPC for a backward-inclined impeller would amount to $22.57. (Morrison, No. 27 at p. 4) Morrison also recommended that DOE reevaluate the process by which it estimates the costs associated with designing and manufacturing a backward-inclined impeller. Morrison commented that a full evaluation of design, tools, and process would be needed to assess if the technology can meet the expected volume. Morrison recommended that DOE's analysis consider cost increases for the following: (1) necessary housing improvements required to realize potential backward-inclined impeller value; (2) increased strength for motor/fan assembly mounting hardware, which will ensure tighter gaps between inlet and impeller and support of the larger impeller; (3) the equipment changes required to accommodate heat exchanger redesign or safety testing/requalification; and (4) factory parameters. Morrison commented that certain installation considerations should be addressed, including: (1) the need for shipping brackets or added stiffening to account for the larger impeller and (2) the need for tighter clearances between impeller and housing to avoid damage during handling. (Morrison, No. 27 at pp. 3, 4)

AHRI commented that backward-inclined impellers are often larger than comparable forward-inclined impellers, have increased sensitivity to ESP, and require more sophisticated controls, which will affect the overall energy use of the product. (AHRI, No. 23 at p. 6) AHRI stated that the addition of complex controls was not included in DOE's cost analysis, which skews the economic analysis. (AHRI, No. 23 at p. 3)

Trane added that the cost of incorporating the full EBM-Papst system was not included in the TSD as it is not just a matter of replacing the impeller.) Trane commented the TSD assumed that only the impeller was changed and the cost estimate ignored the need for inlet cones with close tolerances. Trane commented that those estimates would be difficult to confirm because the design still needs to be developed. Trane commented that, as published, the TSD cost estimates and energy savings showed 44 to 48 percent of NWG furnace consumers negatively affected and when the full cost of the change is included, Trane believed these results will be found to be understated. (Trane, No. 22 at pp. 2–3)

Lennox commented that the cost and labor required for installing backward-inclined impellers in current furnace designs are not fully accounted for in the TSD. Lennox commented that backward-inclined impellers are a nascent technology that requires a larger diameter or higher rotational speed than a centrifugal forward-curved impeller, adding that backward-inclined impellers are more sensitive to changes in ESP and likely require motors with extended RPM range and controls. Lennox further commented that installing a backward-inclined impeller would require significant furnace redesign that includes modifications in housing design and airflow path, both of which DOE has acknowledged adversely impact furnace efficiency. Lennox commented that the study DOE cites in the TSD (*i.e.,* Wegman, Herman 2003 HVAC Blower Report) was conducted prior to when residential furnace designs became more compact in height to accommodate larger evaporator coil designs required to meet increased DOE conservation standards, and that DOE should take into account the redesign, safety testing, and other costs placed upon the consumer before considering implementing the proposed changes. (Lennox, No. 24 at p. 3)

In response, DOE clarifies that the MPC estimate for backward-inclined impellers from the November 2022 Preliminary Analysis was based on a prototype used in research performed by General Electric and testing performed at national laboratories.[14] However, for this rulemaking, DOE has incorporated manufacturer feedback and new market data to update its MPC estimates for backward-inclined impellers, as

[14] The backward-inclined impeller prototype used for these estimates is detailed in a report titled *California's Secret Energy Surplus: The Potential for Energy Efficiency.* (Available at: *search.issuelab.org/resource/california-s-secret-energy-surplus-the-potential-for-energy-efficiency.html*) (Last accessed June 7, 2023).

reported in Tables IV.17—IV.19 of this document. These costs have been updated to reflect costs to the full furnace system beyond replacing the impeller component (including advanced controls, changes to the airflow path, etc.), but DOE acknowledges that given the current limited use of this technology in consumer furnace fans there is still uncertainty in how the technology would be applied over the full range of products currently available.

DOE did not extend the analysis to account for changes in tolerances and redesign of the heat exchanger and other furnace systems. In manufacturer interviews, some manufacturers noted that airflow changes associated with backward-inclined impellers could require a different approach to heat exchanger designs. These changes could necessitate large conversion costs as manufacturing to tight tolerances and introducing new heat exchanger designs are capital intensive endeavors. DOE recognizes the potential need for upfront capital investments and product conversion costs in addition the estimated changes in MPC, as discussed in section IV.H of this document.

3. Cost-Efficiency Results

The final results of the FER engineering analysis are the MPCs for each furnace fan product class analyzed at each efficiency level (and associated design option), resulting in a cost-efficiency relationship. The cost-efficiency results are shown in tabular form in Table IV.17 through Table IV.19 in the form of efficiency versus MPC. (Q_{Max} is the airflow, in cfm, at the maximum airflow-control setting measured during the proposed DOE test procedure.) As described in section IV.B.2.b of this document, the MPC presented is not for the entire HVAC product because furnace fans are a component of the HVAC product in which they are integrated.

As discussed in section IV.B.2.b of this document, separate cost values were developed for constant-airflow BPM motors and multi-staging because these premium design elements could add comfort or provide other benefits but were not incorporated as design options into efficiency levels for furnace fans used in this analysis.

DOE used the cost-efficiency curves from the engineering analysis as an input to the LCC analysis to determine the added price of the more efficient furnace fan components in HVAC equipment sold to the customer (*see* section IV.E of this document).

TABLE IV.17—COST EFFICIENCY RESULTS BY PRODUCT CLASS—NWG–NC, NWG–C, WGF–NC, NWEF/NWMB, AND MH–EF/MB

	Efficiency level	
	Design option	
	Baseline	EL 1
	BPM motor	BPM motor + backward-inclined impeller
MPC	$108.06	$136.13.
Product Class	Maximum Allowable FER Equation	
NWG–NC	$0.044 * Q_{Max} + 182$	$0.04 * Q_{Max} + 164$.
NWG–C	$0.044 * Q_{Max} + 195$	$0.04 * Q_{Max} + 176$.
WG–NC	$0.044 * Q_{Max} + 199$	$0.04 * Q_{Max} + 179$.
NWEF/NWMB	$0.044 * Q_{Max} + 165$	$0.04 * Q_{Max} + 149$.
MH–EF–MB	$0.044 * Q_{Max} + 101$	$0.04 * Q_{Max} + 91$.

TABLE IV.18—COST EFFICIENCY RESULTS BY PRODUCT CLASS—MH–NWG–NC AND MH–NWG–C

	Efficiency level		
	Design option		
	Baseline	EL 1	EL 2
	Improved PSC	BPM motor	BPM motor + backward-inclined impeller
MPC	$82.39	$108.06	$136.13.
Product Class	Maximum Allowable FER Equation		
MH–NWG–NC	$0.071 * Q_{Max} + 222$	$0.044 * Q_{Max} + 137$	$0.04 * Q_{Max} + 123$.
MH–NWG–C	$0.071 * Q_{Max} + 240$	$0.044 * Q_{Max} + 148$	$0.04 * Q_{Max} + 133$.

TABLE IV.19—COST EFFICIENCY RESULTS BY PRODUCT CLASS—NWO–NC AND MH–NWO–NC

	Efficiency level		
	Design option		
	Baseline	EL 1	EL 2
	Improved PSC	BPM motor	BPM motor + backward-inclined impeller
MPC	$195.61	$216.95	$300.62.
Product Class	Maximum Allowable FER Equation		
NWO–NC	0.071 * Q_{Max} + 382	0.044 * Q_{Max} + 236	0.04 * Q_{Max} + 212.
MH–NWO–NC	0.071 * Q_{Max} + 287	0.044 * Q_{Max} + 176	0.04 * Q_{Max} + 158.

In response to the November 2022 Preliminary Analysis, Morrison commented that the average consumer purchase price increase of $46–47 that DOE projects for consumer fans operating at EL 1 appears to be understated, considering the changes and variances in motor costs depending on whether production occurs in the United States or abroad. Morrison requested clarification on how DOE arrived at that estimate. Morrison commented that certain installation considerations should be addressed, including: (1) the need for shipping brackets or added stiffening to account for the larger impeller and (2) the need for tighter clearances between impeller and housing to avoid damage during handling. (Morrison, No. 27 at p. 4)

In response, DOE notes that the analysis to develop MPCs for each efficiency level includes physical and virtual product teardowns of units that incorporate the technology options associated with that level. Specific motor costs are estimated using cost estimates obtained through manufacturer feedback, including impacts from production location and volume. The costs for these teardowns are then weighted based on several factors, including manufacturer market share and motor horsepower market share. By using the weighted average of these teardown costs, DOE develops an MPC that is representative of the market and takes into account the variation in the market.

Nidec commented during the public meeting that the motor prices for the preliminary analysis indicated a dramatic increase from a baseline PSC to an improved PSC when compared to a BPM motor. Nidec commented that the November 2022 Preliminary Analysis reported a baseline PSC cost of around $65, an ECM cost of $100, and an improved PSC cost of $116. Nidec commented that estimates showed a 90 percent increase in cost for the improved PSC versus the BPM. (Nidec, Public Meeting Transcript, No. 26 at pp. 19–20)

In response, DOE notes that the $65.73 cost reported in the November 2022 Preliminary Analysis reflects the MPC for a furnace fan using an improved PSC motor in the NWGF–C, NWGF–NC, MH–NWGF–NC, MH–NWGF–C, WGF–NC and NWEF/NWMB product classes, and does not reflect a baseline PSC motor cost. In the November 2022 Preliminary Analysis, DOE estimated that the MPC for a furnace fan using an improved PSC motor in the NWOF–NC and MH–NWOF–NC product classes was $116.25. Therefore, the difference between these two costs does not reflect the incremental cost to transition from a baseline PSC motor to an improved PSC motor, but instead reflects the difference in cost of an improved PSC motor for the different product classes. This difference is largely due to the different production volumes assumed for the classes, as outlined in section IV.B.2 of this document.

C. Markups Analysis

The markups analysis develops appropriate markups (*e.g.,* 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. At each step in the distribution channel, companies mark up the price of the product to cover business costs and profit margin. Before developing markups, DOE defines key market participants and identifies distribution channels.

DOE used the same distribution channels for furnace fans as it used for furnaces in the recent energy conservation standards rulemaking for those products. DOE believes that this is an appropriate approach because the vast majority of the furnace fans covered in this rulemaking are a component of a furnace. DOE has concluded that there is insufficient evidence of a replacement market for furnace fans to establish a separate distribution channel on that basis.

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.[15]

To estimate average baseline and incremental mark-ups, DOE relied on several sources, including: (1) the HARDI 2013 Profit Report (*i.e.,* for wholesalers); and (2) U.S. Census Bureau 2017 Economic Census data on the residential and commercial building construction industry (*i.e.,* for general contractors, mechanical contractors, and mobile home manufacturers). In addition, DOE used the 2005 Air Conditioning Contractors of America's (''ACCA'') Financial Analysis on the Heating, Ventilation, Air-Conditioning, and Refrigeration contracting industry to disaggregate the mechanical contractor mark-ups into replacement and new construction markets. DOE also used various sources for the derivation of the mobile home dealer mark-ups (see chapter 6 of the PA TSD).

DOE derived state and local taxes from data provided by the Sales Tax

[15] 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.

Clearinghouse.[16] These data represent weighted averages that include county and city rates. DOE applied the state sales taxes to match the state-level markups for wholesalers and mechanical and general contractors.

Chapter 6 of the PA TSD provides details on DOE's development of markups for consumer furnace fans.

Lennox recommended that DOE review the lower incremental markups for increased consumer furnace fan standard levels considered in the TSD. Lennox stated that Table ES.3.10 from the TSD shows a significantly discounted incremental markup from the baseline markup, which is not logical or aligned with business practices. Lennox commented that it does not believe an increased standard level would result in a lower markup for minimum efficiency products from the current base levels. Lennox recommended that a consistent markup level be applied instead of discounted incremental markups. (Lennox, No. 24 at p. 7–8)

DOE's incremental markup approach assumes that an increase in profitability, which is implied by keeping a fixed markup when the product price goes up, is unlikely to be viable over time in reasonably competitive markets. DOE recognizes that actors in the distribution chains are likely to seek to maintain the same markup on appliances in response to changes in manufacturer sales prices after an amendment to energy conservation standards. However, DOE believes that retail pricing is likely to adjust over time as those actors are forces to readjust their markups to reach a medium-term equilibrium in which per-unit profit is relatively unchanged before and after standards are implemented.

DOE acknowledges that markup practices in response to amended standards are complex and vary across business conditions. However, DOE's analysis necessarily only considers changes in appliance offerings that occur in response to amended standards. DOE continues to maintain that its assumption that standards do not facilitate a sustainable increase in profitability is reasonable.

D. Energy Use Analysis

The purpose of the energy use analysis is to determine the annual energy consumption of consumer furnace fans 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 consumer furnace fan efficiency. The energy use analysis estimates the range of energy use of consumer furnace fans in the field (*i.e.,* as they are actually used by consumers). The energy use analysis provides the basis for other analyses DOE performed, particularly assessments of the energy savings and the savings in consumer operating costs that could result from adoption of amended or new standards.

To establish a reasonable range of energy consumption for consumer furnace fans, DOE primarily used data from the U.S. Energy Information Administration's (EIA's) most recent 2015 Residential Energy Consumption Survey (RECS 2015). RECS 2015 is a national sample survey of housing units that collects statistical information on the consumption of and expenditures for energy in housing units, along with data on energy-related characteristics of the housing units and occupants. RECS 2015 has a sample size of 5,686 housing units and was constructed by EIA to be a national representation of the household population in the United States. DOE also considered the use of consumer furnace fans in commercial applications, based on characteristics from EIA's most recent 2012 Commercial Building Energy Consumption Survey (CBECS 2012) for a subset of building types that use consumer furnace fans covered by a potential standard. DOE utilized additional data sources to refine the development of a representative population of buildings for each furnace fan product class, as detailed in chapter 7 of the PA TSD.

In calculating the energy consumption of furnace fans, DOE adjusted the energy use from RECS 2015 and CBECS 2012 to normalize for weather. This was accomplished by adjusting the RECS 2015 household and CBECS 2012 building energy consumption values based on 10-year average heating degree-day (HDD) and average cooling degree-day (CDD) data for each geographical region. DOE also accounted for the change in building shell characteristics by applying the building shell efficiency index and projected trend in the HDD and CDD in EIA's Annual Energy Outlook 2023.

DOE's analysis takes into account ACCA Manuals J, S, and D methods to size every household and building in the sample. DOE first uses Manual J to estimate the house or building design heating load in order to determine the blower requirements for the assigned heating and cooling equipment. DOE's analysis considers that typically the furnace fan is sized based on the maximum cooling capacity required. The heating and cooling furnace fan speed setting is then varied to match the recommended/required airflow performance and takes into account differences in the ductwork system curve in the field.

Chapter 7 of the PA TSD provides details on DOE's energy use analysis for consumer furnace fans.

WM technologies requested information regarding DOE's use of RECS data and stated that RECS has stated that the 2015 imputation rates have a variability of 65.6 percent. (WM Technologies, No. 26 at pp. 31–32)

In response, DOE notes that EIA administers the RECS to a nationally representative sample of U.S. housing units. For RECS 2015, specially trained interviewers collected energy characteristics on the housing unit, usage patterns, and household demographics. This information is combined with data from energy suppliers to these homes to estimate energy costs and usage for heating, cooling, appliances, and other end uses. The RECS survey data, including energy use, is an integral ingredient of EIA's Annual Energy Outlook (AEO) and Monthly Energy Review (MER). EIA's methodology for RECS 2015 is described in multiple reports.[17] As described in these reports, RECS 2015 represents a substantial update to the end-use modeling and calibration methods. For example, in the 2015 RECS, the end-use models follow an engineering approach, and the calibration—which follows a minimum variance estimation approach—is based on the relative uncertainties of and correlations between the end uses being estimated. Instead of estimating unknown parameters and interpreting their solution values as in statistical modeling, engineering models improve upon statistical models by drawing on existing studies. Also, engineering models lead to more realistic variations across modeled housing units. In addition, calibration procedures in RECS 2015 use minimum variance estimation, which better incorporates household characteristics data uncertainty and recognizes correlations between end uses. DOE notes that households that use natural gas, propane, or fuel oil predominantly use these fuels for space heating and water heating. In the case of space heating, it is heavily seasonal, while water heating

[16] Sales Tax Clearinghouse Inc., State Sales Tax Rates Along with Combined Average City and County Rates (Jan. 4, 2023). (Available at *www.thestc.com/STrates.stm*) (Last accessed Jun. 1, 2023).

[17] See *www.eia.gov/consumption/residential/data/2015/index.php?view=methodology* (Last accessed Jan. 3, 2023).

remains more constant throughout the year.

For the furnace fan energy use analysis, DOE primarily used the RECS 2015 sample to derive the heating and cooling loads to estimate furnace fan operating hours in the cooling and heating mode. DOE also notes that the variables used from RECS 2015 that are used for the furnace fan analysis have low imputation rates. DOE determined the 95-percent confidence level for the overall average heating and cooling energy use values used in its analysis for consumer furnace fans to be plus or minus 2.7 percent, using EIA's methodology for calculating sampling error.[18] DOE also compared the RECS 2015 energy consumption estimates for furnaces to previous RECS energy consumption estimates and other available studies, and the Department found that energy consumption values estimated in 2015 are similar (or within in the RECS 2015 sampling error) of those other sources, after being adjusted for heating degree-day differences, building shell changes in the stock, and average furnace efficiency in the stock. This analysis included comparing homes using consumer furnaces by home sizes and type in the different studies, including larger sample sized studies at the national level such as the 2021 American Community Survey (ACS),[19] the 2021 American Housing Survey (AHS),[20] the 2022 American Home Comfort Study,[21] as well as regional studies such as the 2016–2017 Residential Building Stock Assessment (RBSA) for the northwest region (Idaho, Montana, Oregon, and Washington),[22] the 2019 Residential Building Stock Assessment for the State of New York,[23] the Massachusetts Residential Baseline Study,[24] and the 2019 California Residential Appliance Saturation Study (RASS).[25] In conclusion, DOE finds that RECS 2015 matches other studies' energy use estimates for furnace and is a reliable source for DOE to use to create a representative national sample reflecting variations in real world energy use. See appendix 7A and 7B of the PA TSD for more details.

Morrison commented that DOE noted the CBECS 2012 and RECS 2015 values for HDD and CDD to be different for the same location, and requested further details that would clarify how the same location can have different heating and cooling loads for residential furnaces. (Morrison, No. 27 at p. 6) In response, DOE notes that in the PA TSD Table 7E.3.1 shows the HDD for each of the 360 weather stations in the NOAA data set that DOE used for mapping to RECS 2015 and CBECS 2012 individual sampled housing units and buildings. The columns labeled RECS 2015 shows CDD and HDD for 2015 that would then be comparable to the HDD/CDD data provided by EIA in the RECS 2015 sample. Similarly, the columns labeled CBECS 2012 shows CDD and HDD for 2012 that would then be comparable to the HDD/CDD data provided by EIA in the CBECS 2012 sample.

Morrison requested further insight and verification of DOE's claim that the electric motor's power is ''taken into account by increasing the heating load, decreasing the cooling load or both for more efficient furnace fans.'' (Morrison, No. 27 at p. 3) In addition, Morrison requested clarification on how DOE calculated circulation mode power and how it accounts for the varying levels of beneficial (for heating) and detrimental (for cooling) power use in the circulating-only mode. Morrison commented that since there is rarely no demand for either, the split would be about 50/50—half the time the power usage will be beneficial and half the time detrimental for the household. (Morrison, No. 27 at p. 4)

DOE clarifies that the energy use analysis takes into account that heat is being transferred from the furnace fan motor to the airflow in the ductwork. Since higher efficiency furnace fan design options improve motor efficiency, less heat is released into the ductwork for higher efficiency designs. The heat provided by the motor reduces the heating load and increases the cooling load that the furnace needs to meet. Therefore, the heat load is increased, while cooling load is decreased for higher efficiency designs furnace fan options. For example, for NWOFs the average fuel energy use for going from EL 0 to EL 1 is increased by about 1 MMBtu/yr on average (or 1.6%), while the fuel energy use from going from EL 1 to EL 2 is increased by 0.2 MMBtu/y (or about 0.3%). DOE also took into account the beneficial (for heating) and detrimental (for cooling) power use in the circulating-only mode by estimating the monthly energy use for circulating-only mode and separating the months into heating, cooling, or shoulder months for each sampled household.

Morrison requested clarification on some of the equations and variables that DOE utilized in the TSD. Specifically, Morrison commented on the following: (1) it is not possible to reconcile equations 7.3, 7.4, and 7.5, because the same coefficients are used to set up the incongruent state of cfm = watts/cfm; and (2) DOE's use of the pressure variable in place of the more typical cfm variable when assessing curves, considering that a reduction in flow—when not required—will reduce fan energy consumption and a reduction of only 3 percent in flow will be equal to 10 percent in energy savings. (Morrison, No. 27 at p. 3–4) As explained in chapter 7 and appendix 7B–D of the PA TSD, the performance curves of CFM vs. pressure (equation 7.3) and watts per cfm (equation 7.5) are combined in the fan power curve equation (equation 7.4) to produce the wattage usage at the operating point.

Morrison commented that it identified inconsistencies regarding DOE's assumptions about consumer use and need. Morrison recommended that DOE take into account the use of furnaces by some consumers as a backup to heat pumps and therefore a secondary heat source. Morrison further noted that, in Table 7A.2.1 and Table 7A.2.2 in the PA TSD, Morrison identified an inconsistent relationship in the data from RECS 2015 showing reported replacements for various product classes; Morrison requested clarification on this uneven relationship between shipment numbers and numbers of households. (Morrison, No. 27 at p. 5) In response, DOE takes into account gas-fired furnaces used for backup to heat pumps as well as furnaces used as secondary equipment in its analysis. The sample for consumer furnace fans

[18] See *www.eia.gov/consumption/residential/data/2015/pdf/microdata_v3.pdf* (Last accessed Jan. 3, 2023).

[19] U.S. Census Bureau, 2021 American Community Survey (Available at: *www.census.gov/programs-surveys/acs*) (Last accessed Jan. 3, 2023).

[20] Department of Housing and Urban Development (HUD) and U.S. Census Bureau, 2021 American Housing Survey (Available at: *www.census.gov/programs-surveys/ahs.html*) (Last accessed Jan. 3, 2023).

[21] Decision Analyst, 2022 American Home Comfort Study (Available at: *www.decisionanalyst.com/syndicated/homecomfort/*) (Last accessed Jan. 3, 2023).

[22] NEEA, 2016–2017 Residential Building Stock Assessment (Individua Reports for Single Family, Manufactured Homes and Multifamily Homes) (Available at: *neea.org/data/residential-building-stock-assessment*) (Last accessed Jan. 3, 2023).

[23] NYSERDA, 2019 Residential Building Stock Assessment (Available at: *www.nyserda.ny.gov/About/Publications/Building-Stock-and-Potential-Studies/Residential-Building-Stock-Assessment*) (Last accessed Jan. 3, 2023).

[24] Electric and Gas Program Administrators of Massachusetts, Massachusetts Residential Building Use and Equipment Characterization Study (Available at: *ma-eeac.org/wp-content/uploads/Residential-Building-Use-and-Equipment-Characterization-Study-Comprehensive-Report-2022-03-01.pdf*) (Last accessed Jan. 3, 2023).

[25] CEC, 2019 California Residential Appliance Saturation Study (Available at: *www.energy.ca.gov/publications/2021/2019-california-residential-appliance-saturation-study-rass*) (Last accessed Jan. 3, 2023).

includes those used in secondary units. Multiple factors could impact the difference between shipments and the available stock, including equipment switching (in the no-new standards case), changes in new construction saturations and growth in different regions due to demographic shifts, differences in lifetime, etc. Therefore, DOE relies on the historical shipments data that it deems most correctly reflects future shipments in 2030 and beyond.

Morrison commented that DOE shows the test procedure for cooling as having pressures ranging from 0.1 to 0.2 w.c. for conventional split systems and noted that this reference is from an old test method; the new test method effective in 2023 has higher pressures (M1 vs M). (Morrison, No. 27 at p. 5) DOE acknowledges that the new test procedure should have been referenced in the previous PA TSD. The values in the TSD from the old test procedure were provided for reference only and are not directly used in the analysis.

Morrison stated that appendix 7C of the PA TSD (Calculation of Furnace Blower Fan Energy Consumption), begins with an incorrect statement by DOE that ''The efficiency consumption (and overall efficiency) of a blower motor depends on the speed at which the motor operates, the external static pressure difference across the blower, and the airflow through the blower.'' Morrison commented that electrical consumption depends on the design of the furnace, the fan, and the motor in combination with the ductwork present and all are important to the FER result. (Morrison, No. 27 at p. 5) DOE agrees that the efficiency of the furnace fan will depend on the design of the furnace, the design of the furnace and motor, in combination with the ductwork. DOE's analysis is built around the selected design options and current furnace designs that from the engineering analysis provide the efficiency and energy use characteristics by design option. Once these design options are fixed the energy consumption depends on the intersection between the furnace fan performance curves and the ductwork present.

Morrison commented that all discussion in appendix 7C of the PA TSD misses the point and purpose of the furnace operation and added that Figure 7C.1.1 (Power Determination) uses pressure as the x-axis independent variable, but the relevant independent variable is the volume flow rate with the assumption of a relatively fixed air density. Morrison commented that performance tables in furnace literature use pressure as the variable, stating that this is the easy method of operational determination for installers in the field—but not an appropriate way to conduct a technical analysis of consumer furnace fans. Morrison further commented that 7C.1 contains an error: air power is not proportional to air speed but rather volume rate of airflow. (Morrison, No. 27 at p. 6) Morrison also commented that, in section 7C–4 of the PA TSD, the method of analysis is confusing and the first two assumptions listed on 7C–4 are incorrect: (1) Regarding the assumption that slope of airflow and watts/cfm does not vary within the same motor technology, Morrison commented that performance curves for furnace fans will have varying slope dependent on the fan, motor and furnace system for the same motor technology, and that some small range changes could appear to have the same slope but the entirety of the performance range of interest will have variation; (2) Regarding the assumption that BPM (constant airflow) and PSC with controls always maintain the same airflow, Morrison commented that BPM (constant airflow) will closely maintain the airflow rate until the maximum power of the motor is achieved and then it will enter constant power mode, and unless there are new motor controller designs available in commerce, PSC motors with controls will adjust along a path of constant torque until the power limit is reached then along a constant power mode. Morrison added that this is also true for BPM (*i.e.,* constant torque). (Morrison, No. 27 at p. 6) In addition, Morrison commented that the curves in section 7C.3 of the PA TSD have a curious feature that gives the reader the suggestion that the BPM–CT uses less power that the BPM–CA, and that the use of pressure for the independent variable gives rise to this curious effect. Morrison commented that at the same operating point, flow, and pressure, the two motors (assuming same design/manufacturer) in the same appliance (same furnace and fan) would have virtually the same efficiency and thus the watts consumed would be about the same. Morrison stated that because of this oddity, further limited response time was not spent analyzing these curves in greater detail, but Morrison commented that the oddity raises question as to the validity of the analysis as it relates to real products. (Morrison, No. 27 at p. 6)

DOE's analysis relied on the manufacturer product literature and how the data was presented in terms of using pressure as the variable for the furnace fan equations. DOE contends that since the furnace fan energy use operates at a few specific operating conditions (one or more at heating, cooling, and/or continuous fan), that DOE's approach is valid in capturing the field energy use for furnace fans. Additionally, DOE validated its energy use methodology approach by comparing it to available field data measuring energy use of furnace fans in the field [26] [27] and building model data.[28] DOE acknowledges that it is expected to see a higher pressure for constant airflow BPM and the watts/cfm should be the same for both constant airflow BPM and constant torque BPM. DOE notes that there may be inconsistency because of some errors made in the PA documentation. However, for this NOPD analysis, DOE has largely maintained the methodology from the preliminary analysis. DOE would like to note that even if there were further updates to the energy use analysis, it would likely result in lower energy savings and consumer net cost, and thus the conclusions of the determination would remain the same.

Trane commented that according to DOE, the RECS results regarding heating energy use identifies NWG–NC as 6.8 and NWG-C as 43.3 MMBtu. However, Trane commented that based on industry sales, their values should be almost equal, or NWG–NC should be greater than NWG-C. (Trane, No. 22 at p. 3) DOE clarifies that its analysis assumes that in 2030 the heating load is 26.1 MMBtu/yr for NWG–NC and 37.1 MMBty/yr for NWG-C. This is based on shipments data by states that show that Northern states tend to have a much larger fraction of condensing furnaces compared to Rest of Country states. Therefore, the NWG-C sample includes more homes in colder climates with higher heating loads.

Trane commented that DOE defines the AFUE of a new unit as 96 percent, whereas a recent NOPR defines the minimum AFUE as 95 percent. (Trane, No. 22 at p. 3) Trane questioned DOE's assumption that the AFUE of an existing unit is 92 percent, stating that this value should be closer to 95 percent given that a unit's AFUE does not change much over time. (Trane, No. 22 at p. 3) Trane also commented that because DOE identifies the AFUE for an existing

[26] Pigg, S. Central Electricity Use by New Furnaces: A Wisconsin Field Study. 2003. Accessible at: *www.proctoreng.com/dnld/WIDOE2013.pdf* (last accessed: Jun. 1, 2023).

[27] Wilcox, B., J. Proctor, R. Chitwood, and K. Nittler. Furnace Fan Watt Draw and Air Flow in Cooling and Air Distribution Modes. 2008 California Building Energy Efficiency Standards. 2006.

[28] See *eta-publications.lbl.gov/sites/default/files/furnace_blower_electricity_national_and_regional_savings_potential_lbnl_417e.pdf*.

NWG-C unit to be less than that of a new NWG-C unit, then the AFUE for an existing NWG–NC unit should also be less than that of a new NWG–NC unit. (Trane, No. 22 at p. 3) DOE clarifies that it defined the AFUE of new units based on the projected market shares by AFUE in 2030. For NWG-C units, the market share was also divided into North and Rest of Country and ranged from 90% AFUE to 98%, with an overall shipment weighted average 95% AFUE. In terms of the existing AFUE unit, DOE analysis is set such that the AFUE of the existing unit is always equal or less than the AFUE of the new unit.

Trane commented that the correct basis for furnace fan AFUE should be ASHRAE 103–1993 and not ASHRAE 103–2022, as stated by DOE in the TSD. (Trane, No. 22 at p. 3) DOE relies on the supplementary energy use equations found in ASHRAE 103–2022, the latest ASHRAE test procedure. A NIST report [29] and LBNL reports [30] have found the updated version to be more accurate to estimate the energy use of furnaces, especially two-stage and modulating furnaces.

Trane commented that the use of adjustment factors for FER, HHL, COH, and HCL is inconsistent with adjustment factor use in the Furnace TSD, EERE–2014–BT–STD–0031–0320. (Trane, No. 22 at p. 3) Trane also commented on inconsistencies between the Preliminary Consumer Furnace Fan LCC and PBP Analysis document (EERE–2021–BT–STD–0029–0012) and the furnace fan TP (CFR Title 10, chapter 2, subchapter D, part 430, subpart B, appendix AA): (1) the TSD states the range of airflow to be 300–500 CFM/nominal ton, but the calculations were conducted at 400 CFM/nominal ton rather than 500 CFM/nominal ton; (2) the TP requires the heating airflow control to be set at the maximum, while the TSD states that the heating airflow control setting can span a range between 35–65 °F and that the max heating airflow control setting should be set to achieve a 35 °F rise, but the calculation used in the TSD utilizes a 50 °F rise which is much lower than the maximum CFM; (3) the FER adjustment factor was not addressed in either the TSD or the LCC and PA documents; and (4) the FER adjustment factor was only applied to the intercept of the polynomial equation to determine wattage and not to the entire watt/CFM equation. (Trane, No. 22 at p. 4)

DOE's LCC analysis applies a temperature rise distribution ranging from 30 degrees to 80 degrees, with an average of 60 degrees, which is consistent with manufacturer product literature and field installation data. The LCC analysis also applies a CFM/ton distribution ranging from 300 to 500, with an average of around 400 CFM/ton, which is the more commonly used value both in manufacturer product literature information and in the majority of installations. The FER adjustment factor is only used to make sure the performance curves match the FER ratings at each efficiency level. For this NOPD analysis, DOE has largely maintained the methodology from the prelim analysis. DOE would like to note that even if there were further updates to the energy use analysis, it would likely result in lower energy savings and consumer net cost, and thus the conclusions of the determination would remain the same.

E. Life-Cycle Cost and Payback Period Analysis

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

- The LCC is the total consumer expense of an appliance or product over the life of that product, consisting of total installed cost (manufacturer selling price, distribution chain markups, sales tax, and installation costs) plus operating costs (expenses for energy use, maintenance, and repair). To compute the operating costs, DOE discounts future operating costs to the time of purchase and sums them over the lifetime of the product.
- The PBP is the estimated amount of time (in years) it takes consumers to recover the increased purchase cost (including installation) of a more-efficient product through lower operating costs. DOE calculates the PBP by dividing the change in purchase cost at higher efficiency levels by the change in annual operating cost for the year that amended or new standards are assumed to take effect.

For any given efficiency level, DOE measures the change in LCC relative to the LCC in the no-new-standards case, which reflects the estimated efficiency distribution of consumer furnace fans 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 housing units and, for NWGFs, also commercial buildings. As stated previously, DOE developed household samples from 2015 RECS and CBECS 2012. For each sample household, DOE determined the energy consumption for the consumer furnace fans 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 consumer furnace fans.

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

The computer model DOE uses to calculate the LCC and PBP relies on a Monte Carlo simulation to incorporate uncertainty and variability into the analysis. The Monte Carlo simulations randomly sample input values from the probability distributions and consumer furnace fan user samples. For this determination, the Monte Carlo approach is implemented in MS Excel together with the Crystal Ball™ add-on.[31] The model calculated the LCC and PBP 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

[29] Stanely, Liu. 2002. Proposed Revisions of Part of the Test Procedure for Furnaces and Boilers in ASHRAE Standard 103–1993. September. Gaithersburg, Md.: U.S. Department of Commerce, National Institute of Standards and Technology, Building Environment Division, Building and Fire Research Laboratory.

[30] *See eta.lbl.gov/publications/residential-two-stage-gas-furnaces-do*; and see *eta.lbl.gov/publications/furnace-blower-electricity-national*.

[31] Crystal Ball™ is commercially-available software tool to facilitate the creation of these types of models by generating probability distributions and summarizing results within Excel, available at *www.oracle.com/technetwork/middleware/crystalball/overview/index.html* (last accessed July 6, 2018).

chosen based on its probability. If the chosen product efficiency is greater than or equal to the efficiency of the standard level under consideration, the LCC and PBP calculation reveals that a consumer is not impacted by the standard level. By accounting for consumers who already purchase more-efficient products, DOE avoids overstating the potential benefits from increasing product efficiency.

DOE calculated the LCC and PBP for all consumers of consumer furnace fans as if each were to purchase a new product in the expected year of required compliance with new or amended standards. For purposes of its analysis, DOE used 2030 as the first year of compliance with any amended standards for consumer furnace fans.

Table IV.20 summarizes the approach and data DOE used to derive inputs to the LCC and PBP calculations. The subsections that follow provide further discussion.

TABLE IV.20—SUMMARY OF INPUTS AND METHODS FOR THE LCC AND PBP ANALYSIS *

Inputs	Source/method
Product Cost	Derived from the manufacturer production cost (MPC) for furnace fans at different heating input capacities for each efficiency level (from the engineering analysis). The MPCs are then multiplied by the various market participant markups (*e.g.,* manufacturer, wholesaler, and plumbing contractor) for each distribution channel and sales taxes derived for each state and the District of Columbia.
Installation Costs	Varies by efficiency level and individual house/building characteristic. Material and labor costs are derived for each state and the District of Columbia mainly using RSMeans Residential Cost Data 2023. Overhead and profits are included in the RSMeans data. Probability distributions are derived for various installation cost input parameters.
Annual Energy Use	Derived mainly by using the heating energy use data for each housing unit and building from Energy Information Administration (EIA)'s 2015 Residential Energy Consumption Survey (RECS 2015) and EIA's 2012 Commercial Buildings Energy Consumption Survey (CBECS 2012) together with consumer furnace fans test procedure calculation methodologies used to determine the annual energy consumption associated with the considered standard levels. Probability distributions are derived for various input parameters.
Energy Prices	Calculated monthly marginal average electricity, natural gas or LPG, and fuel oil prices in each of the 50 U.S. states and District of Columbia using EIA historical data and billing data for each RECS 2015 housing unit and CBECS 2012 building.
Energy Price Trends	Residential and commercial prices were escalated by using EIA's 2023 Annual Energy Outlook (AEO 2023) forecasts to estimate future energy prices. Escalation was performed at the census division level.
Repair and Maintenance Costs	Estimated the costs associated with preventive maintenance (*e.g.,* checking furnace fan) and repair (*e.g.,* replacing motor) based on data from a variety of published sources including RSMeans 2023 Facilities Maintenance and Repair Data. It is assumed that maintenance and repair costs vary by efficiency level and probability distributions are derived for various input parameters.
Product Lifetime	Used Weibull probability distribution of lifetimes developed for consumer furnace fans based on various survey and shipments data.
Discount Rates	Probability distributions by income bins are derived for residential discount rates based on multiple Federal Reserve Board's Survey of Consumer Finances from 1995–2019 and various interest rate sources. Probability distributions for commercial discount rates for various building activities (*e.g.,* office) are derived using multiple interest rate sources. See section IV.E.7.
Compliance Date	2030 (5 years after expected publication of the final rule).

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

1. Product Cost

To calculate consumer product costs, DOE multiplied the MPCs developed in the engineering analysis by the markups described previously (along with sales taxes). DOE used different markups for baseline products and higher-efficiency products, because DOE applies an incremental markup to the increase in MSP associated with higher-efficiency products.

DOE assumed no price trend for consumer furnace fans due to uncertainty in future commodity prices. *See* chapter 8 of the PA TSD for details.

2. Installation Cost

Installation cost includes labor, overhead, and any miscellaneous materials and parts needed to install the product. Because consumer furnace fans are installed in furnaces in the factory, there is generally no additional installation cost in the home. However, consumer furnace fans that employ a constant-airflow BPM design may require additional installation costs. DOE assumed that all constant-airflow BPM furnace fan installations will require extra labor at startup to check and adjust airflow.

DOE estimated the installation costs at each considered efficiency level using a variety of sources, including RSMeans data, manufacturer literature, and information from an expert consultant report. DOE's analysis of installation costs accounted for regional differences in labor costs. For a detailed discussion of the development of installation costs, *see* appendix 8C of the PA TSD.

3. Annual Energy Consumption

For each sampled household or commercial building, DOE determined the energy consumption for a consumer furnace fan at different efficiency levels using the approach described previously in section IV.D of this document.

4. Energy Prices

A marginal energy price reflects the cost or benefit of adding or subtracting one additional unit of energy consumption. Because marginal price more accurately captures the incremental savings associated with a change in energy use from higher efficiency, it provides a better representation of incremental change in consumer costs than average electricity prices. Therefore, DOE applied average natural gas and electricity prices for the energy use of the product purchased in the no-new-standards case, and marginal prices for the incremental change in energy use associated with the other efficiency levels considered.

DOE derived average monthly marginal residential and commercial electricity, natural gas, LPG, and fuel oil prices for each State using data from

EIA.[32] [33] [34] DOE calculated marginal monthly regional energy prices by: (1) first estimating an average annual price for each region; (2) multiplying by monthly energy price factors; and (3) multiplying by seasonal marginal price factors for electricity, natural gas, and LPG. The analysis used historical data up to 2022 for residential and commercial natural gas and electricity prices and historical data up to 2021 for LPG and fuel oil prices. Further details may be found in chapter 8 of the PA TSD.

DOE compared marginal price factors developed by DOE from the EIA data to develop seasonal marginal price factors for 23 gas tariffs provided by the Gas Technology Institute for the 2016 residential boilers energy conservation standards rulemaking.[35] DOE found that the winter price factors used by DOE are generally comparable to those computed from the tariff data, indicating that DOE's marginal price estimates are reasonable at average usage levels. The summer price factors are also generally comparable. Of the 23 tariffs analyzed, eight have multiple tiers, and of these eight, six have ascending rates and two have descending rates. The tariff-based marginal factors use an average of the two tiers as the commodity price. A full tariff-based analysis would require information about the household's total baseline gas usage (to establish which tier the consumer is in), and a weight factor for each tariff that determines how many customers are served by that utility on that tariff. These data are generally not available in the public domain. DOE's use of EIA State-level data effectively averages overall consumer sales in each State, and so incorporates information from all utilities. DOE's approach is, therefore, more representative of a large group of consumers with diverse baseline gas usage levels than an approach that uses only tariffs.

DOE notes that within a State, there could be significant variation in the marginal price factors, including differences between rural and urban rates. To take this into account, DOE developed marginal price factors for each individual household using RECS 2015 billing data. These data are then normalized to match the average State marginal price factors, which are equivalent to a consumption-weighted average marginal price across all households in the State. For more details on the comparative analysis and updated marginal price analysis, *see* appendix 8D of the PA TSD. 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.[36] To estimate price trends after 2050, DOE used the average annual rate of change in prices from 2046 through 2050.

5. Maintenance and Repair Costs

The maintenance cost is the routine cost to the consumer of maintaining product operation. The regular furnace maintenance generally includes checking the furnace fan. DOE assumes that this maintenance cost is the same at all efficiency levels.

The repair cost is the cost to the consumer for replacing or repairing components in the consumer furnace fan that have failed. DOE included motor replacement as a repair cost for a fraction of furnace fans. To estimate rates of motor failure, DOE developed a distribution of fan motor lifetime (expressed in operating hours) by motor size using data from DOE's analysis for small electric motors and manufacturer literature. (75 FR 10874) DOE then paired these data with the calculated number of annual operating hours for each sample furnace fan. Motor costs were based on costs developed in the engineering analysis and the replacement markups developed in the markup analysis. DOE assumed that the motor cost does not apply if motor failure occurs during the furnace warranty period (assumed to be at least 1 year and 5 or more years for a fraction of installations).

The repair costs (including labor hours, component costs, and frequency) at each considered efficiency level are derived based on RSMeans data,[37] manufacturer literature, and a report from the Gas Research Institute (GRI).[38] DOE accounted for regional differences in labor costs. For a detailed discussion of the development of maintenance and repair costs, see appendix 8E of the PA TSD.

6. Product Lifetime

The product lifetime is the age at which a product is retired from service. Furnace fan lifetimes are considered equivalent to furnace lifetimes, so DOE modeled furnace fan lifetime based on estimated furnace lifetimes. Because product lifetime varies, DOE uses a lifetime distribution to characterize the probability that a product will be retired from service at a given age. DOE conducted an extensive literature review and took into account published studies. Because the basis for the estimates in the literature was uncertain, DOE developed a method using national survey data, along with shipment data, to estimate the distribution of consumer furnace lifetimes in the field.

DOE assumed that the probability function for the annual survival of consumer furnace would take the form of a Weibull distribution. DOE derived the Weibull distribution parameters by using stock and age data on consumer furnaces from U.S. Census's biennial American Housing Survey (AHS) from 1974–2019 [39] and EIA's RECS 1990, 1993, 2001, 2005, 2009, and 2015.[40]

DOE used the results from the 2019 AHCS survey to estimate the national average lifetime of 21.4 years. DOE also determined the average lifetime for different regions: 22.5 years for the North region and 20.2 years for rest of

[32] U.S. Department of Energy-Energy Information Administration, Form EIA–861M (formerly EIA–826) detailed data (2022) (Available at: *www.eia.gov/electricity/data/eia861m/*) (Last accessed Jun. 1, 2023).

[33] U.S. Department of Energy-Energy Information Administration, Natural Gas Navigator (2022) (Available at: *www.eia.gov/naturalgas/data.php*) (Last accessed Jun. 1, 2023).

[34] U.S. Department of Energy-Energy Information Administration, 2021 State Energy Data System (SEDS) (2021) (Available at: *www.eia.gov/state/seds/*) (Last accessed Jun. 1, 2023).

[35] GTI provided a reference located in the docket of DOE's 2016 rulemaking to develop energy conservation standards for residential boilers. (Docket No. EERE–2012–BT–STD–0047–0068) (Available at: *www.regulations.gov/document/EERE-2012-BT-STD-0047-0068*) (Last accessed June 1, 2023).

[36] EIA. *Annual Energy Outlook 2023 with Projections to 2050.* Washington, DC. Available at *www.eia.gov/forecasts/aeo/* (last accessed Jun. 1, 2023).

[37] RSMeans Company Inc., *RS Means Facilities Maintenance & Repair Cost Data* (2021) (Available at: *www.rsmeans.com/*) (Last accessed Jun. 1, 2023).

[38] Jakob, F.E., J.J. Crisafulli, J.R. Menkedick, R.D. Fischer, D.B. Philips, R.L. Osbone, J.C. Cross, G.R. Whitacre, J.G. Murray, W.J. Sheppard, D.W. DeWirth, and W.H. Thrasher, *Assessment of Technology for Improving the Efficiency of Residential Gas Furnaces and Boilers, Volume I and II—Appendices* (September 1994) Gas Research Institute, Report No. GRI–94/0175 (Available at: *www.gti.energy/software-and-reports/*) (Last accessed Feb. 15, 2022).

[39] U.S. Census Bureau: Housing and Household Economic Statistics Division, *American Housing Survey,* Multiple Years (1974, 1975, 1976, 1977, 1978, 1979, 1980, 1981, 1983, 1985, 1987, 1989, 1991, 1993, 1995, 1997, 1999, 2001, 2003, 2005, 2007, 2009, 2011, 2013, 2015, 2017, 2019, and 2021). (Available at *https://www.census.gov/programs-surveys/ahs.html*) (Last accessed June 1, 2023).

[40] U.S. Department of Energy: Energy Information Administration, *Residential Energy Consumption Survey (''RECS''),* Multiple Years (1990, 1993, 1997, 2001, 2005, 2009, and 2015). (Available at *www.eia.gov/consumption/residential/*) (Last accessed June 1, 2023).

the country. These results are used to scale the average lifetime for these regions.

7. Discount Rates

In the calculation of LCC, DOE applies discount rates appropriate to households to estimate the present value of future operating cost savings. DOE estimated a distribution of discount rates for consumer furnace fans 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.[41] 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 long-time horizon modeled in the LCC analysis, 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 using data from the Federal Reserve Board's Survey of Consumer Finances[42] (''SCF'') for 1995, 1998, 2001, 2004, 2007, 2010, 2013, 2016, and 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 4.1 percent. *See* chapter 8 of the PA TSD for further details on the development of consumer discount rates.

To establish commercial discount rates for the small fraction of consumer furnace fans in commercial buildings, DOE estimated the weighted-average cost of capital using data from Damodaran Online.[43] 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. DOE's commercial discount rate approach is based on the methodology described in a LBNL report, and the distribution varies by business activity. The average rate for consumer furnace fans used in commercial applications in this analysis, across all business activity, is 7.2 percent.

See chapter 8 of the PA TSD for further details on the development of consumer and commercial discount rates.

Morrison recommended that DOE take into account Federal rate increases, which are moving to a more typical state as compared to DOE's selected range from 1995–2019, in which rates were historically low. (Morrison, No. 27 at p. 4) DOE relies on the most recent Survey of Consumer Finance data available, which includes all data available from 2015–2019. In addition, many of the interest rate data used in the discount rate analysis is based on the latest 30-year average, which is updated to 1993–2022 for this NOPD. While DOE acknowledges that there have been interest rate increases in the recent past, DOE cannot conclude that more recent data would be more representative of discount rates in the considered year of compliance, 2030, than the best available time series of data DOE is currently using. For this reason, DOE has not changed its methodology for determining consumer discount rates.

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

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

For consumer furnace fans, DOE does not have any shipments data by efficiency after the 2019 furnace fan standard became effective. To cover the lack of available shipments data, DOE used the DOE's Compliance Certification Management System (CCMS) Database for furnace fans and furnaces to develop efficiency distribution based on available models. Table IV.21 shows the resulting market shares by efficiency level. For a detailed discussion of the development of no-new-standards case distributions based on models, *see* appendix 7F of the PA TSD.

TABLE IV.21—NO-NEW-STANDARDS CASE ENERGY EFFICIENCY DISTRIBUTIONS IN 2030 FOR CONSUMER FURNACE FANS

Product class	EL	No-new-standards case (%)	Efficiency level (%)	
			1	2
Non-Weatherized, Non-Condensing Gas Furnace Fan	0	100		
	1		100	
Non-Weatherized, Condensing Gas Furnace Fan	0	100		

[41] 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.

[42] The Federal Reserve Board, Survey of Consumer Finances (1995, 1998, 2001, 2004, 2007, 2010, 2013, 2016, and 2019) (Available at: *www.federalreserve.gov/econres/scfindex.htm*) (Last accessed Jun. 1, 2023).

[43] Damodaran, A. Data Page: Historical Returns on Stocks, Bonds and Bills-United States. 2023. (Last accessed Jun. 1, 2023) *pages.stern.nyu.edu/~adamodar/*.

TABLE IV.21—NO-NEW-STANDARDS CASE ENERGY EFFICIENCY DISTRIBUTIONS IN 2030 FOR CONSUMER FURNACE FANS—Continued

Product class	EL	No-new-standards case (%)	Efficiency level (%)	
			1	2
	1		100	
Weatherized Non-Condensing Gas Furnace Fan	0	100		
	1		100	
Non-Weatherized, Non-Condensing Oil Furnace Fan	0	46		
	1	54	100	
	2			100
Non-Weatherized Electric Furnace/Modular Blower Fan	0	100		
	1		100	
Mobile Home Non-Weatherized, Non-Condensing Gas Furnace Fan	0	11		
	1	89	100	
	2			100
Mobile Home Non-Weatherized, Condensing Gas Furnace Fan	0	8		
	1	92	100	
	2			100
Mobile Home Non-Weatherized Oil Furnace Fan	0	90		
	1	10	100	
	2			100
Mobile Home Electric Furnace/Modular Blower Fan	0	100		
	1		100	

AHRI and Lennox commented that model counts in the certification directory do not reflect sales volume, and that a high number of models produced at a specific efficiency level does not necessarily imply a large market share of those products. (AHRI, No. 23 at p. 4; Lennox, No. 24 at p. 4) Lennox further stated that industry and manufacturers do not generally track shipment data of products that may exceed the baseline because while consumers may consider AFUE when purchasing a residential furnace, furnace fans are not a feature upon which consumers base their purchase decisions. (Lennox, No. 24 at p. 8)

As indicated by Lennox, DOE has not been able to obtain other information to develop a no-new-standards case efficiency distribution, and as such, continues to rely on model availability as a proxy.

9. Payback Period Analysis

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

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

F. 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.[44] The shipments model takes an accounting approach in tracking market shares of each product class and the vintage of units in the stock. Stock accounting uses product shipments as inputs to estimate the age distribution of in-service product stocks for all years. The age distribution of in-service product stocks is a key input to calculations of both the NES and NPV, because operating costs for any year depend on the age distribution of the stock.

DOE developed shipment projections based on historical data and an analysis of key market drivers for each product. The vast majority of furnace fans are shipped installed in furnaces, so DOE estimated furnace fan shipments by projecting furnace shipments in three market segments: (1) replacements, (2) new housing, and (3) new owners in buildings that did not previously have a central furnace.

To project furnace replacement shipments, DOE developed retirement functions for furnaces from the lifetime estimates and applied them to the existing products in the housing stock. The existing stock of products is tracked by vintage and developed from historical shipments data. The shipments analysis uses a distribution of furnace lifetimes to estimate furnace replacement shipments. In addition, DOE adjusted replacement shipments by taking into account demolitions, using the estimated changes to the housing stock from *AEO2023*.

DOE assembled historical shipments data for consumer furnaces from Appliance Magazine from 1954–2012,[45] AHRI from 1996–2022,[46] HARDI from 2013–2022,[47] and BRG from 2007–2022.[48] DOE also used the 1992 and 1994–2003 shipments data by State provided by AHRI[49] and 2004–2009 and 2010–2015 shipments data by the North region and the rest of country

[44] 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.

[45] Appliance Magazine. Appliance Historical Statistical Review: 1954–2012 (2014).

[46] Air-Conditioning, Heating, & Refrigeration Institute, *Furnace Historical Shipments Data.* (1996–2022) (Available at: *https://www.ahrinet.org/analytics/statistics/historical-data/furnaces-historical-data*) (Last accessed June 1, 2023).

[47] Heating, Air-conditioning and Refrigeration Distributors International (HARDI). *Gas Furnace Shipments Data from 2013–2022* (*Provided to Lawrence Berkeley National Laboratory*).

[48] BRG Building Solutions. The North American Heating & Cooling Product Markets (Available at: *https://www.brgbuildingsolutions.com/solutions/market-reports/*) (Last accessed Jun. 1, 2023).

[49] Air-Conditioning, Heating, and Refrigeration Institute (formerly Gas Appliance Manufacturers Association). *Updated Shipments Data for Residential Furnaces and Boilers,* April 25, 2005 (Available at: *www.regulations.gov/document/EERE-2006-STD-0102-0138*) (Last accessed June 1 2023).

provided by AHRI,[50] as well as HARDI shipments data that is disaggregated by region and most States to disaggregate shipments by region. DOE also used CBECS 2012 data and BRG shipments data to estimate the commercial fraction of shipments. Disaggregated shipments for MHGFs are not available, so DOE disaggregated MHGF shipments from the total by using a combination of data from the U.S. Census,[51 52] American Housing Survey (AHS),[53] RECS,[54] and a 2014 MHGF shipments estimate by Mortex.[55]

To project shipments to the new housing market, DOE utilized a projection of new housing construction and historic saturation rates of various furnaces in new housing. DOE used the *AEO2023* housing starts and commercial building floor space projections and data from U.S. Census Characteristics of New Housing,[56 57] Home Innovation Research Labs Annual Builder Practices Survey,[58] RECS 2015, AHS 2021, and CBECS 2012 to estimate new construction saturations. DOE also estimated future furnace saturation rates in new single-family housing based on a weighted average of values from the U.S. Census Bureau's Characteristics of New Housing from 1999 through 2022, and for multi-family building using data from Census Bureau's Characteristics of New Housing (Multi-Family Units) from 1973 through 2022.[59]

To project shipments to the new-owner market, DOE estimated the new owners based on the residual shipments from the calculated replacement and new construction shipments compared to historical shipments over five years (2018–2022). DOE compared this with data from Decision Analysts' 2002 to 2022 American Home Comfort Study,[60] 2023 BRG data,[61] and AHRI's estimated shipments in 2000,[62] which showed similar historical fractions of new owners. DOE assumed that the new-owner fraction would be the 10-year average (2013–2022) in 2030 and then decrease to zero by the end of the analysis period (2059).

Lennox commented that DOE likely overstates shipments for gas furnaces. Lennox commented that DOE currently has open rulemakings for furnaces (*e.g.,* a NOPR for NWGs and a notice of TSD for oil, electric, and weatherized gas furnace energy conservation standards), the outcome of which will likely result in reduced market shares of certain products and elimination of others. Furthermore, Lennox commented that the market shares will likely be affected by the current efforts under the Biden administration to decarbonize space heating, and that states such as California and New York are implementing plans to completely electrify space heating as early as 2030. Lennox added that furnace costs are likely to change due to increased energy conservation standards and decarbonization efforts to electrify space heating (Lennox, No. 24 at p. 2–4) Lennox stated that DOE TSD projections are not likely to be indicative of future furnace shipments. (Lennox, No. 24 at p. 8)

Similarly, AHRI commented that DOE did not consider the impact of ongoing rulemakings and electrification policies in its analysis. AHRI commented that not accounting for these changes affects future shipment projections and the actual impact of a more stringent rule on national energy savings. (AHRI, No. 23 at p. 1) AHRI commented that the impact of State, county, and local policies should not be discounted in DOE's market projections because these policies impact nearly one fifth of the furnace fan market. AHRI provided examples of relevant policies in California, New York, Massachusetts, Maryland's Montgomery County, and New York City related to eliminating NO_X emissions for space and water heating, transitioning from combustion fuels to electric heat pumps, reducing greenhouse gas emissions, building decarbonization, and restricting fossil fuel usage in new construction. AHRI further commented that these policies need to be accounted for in the shipment and impact analysis. (AHRI, No. 23 at p. 2)

Morrison also commented that DOE is not projecting the ways decarbonization efforts currently underway across the country will impact future furnace shipments. (Morrison, No. 27 at p. 5)

The CA IOUs commented that they expect furnace shipments to flatten or decline in the coming years considering local, State, and Federal efforts on carbonization. (CA IOUs, No. 21 at p. 5)

For the consumer furnace NOPR, assumptions regarding future policies encouraging electrification of households were uncertain at that time, so such policies were not incorporated into the shipments projection. For the consumer furnace final rule, DOE accounted for the 2022 update to Title 24 in California[63] and also the decision of the California Public Utilities Commission to eliminate ratepayer subsidies for the extension of new gas lines beginning in July 2023. Together, these policies are expected to lead to the eventual phase-out of gas-fired furnaces in new single-family homes in California. The California Air Resources Board has adopted a 2022 State Strategy for the State Implementation Plan that would effectively ban new gas furnaces beginning in 2030.[64] However, because a final decision on this rule would not happen until 2025, DOE did not include

[50] Air-Conditioning, Heating, and Refrigeration Institute. Non-Condensing and Condensing Regional Gas Furnace Shipments for 2004–2009 and 2010–2015 Data Provided to DOE contractors, July 20, 2010 and November 26, 2016.

[51] U.S. Census Bureau, Manufactured Homes Survey: Annual Shipments to States from 1994–2022 (Available at: *https://www.census.gov/data/tables/time-series/econ/mhs/latest-data.html*) (Last accessed June 1, 2023).

[52] U.S. Census Bureau, Manufactured Homes Survey: Historical Annual Placements by State from 1980–2013 (Available at: *www.census.gov/data/tables/time-series/econ/mhs/historical-annual-placements.html*) (Last accessed June 1, 2023).

[53] U.S. Census Bureau—Housing and Household Economic Statistics Division, American Housing Survey, multiple years from 1973–2021 (Available at: *www.census.gov/programs-surveys/ahs/data.html*) (Last accessed June 1, 2023).

[54] Energy Information Administration (EIA). Residential Energy Consumption Survey (RECS), multiple years from 1979–2015 (Available at: *www.eia.gov/consumption/residential/*) (Last accessed June 1, 2023).

[55] Mortex estimated that the total number of MHGFs manufactured in 2014 was about 54,000, and about two-thirds were sold to the replacement market. Mortex also stated that MHGF sales have not been growing. (Mortex, No. 0157 at p. 3) (Available at: *www.regulations.gov/document/EERE-2014-BT-STD-0031-0157*) (Last accessed June 1, 2023).

[56] U.S. Census. Characteristics of New Housing from 1999–2022 (Available at: *www.census.gov/construction/chars/*) (Last accessed June 1, 2023).

[57] U.S. Census. Characteristics of New Housing (Multi-Family Units) from 1973–2022 (Available at: *www.census.gov/construction/chars/mfu.html*) (Last accessed June 1, 2023).

[58] Home Innovation Research Labs (independent subsidiary of the National Association of Home Builders (NAHB). Annual Builder Practices Survey (2015–2019) (Available at: *www.homeinnovation.com/trends_and_reports/data/new_construction*) (Last accessed June 1, 2023).

[59] U.S. Census Bureau, Characteristics of New Housing (Available at: *www.census.gov/construction/chars/*) (Last accessed June 1, 2023).

[60] Decision Analysts, 2002, 2004, 2006, 2008, 2010, 2013, 2016, 2019, and 2022 American Home Comfort Study (Available at: *www.decisionanalyst.com/Syndicated/HomeComfort/*) (Last accessed Jun. 1, 2023).

[61] BRG data (Available at: *www.brgbuildingsolutions.com/*) (Last accessed Jun. 1, 2023).

[62] AHRI (formerly GAMA), Furnace and Boiler Shipments data provided to DOE for Furnace and Boiler ANOPR (Jan. 23, 2002).

[63] The 2022 update includes heat pumps as a performance standard baseline for water heating or space heating in single-family homes, as well as space heating in multi-family homes. Under the California Code, builders will need to either include one high-efficiency heat pump in new constructions or subject those buildings to more-stringent energy efficiency standards.

[64] California Air Resources Board, 2022 State Strategy for the State Implementation Plan. (Available at: *ww2.arb.ca.gov/resources/documents/2022-state-strategy-state-implementation-plan-2022-state-sip-strategy*) (Last accessed June 1, 2023).

this latter policy in its analysis for the consumer furnace final rule.

DOE understands that ongoing electrification policies at the Federal, State, and local levels are likely to encourage installation of heat pumps in some new homes and adoption of heat pumps in some homes that currently use gas-fired furnaces. However, there are many uncertainties about the timing and effects of these policies that make it difficult to fully account for their likely impact on gas-fired furnace market shares in the time frame for the analysis (*i.e.,* 2030 through 2059). Nonetheless, DOE has modified some of its projections to attempt to account for impacts that are most likely in the relevant time frame. The changes result in a decrease of gas-fired furnace shipments in the no-new-standards case compared to the consumer furnace NOPR analysis, with a corresponding decrease in estimated energy savings resulting from the standards. DOE acknowledges that electrification policies may result in a larger decrease in shipments of gas-fired furnaces than projected in the consumer furnace final rule, especially if stronger policies are adopted in coming years. However, this would occur in the no-new amended standards case and, thus, would only reduce the energy savings estimated in this rule. Given that DOE is tentatively determining that standards do not need to be amended, a decrease in shipments projected would not change that decision.

AHRI commented that if DOE enacts the energy levels put forth in the consumer furnace July 2022 NOPR, these products will no longer be on the market by 2030. AHRI also commented that DOE should consider the consumers who are unable to replace their existing non-condensing product and will end up switching fuels and adopting a heat pump in its analysis. (AHRI, No. 23 at p. 2)

DOE notes that this analysis only considers what has been finalized for consumer furnace standards. Once the consumer furnace standards are finalized, DOE will take the amended consumer furnace standards into account for future analysis. Given that DOE is tentatively determining that furnace fan standards do not need to be amended, potential amended consumer furnace standards would not change that decision at this time.

Morrison commented that regarding shipments in the no-new-standards case, Figure 9.4.1 in the TSD fails to account for an echo demand reduction approximately 20 years out from the dip in 2010. (Morrison, No. 27 at p. 5)

DOE updated the furnace shipments analysis to take into account a decrease in projected shipments around 2025–2040 due to the 2010 market dip. Given that DOE is tentatively determining that standards do not need to be amended, a decrease in shipments projected would not change that decision.

G. National Impact Analysis

The NIA assesses the NES and the NPV from a national perspective of total consumer costs and savings that would be expected to result from new or amended standards at specific efficiency levels.[65] (''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 consumer furnace fans sold from 2030 through 2059.

DOE evaluates the effects 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 ELs 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 EL. Interested parties can review DOE's analyses by changing various input quantities within the spreadsheet. The NIA spreadsheet model uses typical values (as opposed to probability distributions) as inputs.

Table IV.22 summarizes the inputs and methods DOE used for the NIA analysis for the NOPD. Discussion of these inputs and methods follows the table. *See* chapter 10 of the PA TSD for details.

TABLE IV.22—SUMMARY OF INPUTS AND METHODS FOR THE NATIONAL IMPACT ANALYSIS

Inputs	Method
Shipments	Annual shipments from shipments model.
Modeled Compliance Date of Standard.	2030.
Efficiency Trends	No-new-standards case based on historical shipment data and on current consumer furnace fans model availability by efficiency level (*see* chapter 8 of the PA TSD). Roll-up in the compliance year for standards cases.
Annual Energy Consumption per Unit.	Annual weighted-average values are a function of shipments-weighted unit energy use consumption.
Total Installed Cost per Unit	Annual weighted-average values as a function of the efficiency distribution (*see* chapter 8 of the PA TSD).
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 as a function of efficiency level (*see* chapter 8 of the PA TSD).
Energy Prices	AEO2023 projections to 2050 and extrapolation thereafter.
Energy Site-to-Primary and FFC Conversion.	A time-series conversion factor based on AEO2023.
Discount Rate	Three percent and seven percent.

[65] The NIA accounts for impacts in the 50 states and Washington, DC.

TABLE IV.22—SUMMARY OF INPUTS AND METHODS FOR THE NATIONAL IMPACT ANALYSIS—Continued

Inputs	Method
Present Year	2023.

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.E.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.

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 (2030). 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. Taking this efficiency distribution as a starting point, DOE projected standards-case efficiencies after 2030 using similar assumptions regarding future efficiency improvements as in the no-new-standards case.

To project efficiencies for the no-new-standards case, DOE used historical shipment data and current consumer furnace fan model availability by efficiency level (see chapter 8 of the PA TSD).

2. National Energy Savings

The NES analysis involves a comparison of national energy consumption of the considered products between each potential standards case (EL) 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 *AEO2023.* 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. A rebound effect reduces the energy savings attributable to a standard. Where appropriate, DOE accounts for the direct rebound effect when estimating the NES from potential standards. In the residential sector, in the NIA model for product classes with an improved PSC motor standard, DOE applied a rebound effect for those standards cases that require a BPM motor furnace fan. A rebound effect factor of 16% was determined by calculating the additional electricity use that is required from a doubling of the use of continuous fan circulation compared to the average use assumed in the energy use analysis.[66] Although a lower value might be warranted, DOE preferred to be conservative and not risk understating the rebound effect. For commercial applications, DOE applied no rebound effect, a decision consistent with other recent energy conservation standards rulemakings.[67] [68] [69]

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 NIA 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[70] that EIA uses to prepare its AEO. The FFC factors incorporate losses in production, and delivery in the case of natural gas, (including fugitive emissions) and additional energy used to produce and deliver the various fuels used by power plants. The approach used for deriving FFC measures of energy use and emissions is described in appendix 10B of the PA 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.

The operating cost savings are energy cost savings, which are calculated using the estimated energy savings in each year and the projected price of the appropriate form of energy. To estimate

[66] DOE reviewed an evaluation report from Wisconsin that indicates that a considerable number of homeowners who purchase constant-airflow BPM furnaces significantly increase the frequency with which they operate their furnace fan subsequent to the installation of the constant-airflow BPM furnace. On average, this report indicates that there is a doubling in the amount of continuous fan circulation use. DOE assumed that this doubling was the same for all types of furnace fans that had a significant decrease in energy use in the continuous fan circulation mode. (Evaluation report available at: *http://www.focusonenergy.com/sites/default/files/emcfurnaceimpactassessment_evaluationreport.pdf*)

[67] DOE. Energy Conservation Program for Certain Industrial Equipment: Energy Conservation Standards for Small, Large, and Very Large Air-Cooled Commercial Package Air Conditioning and Heating Equipment and Commercial Warm Air Furnaces; Direct final rule. 81 FR 2419 (Jan. 15, 2016) (Available at: *www.regulations.gov/document/EERE-2013-BT-STD-0021-0055*) (Last accessed Feb. 15, 2022).

[68] DOE. Energy Conservation Program: Energy Conservation Standards for Residential Boilers; Final rule. 81 FR 2319 (Jan. 15, 2016) (Available at: *www.regulations.gov/document/EERE-2012-BT-STD-0047-0078*) (Last accessed Feb. 15, 2022).

[69] DOE. Energy Conservation Program: Energy Conservation Standards for Commercial Packaged Boilers; Final Rule. 85 FR 1592 (Jan. 10, 2020) (Available at: *www.regulations.gov/document/EERE-2013-BT-STD-0030-0099*) (Last accessed Feb. 15, 2022).

[70] 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 June 26, 2023).

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 *AEO2023,* which has an end year of 2050. To estimate price trends after 2050, DOE used the average annual rate of change in prices from 2020 through 2050.

In calculating the NPV, DOE multiplies the net savings in future years by a discount factor to determine their present value. For this NOPD, 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.[71] 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.

H. Further Considerations Related to Backward-Inclined Impellers

Although DOE did not screen out backward-inclined impellers from further considerations in this analysis (for the reasons discussed in section IV.A.4.a), DOE is aware of several points of uncertainty related to the impacts of a potential standard that required the use of this technology. First, as discussed in section IV.B.1.c of this document, because there are only a small number of models on the market with backward-inclined impellers and several manufacturers expressed concerns about the implementation of this technology, DOE understands that there may be uncertainty related to whether this technology can be implemented across all input capacities and cabinet sizes. Similarly, as discussed in section IV.A.4.a of this document, manufacturers also raised concerns about the potential negative impacts on consumer utility because of increased noise in certain sizes of furnaces (although DOE is not aware of data on this subject). Additionally, the incorporation of backward-inclined impellers could require system changes to the furnace system that expand beyond the scope of the furnace fan. Manufacturers noted that adoption of backward-inclined impellers could necessitate system considerations to ensure reliability of heat exchanger performance, acceptable sound performance, and ease of installation. Manufacturers also raised concerns that constraints of backward-inclined impeller designs could impede the flexibility of installation configurations. For some fraction of the market, complete furnace redesign would be required to accommodate the backward-inclined impellers design option.

Finally, as discussed in section IV.B.1.c of this document, DOE understands that there is uncertainty associated with the estimated 10 percent reduction in FER for fans using a backward-inclined impeller as compared to models that include forward-inclined impellers. Uncertainty related to the results of the energy use analysis contributes uncertainty to all the conclusions of DOE's subsequent analyses, including the life-cycle cost and payback period analyses and the national impact analysis. As discussed in section V.C.1 of this document, DOE has considered these uncertainties in its ultimate decision of whether to propose amended standards for consumer furnace fans.

V. Analytical Results and Conclusions

The following section addresses the results from DOE's analyses with respect to the considered energy conservation standards for consumer furnace fans. It addresses the ELs examined by DOE and the projected impacts of each of these levels. To estimate the impacts of amended standards for consumer furnace fans, DOE compared the no-new-standards case to scenarios in which specific Candidate Standards Levels (''CSLs'') are implemented. CSL 1 analyzes a scenario in which standards corresponding to EL 1 are adopted for the NWO–NC, MH–NWG–NC, MH–NWG–C, and MH–NWO product classes and standards are not amended for the NWG–NC, NWG–C, WG–NC, NWEF/NWMB, and MH–EF/MB product classes. CSL 2 analyzes a scenario in which standards are adopted corresponding to EL 1 for the NWG–NC, NWG–C, WG–NC, NWEF/NWMB, and MH–EF/MB product classes and as EL 2 for the NWO–NC, MH–NWG–NC, MH–NWG–C, and MH–NWO product classes. In other words, CSL 1 analyzes a scenario in which BPM motors are required for all product classes and CSL 2 analyzes a scenario in which BPM motors with backward-inclined impellers are required for all product classes, corresponding to the max-tech efficiency level for all product classes.

A. Economic Impacts on Individual Consumers

DOE analyzed the cost effectiveness (*i.e.,* the savings in operating costs throughout the estimated average life of consumer furnace fans compared to any increase in the price of, or in the initial charges for, or maintenance expenses of, the consumer furnace fans which are likely to result from the imposition of a standard at an EL by considering the LCC and PBP at each EL. These analyses are discussed in the following sections.

In general, higher-efficiency products can 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. Section IV.E of this NOPD provides detailed information on the LCC and PBP analyses.

Table V.1 through Table V.18 show the average LCC and PBP results for the ELs considered for consumer furnace fans in this analysis.

[71] United States Office of Management and Budget, *Circular A–4: Regulatory Analysis* (Sept. 17, 2003) Section E (Available at: *obamawhitehouse.archives.gov/omb/circulars_a004_a-4/*) (Last accessed May 31, 2023).

TABLE V.1—AVERAGE LCC AND PBP RESULTS BY EFFICIENCY LEVEL FOR NON-WEATHERIZED, NON-CONDENSING GAS FURNACE FAN

[NWG–NC]

Efficiency level	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	403	67	1,160	1,563		20.9
1	495	60	1,069	1,565	12.9	20.9

TABLE V.2—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR NON-WEATHERIZED, NON-CONDENSING GAS FURNACE FAN

[NWG–NC]

Efficiency level	% Consumers with net cost	Average savings—impacted consumers (2022$)
0	0.0	NA
1	68.4	(1)

TABLE V.3—AVERAGE LCC AND PBP RESULTS BY EFFICIENCY LEVEL FOR NON-WEATHERIZED, CONDENSING GAS FURNACE FAN

[NWG–C]

Efficiency level	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	420	61	1,106	1,525		21.9
1	501	55	1,024	1,526	13.3	21.9

TABLE V.4—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR NON-WEATHERIZED, CONDENSING GAS FURNACE FAN

[NWG–C]

Efficiency level	% Consumers with net cost	Average savings—impacted consumers (2022$)
0	0.0	NA
1	70.7	(0)

TABLE V.5—AVERAGE LCC AND PBP RESULTS BY EFFICIENCY LEVEL FOR MOBILE HOME NON-WEATHERIZED, NON-CONDENSING GAS FURNACE FAN

[MH–NWG–NC]

Efficiency level	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	212	54	884	1,096		20.7
1	258	35	589	847	2.3	20.7
2	332	30	530	863	5.0	20.7

TABLE V.6—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR MOBILE HOME NON-WEATHERIZED, NON-CONDENSING GAS FURNACE FAN

[MH–NWG–NC]

Efficiency level	% consumers with net cost	Average savings—impacted consumers (2022$)
0	0.0	NA
1	3.8	231
2	76.1	9

TABLE V.7—AVERAGE LCC AND PBP RESULTS BY EFFICIENCY LEVEL FOR MOBILE HOME NON-WEATHERIZED, CONDENSING GAS FURNACE

[MH–NWG–C]

Efficiency level	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	238	62	1,039	1,277		21.5
1	300	37	666	966	2.5	21.5
2	364	34	631	995	4.6	21.5

TABLE V.8—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR MOBILE HOME NON-WEATHERIZED, CONDENSING GAS FURNACE

[MH–NWG–C]

Efficiency level	% Consumers with net cost	Average savings—impacted consumers (2022$)
0	0.0	NA
1	1.5	292
2	82.1	(7)

TABLE V.9—AVERAGE LCC AND PBP RESULTS BY EFFICIENCY LEVEL FOR MOBILE HOME ELECTRIC FURNACE/MODULAR BLOWER FAN

[MH–EF/MB]

Efficiency level	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	255	36	629	885		20.7
1	315	32	578	893	14.7	20.7

TABLE V.10—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR MOBILE HOME ELECTRIC FURNACE/MODULAR BLOWER FAN

[MH–EF/MB]

Efficiency level	% Consumers with net cost	Average savings—impacted consumers (2022$)
0	0.0	NA
1	71.5	(8)

TABLE V.11—AVERAGE LCC AND PBP RESULTS BY EFFICIENCY LEVEL FOR NON-WEATHERIZED, NON-CONDENSING OIL FURNACE FAN

[NWO–NC]

Efficiency level	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	568	151	2,601	3,169		22.2
1	654	110	1,940	2,594	2.1	22.2
2	765	103	1,840	2,605	4.1	22.2

TABLE V.12—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR NON-WEATHERIZED, NON-CONDENSING OIL FURNACE FAN

[NWO–NC]

Efficiency level	% Consumers with net cost	Average savings—impacted consumers (2022$)
0	0.0	NA
1	4.4	618
2	52.2	274

TABLE V.13—AVERAGE LCC AND PBP RESULTS BY EFFICIENCY LEVEL FOR WEATHERIZED NON-CONDENSING GAS FURNACE FAN

[WG–NC]

Efficiency level	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	385	81	1,322	1,706		20.6
1	478	71	1,188	1,666	9.1	20.6

TABLE V.14—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR WEATHERIZED NON-CONDENSING GAS FURNACE FAN

[WG–NC]

Efficiency level	% Consumers with net cost	Average savings—impacted consumers (2022$)
0	0.0	NA
1	54.9	40

TABLE V.15—AVERAGE LCC AND PBP RESULTS BY EFFICIENCY LEVEL FOR ELECTRIC FURNACE/MODULAR BLOWER

[EF/MB]

Efficiency level	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	305	43	726	1,031		20.7
1	371	39	673	1,045	16.0	20.7

TABLE V.16—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR ELECTRIC FURNACE/MODULAR BLOWER
[EF/MB]

Efficiency level	% Consumers with net cost	Average savings—impacted consumers (2022$)
0	0.0	NA
1	77.5	(14)

TABLE V.17—AVERAGE LCC AND PBP RESULTS BY EFFICIENCY LEVEL FOR MOBILE HOME NON-WEATHERIZED, NON-CONDENSING OIL FURNACE FAN
[MH–NWO–NC]

Efficiency level	Average costs (2022$)				Simple payback period (years)	Average lifetime (years)
	Installed cost	First year's operating cost	Lifetime operating cost	LCC		
0	491	88	1,539	2,030		22.5
1	541	66	1,187	1,728	2.3	22.5
2	624	61	1,105	1,729	5.0	22.5

TABLE V.18—LCC SAVINGS RELATIVE TO THE BASE CASE EFFICIENCY DISTRIBUTION FOR MOBILE HOME NON-WEATHERIZED, NON-CONDENSING OIL FURNACE FAN
[MH–NWO–NC]

Efficiency level	% Consumers with net cost	Average savings—impacted consumers (2022$)
0	0.0	NA
1	21.0	308
2	54.7	276

B. National Impact Analysis

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

1. Significance of Energy Savings

To estimate the energy savings attributable to potential amended standards for consumer furnace fans, DOE compared their energy consumption under the no-new-standards case to their anticipated energy consumption under each CSL.

The savings are measured over the entire lifetime of products purchased in the 30-year period that begins in the year of anticipated compliance with amended standards (2030–2059). Table V.20 presents DOE's projections of the NES for each CSL considered for consumer furnace fans. The savings were calculated using the approach described in section IV.G of this document.

TABLE V.20—CUMULATIVE NATIONAL ENERGY SAVINGS FOR CONSUMER FURNACE FANS; 30 YEARS OF SHIPMENTS
[2030–2059]

	Candidate standards level	
	1	2
	quads	
Primary energy	0.013	1.355
FFC energy	0.013	1.374

OMB Circular A–4 [72] requires agencies to present analytical results, including separate schedules of the monetized benefits and costs that show the type and timing of benefits and costs. Circular A–4 also directs agencies to consider the variability of key elements underlying the estimates of benefits and costs. For this proposed determination, 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.[73] [74] The review timeframe established in EPCA is generally not synchronized with the product lifetime, product manufacturing cycles, or other factors specific to consumer furnace fans. Thus, such results are presented for informational purposes only and are not indicative of any change in DOE's analytical methodology. The NES sensitivity analysis results based on a 9-year analytical period are presented in Table V.21. The impacts are counted over the lifetime of consumer furnace fans purchased in 2030–2038.

[72] U.S. Office of Management and Budget. *Circular A–4: Regulatory Analysis.* September 17, 2003. Available at *obamawhitehouse.archives.gov/omb/circulars_a004_a-4/* (Last accessed Sept. 9, 2021).

[73] U.S. Office of Management and Budget. *Circular A–4: Regulatory Analysis.* September 17, 2003. Available at *obamawhitehouse.archives.gov/omb/circulars_a004_a-4/* (last accessed August 29, 2023).

[74] Section 325(m) of EPCA requires DOE to review its standards at least once every 6 years, and requires, for certain products, a 3-year period after any new standard is promulgated before compliance is required, except that in no case may any new standards be required within 6 years of the compliance date of the previous standards. If DOE makes a determination that amended standards are not needed, it must conduct a subsequent review within three years following such a determination. As DOE is evaluating the need to amend the standards, the sensitivity analysis is based on the review timeframe associated with amended 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.

TABLE V.21—CUMULATIVE NATIONAL ENERGY SAVINGS FOR CONSUMER FURNACE FANS; 9 YEARS OF SHIPMENTS

[2030–2038]

	Candidate standards level	
	1	2
	(quads)	
Primary energy	0.005	0.376
FFC energy	0.005	0.381

2. 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 CSLs considered for consumer furnace fans. In accordance with OMB's guidelines on regulatory analysis,[75] DOE calculated NPV using both a 7-percent and a 3-percent real discount rate. Table V.22 shows the consumer NPV results with impacts counted over the lifetime of products purchased in 2030–2059.

TABLE V.22—CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR CONSUMER FURNACE FANS; 30 YEARS OF SHIPMENTS

[2030–2059]

Discount rate	Candidate standards level	
	1	2
	(billion 2022$)	
3 percent	0.112	1.821
7 percent	0.042	(0.150)

Note: Number in parentheses means negative.

The NPV results based on the aforementioned 9-year analytical period are presented in Table V.23. The impacts are counted over the lifetime of products purchased in 2030–2038. 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.

[75] U.S. Office of Management and Budget. *Circular A–4: Regulatory Analysis.* September 17, 2003. Available at *obamawhitehouse.archives.gov/omb/circulars_a004_a-4/* (Last accessed Sept. 9, 2021).

TABLE V.23—CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR CONSUMER FURNACE FANS; 9 YEARS OF SHIPMENTS

[2030–2038]

Discount rate	Candidate standards level	
	1	2
	(billion 2022$)	
3 percent	0.056	0.716
7 percent	0.026	(0.071)

Note: Number in parentheses means negative.

C. Proposed Determination

EPCA mandates that DOE consider whether amended energy conservation standards for consumer furnace fans would be technologically feasible. (42 U.S.C. 6295(m)(1)(A) and 42 U.S.C. 6295(n)(2)(B)) EPCA also requires DOE to consider whether energy conservation standards for consumer furnace fans would be cost effective through an evaluation of the savings in operating costs throughout the estimated average life of the covered product compared to any increase in the price of, or in the initial charges for, or maintenance expenses of, the covered products which are likely to result from the imposition of an amended standard. (42 U.S.C. 6295(m)(1)(A), 42 U.S.C. 6295(n)(2)(C), and 42 U.S.C. 6295(o)(2)(B)(i)(II)) Finally, EPCA mandates that DOE consider whether amended energy conservation standards for consumer furnace fans would result in significant conservation of energy. (42 U.S.C. 6295(m)(1)(A) and 42 U.S.C. 6295(n)(2)(A))

DOE conducted an LCC analysis to estimate the net costs/benefits to users from increased efficiency in the considered consumer furnace fans, the results of which are shown in Table V.1. DOE then aggregated the results from the LCC analysis to estimate the NPV of the total costs and benefits experienced by the Nation. (See results in Table V.4 and Table V.5.) As noted, the inputs for determining the NPV 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.

To estimate the energy savings attributable to potential amended standards for consumer furnace fans, DOE compared their energy consumption under the no-new-standards case to their anticipated energy consumption under each potential standard level. The savings are measured over the entire lifetime of products purchased in the 30-year period that begins in the year of anticipated compliance with amended standards (2030–2059). The results of this analysis are shown in Table V.20 and Table V.21.

Because an analysis of potential cost effectiveness and energy savings first requires an evaluation of the relevant technology, DOE typically first discusses the technological feasibility of amended standards. DOE then typically addresses the cost effectiveness and energy savings associated with potential amended standards. For the current analysis, DOE reviewed the impacts of amended standards corresponding to the implementation of the two design options analyzed in this rule (*i.e.,* BPM motor with forward-curved impellers and BPM motor with backward inclined impellers, as discussed in section IV.B of this document) separately. For each design option, DOE considered the technological feasibility, cost-effectiveness, and significance of energy savings.

1. BPM Motor With Backward-Inclined Impellers

BPM motors with backward-inclined impellers are included in the current analysis as the max-tech design option for all furnace fan product classes. In other words, they are analyzed as EL 1 for the NWG–NC, NWG–C, WG–NC, NWEF/NWMB, and MH–EF/MB product classes and as EL 2 for the NWO–NC, MH–NWG–NC, MH–NWG–C, and MH–NWO product classes. As discussed in section IV.A.4 of this document, DOE is aware of BPM motors with backward-inclined impellers being used in commercially available consumer furnace fans and therefore this technology is technologically feasible.

As seen in Table V.20, DOE estimates that amended standards for consumer furnace fans would result in energy savings of 1.374 quads at max tech levels over a 30-year analysis period (2030–2059). However, as seen in Table V.1 through Table V.18 and Table V.22, these efficiency levels result in net life-cycle costs for the majority of consumers and negative net present value at a 7-percent discount rate. Therefore, DOE finds that the max-tech ELs (which would require the use of backward-inclined impellers used with BPM motors) are not cost effective.

Additionally, as discussed in section IV.H of this document, there is a significant amount of uncertainty associated technical feasibility of backward-inclined impellers. In particular, DOE has concerns about the feasibility of implementing backward-inclined impellers across all input capacities and cabinet sizes and the unavailability of certain furnace product sizes and uncertainty related to its estimates of the energy reduction associated with backward-inclined impellers as opposed to forward-curved impellers.

2. BPM Motor With Forward-Curved Impellers

Use of BPM motors with forward-curved impellers (which is the type of impeller used in the vast majority of consumer furnace fans on the market today) are included in the current analysis as the design option analyzed in CSL 1. For these product classes, the current standards can be met using less-efficient PSC motors, so replacing the motor with a BPM motor can improve the efficiency of the furnace fan. BPM motors are widely used in commercially available consumer furnace fans and therefore are technologically feasible.

As seen in Table V.22, CSL 1 results in positive NPV at the 3-percent and 7-percent discount rates. And, as seen in Table V.20, DOE estimates that amended standards for consumer furnace fans would result in energy savings of 0.013 quads at CSL 1 over a 30-year analysis period (2030–2059). However, as discussed in section IV.F, shipments in the affected product classes have declined over the past 20 years and could decline faster than current shipment projections, which may lead to reductions in energy savings from amended standards.

Given the small role of NWO–NC, MH–NWG–NC, MH–NWG–C, and MH–NWO in the overall furnace market and the low sales relative to the consumer boiler and consumer water heater markets, manufacturers may de-prioritize furnace fan updates for these product classes. Depending on how companies prioritize resources, there could be reduced availability of NWO–NC, MH–NWG–NC, and MH–NWO products in the marketplace after 2030. Additionally, there is a potential risk that some manufacturers would choose to exit these markets rather than redesign affected products given the low shipment volumes, lack of anticipated growth, limited potential for cost recovery, and need to prioritize technical resources. In particular, the loss of a few manufacturers in the NWO–NC market could lead to changes in the competition and shifts toward the market becoming highly concentrated.

As discussed previously, any amended standards for furnace fans would be required to comply with the economic justification and other requirements of 42 U.S.C. 6295(o). Based on the declining shipments of the affected product classes and uncertainty over whether manufacturers will choose to remain in a shrinking market, DOE has tentatively determined that it is unable to conclude that amended standards for furnace fans would be economically justified.

3. Summary

As discussed previously, a determination that amended standards are not needed must be based on consideration of whether amended standards will result in significant conservation of energy, are technologically feasible, and are cost effective. (42 U.S.C. 6295(m)(1)(A) and 42 U.S.C. 6295(n)(2)) Additionally, DOE can only propose an amended standard if it is, among other things, economically justified. (42 U.S.C. 6295(m)(1)(B); 42 U.S.C. 6295(o)(2)(A)) With respect to the candidate standard level representing the max-tech design option, BPM motors with backward-inclined impellers, DOE has tentatively determined that an amended standard at this level would not be cost-effective. And, for the candidate standard level representing BPM motors with forward-curved impellers, DOE has tentatively determined that it is unable to conclude that an amended standard at this level would be economically justified. Therefore, DOE has tentatively determined that energy conservation standards for consumer furnace fans do not need to be amended at this time. DOE will consider all comments received on this proposed determination in issuing any final determination.

VI. Procedural Issues and Regulatory Review

A. Review Under Executive Orders 12866, 13563, and 14094

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 proposed 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 proposed regulatory action does not constitute a ''significant regulatory action'' within the scope of section 3(f)(1) of E.O. 12866. Accordingly, this action was not submitted to OIRA for review under E.O. 12866.

B. Review Under the Regulatory Flexibility Act

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

DOE reviewed this proposed determination under the provisions of the Regulatory Flexibility Act and the policies and procedures published on February 19, 2003. Because DOE is proposing not to amend standards for consumer furnace fans, if adopted, the determination would not amend any energy conservation standards. On the basis of the foregoing, DOE certifies that the proposed determination, if adopted, would have no significant economic impact on a substantial number of small entities. Accordingly, DOE has not prepared an IRFA for this proposed determination. DOE will transmit this certification and supporting statement of factual basis to the Chief Counsel for Advocacy of the Small Business Administration for review under 5 U.S.C. 605(b).

C. Review Under the Paperwork Reduction Act

This proposed determination, which proposes to determine that amended energy conservation standards for consumer furnace fans are unneeded under the applicable statutory criteria, would impose no new informational or recordkeeping requirements. Accordingly, OMB clearance is not required under the Paperwork Reduction Act. (44 U.S.C. 3501 *et seq.*)

D. Review Under the National Environmental Policy Act of 1969

DOE is analyzing this proposed action in accordance with the National Environmental Policy Act of 1969 (''NEPA'') and DOE's NEPA implementing regulations (10 CFR part 1021). DOE's regulations include a categorical exclusion for actions which are interpretations or rulings with respect to existing regulations. 10 CFR part 1021, subpart D, appendix A4. DOE anticipates that this action qualifies for categorical exclusion A4 because it is an interpretation or ruling in regards to an existing regulation and otherwise meets the requirements for application of a categorical exclusion. *See* 10 CFR 1021.410. DOE will complete its NEPA review before issuing the final action.

E. Review Under Executive Order 13132

E.O. 13132, ''Federalism,'' 64 FR 43255 (Aug. 10, 1999), imposes certain requirements on Federal agencies formulating and implementing policies or regulations that preempt State law or that have federalism implications. The Executive order requires agencies to examine the constitutional and statutory authority supporting any action that would limit the policymaking discretion of the States and to carefully assess the necessity for such actions. The Executive order also requires agencies to have an accountable process to ensure meaningful and timely input by State and local officials in the development of regulatory policies that have federalism implications. On March 14, 2000, DOE published a statement of policy describing the intergovernmental consultation process it will follow in the development of such regulations. 65 FR 13735. DOE has examined this proposed determination and has tentatively determined that it would not have a substantial direct effect on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. EPCA governs and prescribes Federal preemption of State regulations as to energy conservation for the products that are the subject of this proposed rule. States can petition DOE for exemption from such preemption to the extent, and based on criteria, set forth in EPCA. (42 U.S.C. 6297) Therefore, no further action is required by E.O. 13132.

F. Review Under Executive Order 12988

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

G. Review Under the Unfunded Mandates Reform Act of 1995

Title II of the Unfunded Mandates Reform Act of 1995 (''UMRA'') requires each Federal agency to assess the effects of Federal regulatory actions on State, local, and Tribal governments and the private sector. Public Law 104–4, sec. 201 (codified at 2 U.S.C. 1531). For a proposed regulatory action likely to result in a rule that may cause the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector of $100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish a written statement that estimates the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a), (b)) The UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal governments on a proposed ''significant intergovernmental mandate,'' and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect them. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. 62 FR 12820. DOE's policy statement is also available at *energy.gov/sites/prod/files/gcprod/documents/umra_97.pdf.*

DOE examined this proposed determination according to UMRA and its statement of policy and determined that the proposed determination does not contain a Federal intergovernmental mandate, nor is it expected to require expenditures of $100 million or more in any one year by State, local, and Tribal governments, in the aggregate, or by the private sector. As a result, the analytical requirements of UMRA do not apply.

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

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

I. Review Under Executive Order 12630

Pursuant to E.O. 12630, ''Governmental Actions and Interference with Constitutionally Protected Property Rights,'' 53 FR 8859 (Mar. 15, 1988), DOE has determined that this proposed determination 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 NOPD 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 the Office of Information and Regulatory Affairs (''OIRA'') at OMB, a Statement of Energy Effects for any proposed significant energy action. A ''significant energy action'' is defined as any action by an agency that promulgates or is expected to lead to promulgation of a final rule, and that (1) is a significant regulatory action under Executive Order 12866, or any successor Executive Order; and (2) is likely to have a significant adverse effect on the supply, distribution, or use of energy, or (3) is designated by the Administrator of OIRA as a significant energy action. For any proposed significant energy action, the agency must give a detailed statement of any adverse effects on energy supply, distribution, or use should the proposal be implemented, and of reasonable alternatives to the action and their expected benefits on energy supply, distribution, and use.

This proposed determination, which does not propose to amend energy conservation standards for consumer furnace fans, is not a significant regulatory action under Executive Order 12866. Moreover, it would not 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.

L. Review Under the Information Quality Bulletin for Peer Review

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

In response to OMB's Bulletin, DOE conducted formal peer reviews of the energy conservation standards development process and the analyses that are typically used and has prepared a Peer Review report pertaining to the energy conservation standards rulemaking analyses.[76] 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 with the National Academy of Sciences to review DOE's analytical methodologies to ascertain

[76] ''Energy Conservation Standards Rulemaking Peer Review Report.'' 2007. Available at *energy.gov/eere/buildings/downloads/energy-conservation-standards-rulemaking-peer-review-report-0* (last accessed June 26, 2023).

whether modifications are needed to improve the Department's analyses. DOE is in the process of evaluating the resulting report.[77]

VII. Public Participation

A. Participation in the Webinar

DOE will hold a public webinar upon receiving a request by the deadline identified in the **DATES** section at the beginning of this proposed determination. Interested persons may submit their request for the public webinar to the Appliance and Equipment Standards Program at *ConsumerFurnFan2021STD0029@ee.doe.gov.* If a public webinar is requested, DOE will release webinar registration information, participant instructions, and information about the capabilities available to webinar participants on DOE's website: *www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=14.* Participants are responsible for ensuring their systems are compatible with the webinar software.

B. Submission of Comments

DOE will accept comments, data, and information regarding this proposed determination no later than the date provided in the **DATES** section at the beginning of this proposed rule. Interested parties may submit comments, data, and other information using any of the methods described in the **ADDRESSES** section at the beginning of this document.

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

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

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

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

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

Include contact information each time you submit comments, data, documents, and other information to DOE. No faxes will be accepted.

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

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

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

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

C. Issues on Which DOE Seeks Comment

Although DOE has not identified any specific issues on which it seeks comment, DOE welcomes comments on any aspect of this proposal.

VIII. Approval of the Office of the Secretary

The Secretary of Energy has approved publication of this notification of proposed determination and request for comment.

Signing Authority

This document of the Department of Energy was signed on September 29, 2023, by Jeffrey Marootian, Principal Deputy Assistant Secretary for Energy Efficiency and Renewable Energy, pursuant to delegated authority from the Secretary of Energy. That document with the original signature and date is maintained by DOE. For administrative purposes only, and in compliance with requirements of the Office of the Federal

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

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 September 29, 2023.

Treena V. Garrett,

Federal Register Liaison Officer, U.S. Department of Energy.

[FR Doc. 2023–22149 Filed 10–5–23; 8:45 am]

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