**DEPARTMENT OF ENERGY**

**10 CFR Part 430**

**[EERE–2021–BT–STD–0031]**

**RIN 1904–AF19**

## Energy Conservation Program: Energy Conservation Standards for Oil, Electric, and Weatherized Gas Consumer Furnaces

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

**ACTION:** Final determination.

**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 non-weatherized oil-fired furnaces (''NWOFs''), mobile home oil-fired furnaces (''MHOFs''), weatherized gas furnaces (''WGFs''), weatherized oil-fired furnaces (''WOFs''), and electric furnaces (''EFs''). EPCA also requires the U.S. Department of Energy (''DOE'') to periodically review its existing standards to determine whether more-stringent, amended standards would be technologically feasible and economically justified, and would result in significant energy savings. In this final determination, DOE has determined that the energy conservation standards for EFs, NWOFs, MHOFs, WOFs, and WGFs do not need to be amended.

**DATES:** The effective date of this final determination is November 18, 2024.

**ADDRESSES:** The docket for this activity, 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-0031.* The docket web page contains instructions on how to access all documents, including public comments, in the docket.

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**SUPPLEMENTARY INFORMATION:**

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## I. Synopsis of the Final 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, as codified) Title III, Part B of

[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 reflects the last statutory amendments that impact Parts A and A–1 of EPCA.

EPCA [2] established the Energy Conservation Program for Consumer Products Other Than Automobiles. (42 U.S.C. 6291–6309) These products include oil, electric, and weatherized gas consumer furnaces, the subject of this final determination. (42 U.S.C. 6292(a)(5))

Pursuant to EPCA, DOE is required to review its existing energy conservation standards for covered consumer products no later than six years after issuance of any final rule establishing or amending a standard. (42 U.S.C. 6295(m)(1)) Pursuant to that statutory provision, 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). (*Id.*) DOE has conducted this review of the energy conservation standards for oil, electric, and weatherized gas consumer furnaces under EPCA's six-year-lookback authority described herein.

For this final determination, DOE analyzed oil, electric, and weatherized gas consumer furnaces subject to energy conservation standards specified in the Code of Federal Regulations (''CFR'') at 10 CFR 430.32(e)(1). DOE first analyzed the technological feasibility of more energy-efficient oil, electric, and weatherized gas furnaces and determined that amended standards for electric furnaces are not technologically feasible. For those oil and weatherized gas furnaces 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 determined that the current standards for oil, electric, and weatherized gas furnaces do not need to be amended and is issuing this final determination accordingly.

## II. Introduction

The following sections briefly discuss the statutory authority underlying this final determination, as well as some of the historical background relevant to the establishment of energy conservation standards for oil, electric, and weatherized gas furnaces.

### *A. Authority*

Among other things, EPCA authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment. (42 U.S.C. 6291–6317, as codified) Title III, Part B of EPCA [3] established the Energy Conservation Program for Consumer Products Other Than Automobiles. These products include consumer furnaces, the subject of this document. (42 U.S.C. 6292(a)(5))

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).

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

Subject to certain criteria and conditions, DOE is required to develop test procedures to measure the energy efficiency, energy use, or estimated annual operating cost of each covered product. (42 U.S.C. 6295(o)(3)(A) and 42 U.S.C. 6295(r)) Manufacturers of covered products must use the prescribed DOE test procedure as the basis for certifying to DOE that their product complies with the applicable energy conservation standards and as the basis for any representations regarding the energy use or energy efficiency of the product. (42 U.S.C. 6293(c) and 42 U.S.C. 6295(s)) Similarly, DOE must use these test procedures to evaluate whether a basic model complies with the applicable energy conservation standard(s). (42 U.S.C. 6295(s)) The DOE test procedures for consumer furnaces appear at title 10 of the Code of Federal Regulations (''CFR'') part 430, subpart B, appendix N.

EPCA prescribed energy conservation standards for consumer furnaces (42 U.S.C. 6295(f)(1)–(2)) and directed DOE to conduct future rulemakings to determine whether to amend these standards. (42 U.S.C. 6295(f)(4) and 42 U.S.C. 6295(m)(1)) As explained in section II.B of this document, DOE has completed its rulemaking obligations pursuant to EPCA under 42 U.S.C. 6295(f)(4) for the subject consumer furnaces. However, DOE has ongoing rulemaking obligations under 42 U.S.C. 6295(m)(1) (*i.e.,* the six-year-lookback review requirement). More specifically, and as noted previously, not later than six years after the issuance of any final rule establishing or amending a standard, DOE must publish either a notice of proposed determination (''NOPD'') that standards for the product do not need to be amended, or a NOPR including new proposed energy conservation standards (proceeding to a final rule, as appropriate). (42 U.S.C. 6295(m)(1) and (3)) DOE must make the analysis on which a NOPD or NOPR 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)) Additionally, any new or amended energy conservation standard prescribed by the Secretary for any type (or class) of covered product shall 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)) Among the factors DOE considers in evaluating whether a proposed standard level is economically justified includes whether the proposed standard at that level is cost-effective, as defined under 42 U.S.C. 6295(o)(2)(B)(i)(II). 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))

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

[3] As noted previously, for editorial reasons, upon codification in the U.S. Code, Part B was redesignated Part A.

Finally, pursuant to the amendments to EPCA contained in the Energy Independence and Security Act of 2007 (''EISA 2007''), Public Law 110–140, any final rule for new or amended energy conservation standards promulgated after July 1, 2010, is required to address standby mode and off mode energy use. (42 U.S.C. 6295(gg)(3)) Specifically, when DOE adopts a standard for a covered product after that date, it must, if justified by the criteria for adoption of standards under EPCA (42 U.S.C. 6295(o)), incorporate standby mode and off mode energy use into a single standard, or, if that is not feasible, adopt a separate standard for such energy use for that product. (42 U.S.C. 6295(gg)(3)(A)–(B)) DOE's current test procedures and standards for oil, electric, and weatherized gas furnaces address standby mode and off mode energy use. DOE's energy conservation standards address standby mode and off mode energy use only for non-weatherized oil-fired furnaces (''NWOFs'') (including mobile home furnaces) and electric furnaces (''EFs''). 10 CFR 430.32(e)(1)(iv). In this analysis, DOE considers such energy use in its determination of whether energy conservation standards need to be amended.

DOE is publishing this final determination pursuant to the six-year-lookback review requirement in EPCA.

*B. Background*

1. Current Standards

DOE most recently completed a review of the subject consumer furnace standards in a direct final rule (''DFR'') published in the **Federal Register** on June 27, 2011 (''June 2011 DFR''), through which DOE prescribed amended energy conservation standards for non-weatherized gas furnaces (''NWGFs''), mobile home gas furnaces (''MHGFs''), weatherized gas furnaces (''WGFs''), non-weatherized oil-fired furnaces (''NWOFs''), mobile home oil furnaces (''MHOFs''), and weatherized oil furnaces (''WOFs'').[4] 76 FR 37408. The June 2011 DFR amended the existing energy conservation standards for NWGFs, MHGFs, and NWOFs (which are specified in terms of annual fuel utilization efficiency (''AFUE'')) and amended the compliance date (but left the existing standards in place) for WGFs. The June 2011 DFR also established electrical standby mode and off mode standards for NWGFs, MHGFs, NWOFs, MHOFs, and electric furnaces. As a result of a settlement agreement approved by the Court of Appeals for the District of Columbia (''D.C.'') Circuit, the standards established by the June 2011 DFR for NWGFs and MHGFs did not go into effect.[5] However, the court order left in place the standards for WGFs, NWOFs, MHOFs, WOFs, and EFs, which are the subject of this final determination. These standards are set forth in DOE's regulations at 10 CFR 430.32(e)(1)(ii) and (e)(1)(iv) and are shown in Table II.1 and Table II.2.

TABLE II.1—FEDERAL AFUE ENERGY CONSERVATION STANDARDS FOR OIL, ELECTRIC, AND WEATHERIZED GAS FURNACES

| Product class | AFUE (percent) | Compliance date |
|---|---|---|
| Non-weatherized oil-fired furnaces (not including mobile home furnaces) | 83 | May 1, 2013. |
| Mobile home oil-fired furnaces | 75 | September 1, 1990. |
| Weatherized gas furnaces | 81 | January 1, 2015. |
| Weatherized oil-fired furnaces | 78 | January 1, 1992. |
| Electric furnaces | 78 | January 1, 1992. |

TABLE II.2—FEDERAL STANDBY MODE AND OFF MODE ENERGY CONSERVATION STANDARDS FOR OIL AND ELECTRIC FURNACES

| Product class | Maximum standby mode electrical power consumption, $P_{W, SB}$ (watts) | Maximum off mode electrical power consumption, $P_{W, OFF}$ (watts) | Compliance date |
|---|---|---|---|
| Non-weatherized oil-fired furnaces (including mobile home furnaces) | 11 | 11 | May 1, 2013. |
| Electric furnaces | 10 | 10 | May 1, 2013. |

2. Current Rulemaking History

Amendments to EPCA in the National Appliance Energy Conservation Act of 1987 (''NAECA''; Pub. L. 100–12) established EPCA's original energy conservation standards for furnaces, consisting of the minimum AFUE levels for mobile home furnaces and for all other furnaces except ''small'' gas furnaces. (42 U.S.C. 6295(f)(1)–(2)) The original standards established a minimum AFUE of 75 percent for mobile home furnaces and 78 percent for all other furnaces. Pursuant to authority conferred under 42 U.S.C. 6295(f)(1)(B), DOE subsequently adopted a mandatory minimum AFUE level for ''small'' furnaces through a final rule published in the **Federal Register** on November 17, 1989 (''the

[4] This rulemaking was undertaken pursuant to the voluntary remand in *State of New York, et al.* v. *Department of Energy, et al.,* 08–311–ag(L); 08–312–ag(con) (2d Cir. filed Jan. 17, 2008).

[5] DOE confirmed the standards and compliance dates promulgated in the June 2011 DFR in a notice of effective date and compliance dates published in the **Federal Register** on October 31, 2011 (''October 2011 notice''). 76 FR 67037. After publication of the October 2011 notice, the American Public Gas Association (''APGA'') sued DOE to invalidate the rule as it pertained to NWGFs and MHGFs. Petition for Review, *American Public Gas Association, et al.* v. *Department of Energy, et al.,* No. 11–1485 (D.C. Cir. filed Dec. 23, 2011). On April 24, 2014, the Court granted a motion that approved a settlement agreement that was reached between DOE, APGA, and the various intervenors in the case, in which DOE agreed to a remand of the NWGF and MHGF portions of the June 2011 DFR in order to conduct further notice-and-comment rulemaking. Accordingly, the Court's order vacated the June 2011 DFR in part (*i.e.,* those portions relating to NWGFs and MHGFs) and remanded to the agency for further rulemaking. DOE addressed NWGFs and MHGFs in a separate rulemaking proceeding (*see* Docket No. EERE–2014–BT–STD–0031). DOE published a final rule in the **Federal Register** on December 18, 2023 amending the energy conservation standards for NWGFs and MHGFs. 88 FR 87502.

November 1989 Final Rule''). 54 FR 47916. The standards established by NAECA and the November 1989 Final Rule for ''small'' gas furnaces are still in effect for MHOFs, WOFs, and EFs.

Pursuant to EPCA, DOE was required to conduct two rounds of rulemaking to consider amended energy conservation standards for all consumer furnaces, and an additional round of rulemaking for mobile home furnaces. (42 U.S.C. 6295(f)(4)(A), (B), and (C)) In satisfaction of the first round of amended standards rulemaking under 42 U.S.C. 6295(f)(4)(B), on November 19, 2007, DOE published in the **Federal Register** a final rule (''November 2007 Final Rule'') that revised the standards for most furnaces but left them in place for two product classes (*i.e.,* MHOFs and WOFs).[6] The standards amended in the November 2007 Final Rule were to apply to furnaces manufactured or imported on and after November 19, 2015. 72 FR 65136 (Nov. 19, 2007). The energy conservation standards in the November 2007 Final Rule consist of a minimum AFUE level for each of the six classes of furnaces. *Id.* at 72 FR 65169. Based on the market analysis for the November 2007 Final Rule and the standards established under that rule, the November 2007 Final Rule eliminated the distinction between furnaces based on their certified input capacity (*i.e.,* the standards applicable to ''small'' furnaces were established at the same level and as part of their appropriate class of furnace generally). *Id.*

Following DOE's adoption of the November 2007 Final Rule, several parties jointly sued DOE in the United States Court of Appeals for the Second Circuit (''Second Circuit'') to invalidate the rule. Petition for Review, *State of New York, et al.* v. *Department of Energy, et al.,* Nos. 08–0311-ag(L); 08–0312-ag(con) (2d Cir. filed Jan. 17, 2008). The petitioners asserted that the standards for furnaces promulgated in the November 2007 Final Rule did not reflect the ''maximum improvement in energy efficiency'' that ''is technologically feasible and economically justified'' under 42 U.S.C. 6295(o)(2)(A). On April 16, 2009, DOE filed with the Court a motion for voluntary remand that the petitioners did not oppose. The motion did not state that the November 2007 Final Rule would be vacated, but it indicated that DOE would revisit its initial conclusions outlined in the November 2007 Final Rule in a subsequent rulemaking action. DOE also agreed that the final rule in that subsequent rulemaking action would address both regional standards for furnaces and the effects of alternate standards on natural gas prices. The Second Circuit granted DOE's motion on April 21, 2009. DOE notes that the Second Circuit's order did not vacate the energy conservation standards set forth in the November 2007 Final Rule, and during the remand, the standards went into effect as originally scheduled.

On June 27, 2011, DOE published a direct final rule (''DFR'') in the **Federal Register** (''June 2011 DFR'') revising the energy conservation standards for residential furnaces pursuant to the voluntary remand in *State of New York, et al.* v. *Department of Energy, et al.* 76 FR 37408. In the June 2011 DFR, DOE considered the amendment of the same six product classes considered in the November 2007 Final Rule analysis plus electric furnaces. As discussed previously, the June 2011 DFR amended the existing AFUE energy conservation standards for NWGFs, MHGFs, and NWOFs and amended the compliance date (but left the existing standards in place) for WGFs. The June 2011 DFR also established electrical standby mode and off mode energy conservation standards for NWGFs, MHGFs, NWOFs, MHOFs, and EFs. DOE confirmed the standards and compliance dates promulgated in the June 2011 DFR in a notice of effective date and compliance dates published in the **Federal Register** on October 31, 2011 (''October 2011 Notice''). 76 FR 67037. The November 2007 Final Rule and the June 2011 DFR represented the first and the second rounds, respectively, of the two rulemakings required under 42 U.S.C. 6295(f)(4)(B)–(C) to consider amending the energy conservation standards for consumer furnaces.

The June 2011 DFR and October 2011 Notice amended, in relevant part, the AFUE energy conservation standards and compliance dates for three product classes of consumer furnaces (*i.e.,* NWGFs, MHGFs, and NWOFs).[7] The existing AFUE standards were left in place for three classes of consumer furnaces (*i.e.,* WOFs, MHOFs, and EFs). For WGFs, the existing standard was left in place, but the compliance date was amended. Electrical standby mode and off mode energy consumption standards were established for non-weatherized gas and oil-fired furnaces (including mobile home furnaces) and EFs. Compliance with the energy conservation standards promulgated in the June 2011 DFR was to be required on May 1, 2013 for NWGFs, MHGFs, and NWOFs, and on January 1, 2015, for weatherized furnaces. 76 FR 37408, 37547–37548 (June 27, 2011); 76 FR 67037, 67051 (Oct. 31, 2011). The amended energy conservation standards and compliance dates in the June 2011 DFR superseded those standards and compliance dates promulgated by the November 2007 Final Rule for NWGFs, MHGFs, and NWOFs. Similarly, the amended compliance date for WGFs in the June 2011 DFR superseded the compliance date in the November 2007 Final Rule.

Following DOE's adoption of the June 2011 DFR, APGA filed a petition for review with the United States Court of Appeals for the District of Columbia Circuit (''D.C. Circuit'') to invalidate the DOE rule as it pertained to NWGFs and MHGFs. Petition for Review, *American Public Gas Association, et al.* v. *Department of Energy, et al.,* No. 11–1485 (D.C. Cir. filed Dec. 23, 2011). The parties to the litigation engaged in settlement negotiations, which ultimately led to filing of an unopposed motion on March 11, 2014, seeking to vacate DOE's rule in part and to remand to the agency for further rulemaking.

On April 24, 2014, the Court granted the motion and ordered that the standards established for NWGFs and MHGFs be vacated and remanded to DOE for further rulemaking. As a result, the standards established by the June 2011 DFR for NWGFs and MHGFs did not go into effect, and, thus, required compliance with the standards established in the November 2007 Final Rule for these products began on November 19, 2015. As stated previously, the AFUE standards for WOFs, MHOFs, and EFs were unchanged, and as such, the original standards for those product classes remain in effect. Further, the amended standard for NWOFs was not subject to the Court order and went into effect as specified in the June 2011 DFR. The AFUE standards currently applicable to all residential furnaces,[8] including the

[6] The November 2007 Final Rule adopted amended standards for ''oil-fired furnaces'' generally. However, on July 28, 2008, DOE published a technical amendment final rule in the **Federal Register** that clarified that the amended standards adopted in the November 2007 Final Rule for oil-fired furnaces did not apply to MHOFs and WOFs; rather, they were only applicable for NWOFs. 73 FR 43611, 43613 (July 28, 2008).

[7] For NWGFs and MHGFs, the standards were amended to a level of 80-percent AFUE nationally with a more-stringent 90-percent AFUE requirement in the Northern Region. For NWOFs, the standard was amended to 83-percent AFUE nationally. 76 FR 37408, 37410 (June 27, 2011).

[8] DOE divides consumer furnaces into seven classes for the purpose of setting energy conservation standards: (1) NWGFs, (2) MHGFs, (3) WGFs, (4) NWOFs, (5) MHOFs, (6) WOFs, and (7) EFs. 10 CFR 430.32(e)(1)(ii). As noted previously, DOE analyzed amended standards for NWGFs and

Continued

five product classes for which DOE is analyzing amended standards leading to this final determination, are set forth in DOE's regulations at 10 CFR 430.32(e)(1)(ii).

On January 28, 2022, DOE published in the **Federal Register** a request for information (''January 2022 RFI'') to initiate a review to determine whether any new or amended standards would satisfy the relevant requirements of EPCA for a new or amended energy conservation standard for oil, electric, and weatherized gas consumer furnaces. 87 FR 4513. On November 29, 2022, DOE published in the **Federal Register** a notice of availability of a preliminary technical support document (''TSD'') (''the November 2022 Preliminary Analysis'') and the accompanying preliminary TSD (''the November 2022 Preliminary Analysis TSD'') that presented initial technical analyses in the following areas: (1) market and technology; (2) screening; (3) engineering; (4) markups to determine product price; (5) energy use; (6) LCC and PBP, and (7) national impacts. 87 FR 73259. DOE held a public meeting webinar on December 19, 2022, in order to receive public input and information related to the November 2022 Preliminary Analysis for the subject furnaces. On November 29, 2023, DOE published a NOPD (''the November 2023 NOPD'') in the **Federal Register**, which tentatively determined that current standards for oil, electric, and weatherized gas furnaces do not need to be amended.[9] 88 FR 83426.

DOE received comments in response to the November 2023 NOPD from the interested parties listed in Table II.3.

TABLE II.3—LIST OF COMMENTERS WITH WRITTEN SUBMISSIONS IN RESPONSE TO THE NOVEMBER 2023 NOPD

| Commenter(s) | Abbreviation | Comment No. in the docket | Commenter type |
|---|---|---|---|
| Air-Conditioning, Heating, and Refrigeration Institute | AHRI | 36 | Trade Association. |
| American Gas Association, American Public Gas Association, National Propane Gas Association. | Joint Commenters | 33 | Trade Association. |
| Andrew Chiafullo | Chiafullo | 31 | Individual. |
| Appliance Standards Awareness Project, American Council for an Energy-Efficient Economy, Natural Resources Defense Council, New York State Energy Research and Development Authority, Northwest Energy Efficiency Alliance. | Joint Advocates | 34 | Efficiency Organization. |
| Daikin Comfort Technologies North America, Inc. | Daikin | 35 | Manufacturer. |
| Lennox International | Lennox | 32 | Manufacturer. |
| Michael Ravnitzky | Ravnitzky | 30 | Individual. |

A parenthetical reference at the end of a comment quotation or paraphrase provides the location of the item in the public record.[10]

## III. General Discussion and Rationale

DOE developed this final determination after a review of the market for the subject oil, electric, and weatherized gas consumer furnaces. DOE also considered comments, data, and information from interested parties that represent a variety of interests. This final determination addresses issues raised by these commenters.

### *A. General Comments*

This section summarizes general comments received from interested parties.

#### 1. Comments Supporting Proposed Determination

Daikin supported DOE's conclusion in the November 2023 NOPD that the current standards for oil, electric, and weatherized gas consumer furnaces do not need to be amended based on the results of the analyses that assessed impacts on manufacturers and product availability. (Daikin, No. 35 at p. 1) AHRI supported DOE's determination not to amend energy conservation standards for oil and weatherized gas consumer furnaces due to the small markets for these products, the minimal energy savings potential at the efficiency levels analyzed, and the problems consumers would face from lack of product availability. In addition, AHRI agreed with DOE's conclusion that amended energy standards for electric furnaces are not technologically feasible. (AHRI, No. 36 at p. 1) Ravnitzky supported DOE's conclusion regarding energy conservation standards for oil, electric, and weatherized gas consumer furnaces due to DOE's analysis of the technological feasibility, economic justification, and potential for significant energy savings. (Ravnitzky, No. 30 at p. 1)

Lennox supported DOE's conclusion that no new standards are appropriate for oil and weatherized gas consumer furnaces. (Lennox, No. 32 at pp. 1–2) The commenter agreed with DOE's conclusion that oil-fired and weatherized gas furnaces are niche products with flat or declining sales; Lennox added that consumer cost and utility issues for weatherized gas products—including costs and physical challenges regarding condensate management that would be required if standards were tightened—provide additional support to DOE's conclusion that more-stringent standards for weatherized gas products are not justified. (*Id.* at p. 3) Lennox further agreed with DOE's conclusion that more-stringent energy conservation standards for electric furnaces are not technologically feasible for the niche electric furnace market. (*Id.* at p. 2) Lennox recommended that DOE continue to refrain from increasing furnace equipment costs by imposing new efficiency standards because they cannot be justified due to impacts resulting from the COVID–19 pandemic and the rise of inflation. (*Id.* at pp. 2, 4)

The Joint Commenters supported DOE's proposed determination that amended standards for weatherized gas consumer furnaces are not statutorily justified at this time because they are not economically justified and because they have relatively small or declining

MHGFs as part of a separate rulemaking (*see* Docket No. EERE–2014–BT–STD–0031). DOE published a final rule in the **Federal Register** on December 18, 2023 amending the energy conservation standards for NWGFs and MHGFs. 88 FR 87502.

[9] No stakeholders requested that a public meeting webinar be held in response to the November 2023 NOPD, and, therefore, DOE did not elect to host a webinar for this NOPD.

[10] The parenthetical reference provides a reference for information located in the docket. (Docket No. EERE–2021–BT–STD–0031, which is maintained at *www.regulations.gov*). The references are arranged as follows: (commenter name, comment docket ID number, page of that document).

markets. (Joint Commenters, No. 33 at p. 2)

2. Comments Opposing Proposed Determination

The Joint Advocates recommended that DOE reconsider its proposed determination that amended AFUE standards for oil and weatherized gas consumer furnaces are not needed despite their technological feasibility. The Joint Advocates commented that DOE did not complete a manufacturer impact analysis (''MIA'') for the November 2023 NOPD, despite claiming that amended standards would not be economically justified due to potential manufacturer challenges that may impact the market for those products. These commenters stated that, according to DOE's data, strengthening standards for these products would result in considerable cost savings for consumers, as outlined in the LCC and NIA results presented in the November 2023 NOPD. The Joint Advocates commented that amending the standards for NWOFs in particular could provide significant benefits for consumers. (Joint Advocates, No. 34 at pp. 1–2)

In response, as discussed in section II.A of this document, DOE is directed by EPCA to conduct periodic rulemakings to determine whether to amend the current energy conservation standards for various products, including consumer furnaces. (42 U.S.C. 6295(m)(1)) In determining whether a potential more-stringent 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 seven statutory factors, which include the economic impacts to both consumers and manufacturers. (42 U.S.C. 6295(o)(2)(B)(i)(I)–(VII)) Section IV of this document outlines DOE's approach to analyzing various potential amended standard levels, including a discussion of market trends and qualitative market impacts in section IV.F of this document. Section V of this document provides a qualitative discussion of the potential impacts to manufacturers, as well as a detailed explanation of DOE's weighing of the benefits and burdens (including consumer cost savings as noted by the Joint Advocates) and the rationale for not amending the existing standards for oil, electric, and weatherized gas furnaces.

DOE assessed in the November 2023 NOPD the market size and manufacturer landscape for NWOFs and MHOFs and concluded that these products make up less than one percent of the U.S. residential furnace market. With this small market size and expected diminishing sales, cost recovery could be challenging for manufacturers. In the case of WGFs, manufacturers would need to redesign 99 percent of products on the market today to meet a standard set at EL 1 for those products, and all but one OEM would need to design new condensing products. Given the dynamics of both the oil and weatherized gas furnace market, amending standards may result in shifts in market competition impacting availability of products that cover the full range of capacities. With this understanding of the manufacturer and market landscape, DOE is unable to conclude that any of the efficiency levels analyzed for these categories of furnaces would meet the statutory criteria required to amend energy conservation standards.

3. Other Topics

Ravnitzky recommended that DOE consider establishing a series of incentives and challenges designed to encourage technological advancements in furnace designs that improve both the function and energy efficiency of consumer furnaces. (Ravnitzky, No. 30 at pp. 1–2) The commenter stated that incentivizing innovation offers a way to develop better and more affordable high-efficiency furnaces and suggested that prize contests have resulted in technological advancement while simultaneously fostering energy conservation and affordability. Ravnitzky commented that such a program could spur participants to surpass energy efficiency benchmarks (*e.g.,* AFUE ratings), innovate in the area of emissions reduction, develop materials that enhance heat transfer efficiency and durability, and lead to furnace designs that are both innovative and cost-effective. Ravnitzky argued that an added benefit to an approach incentivizing advancements would be the resulting likelihood of contributing to national energy independence and forming new business opportunities and job creation in the energy sector. (*Id.*) Ravnitzky further commented that incentives and challenges could foster collaboration and competition among manufacturers, universities, independent investors, and other stakeholders. Finally, the commenter recommended that the program be administered by DOE offices, including the Advanced Research Projects Agency—Energy, and structured to reward innovations in design, manufacturing processes, or materials that make high-efficiency furnaces more cost-effective and accessible to consumers. (*Id.*)

In response, DOE notes that its authority to regulate the energy efficiency of consumer products (including consumer furnaces) is outlined in EPCA, as discussed in section II.A of this document. Any incentive programs or prize contests are outside of the scope of that authority and this rulemaking. However, DOE further notes that there are voluntary energy efficiency appliance programs for consumer products, including furnaces, such as the ENERGY STAR® Program administered by the U.S. Environmental Protection Agency (''EPA'') or other DOE-funded initiatives such as the American-Made Challenges program.[11]

The Joint Commenters encouraged DOE to implement the recommendations from the National Academy of Sciences' (''NAS's'') December 2021 report (''the NAS Report'') into its appliance rulemakings, including for WGFs. These commenters stated that the NAS Report identified several suggestions to improve DOE's rulemaking process, including ones related to economic modeling and providing data for public review to ensure transparency. (Joint Commenters, No. 33 at p. 2) The Joint Commenters recommended that DOE should ensure the public has sufficient notice and comment opportunity in the separate rulemaking proceeding mentioned in the November 2023 NOPD so as to confirm that the NAS Report's recommendations are appropriately implemented in all future appliance rulemakings, including this oil, electric, and weatherized gas furnace rulemaking. (*Id.* at p. 3)

The Joint Commenters reiterated the earlier comments of the American Gas Association, *et al.* in response to DOE's request for information regarding energy conservation standards for consumer boilers in May 2021, particularly regarding concerns about the following: (1) DOE's reliance on flawed projections of natural gas price trends and marginal residential natural gas prices, and (2) systemic problems with the agency's economic analysis of standards. The Joint Commenters stated that, like the recommendations in the NAS Report, these earlier comments highlight flaws in DOE's process that must be addressed to better model consumer purchasing decisions, future fuel prices, and more. (*Id.*)

[11] For more information, see *www.energy.gov/eere/funding/eere-prizes-and-competitions.*

In response, DOE notes that the rulemaking evaluating DOE's analytical methodologies and whether any modifications are warranted in relation to the NAS Report will be handled separately from individual product rulemakings, as stated in section VI.L of this document. As discussed in section V.C of this document, DOE is not amending the current energy conservation standards for the subject oil, electric, and weatherized gas consumer furnaces, and DOE has made this determination consistent with EPCA's requirements, including evaluation of economic justification of standards, and applicable executive orders.

*B. Scope of Coverage and Product Classes*

This final determination covers certain product classes of consumer furnaces (*i.e.,* ones for oil, electric, and weatherized gas furnaces) that meet the following definition of consumer ''furnace'' as codified at 10 CFR 430.2:

> A ''furnace'' is defined as a product which utilizes only single-phase electric current, or single-phase electric current or DC current in conjunction with natural gas, propane, or home heating oil, and which—
>
> (A) Is designed to be the principal heating source for the living space of a residence;
>
> (B) Is not contained within the same cabinet with a central air conditioner whose rated cooling capacity is above 65,000 Btu per hour;
>
> (C) Is an electric central furnace, electric boiler, forced-air central furnace, gravity central furnace, or low-pressure steam or hot water boiler; and
>
> (D) Has a heat input rate of less than 300,000 Btu per hour for electric boilers and low-pressure steam or hot water boilers and less than 225,000 Btu per hour for forced-air central furnaces, gravity central furnaces, and electric central furnaces.

10 CFR 430.2. As noted previously, this final determination applies only to oil, electric, and weatherized gas consumer furnaces. The scope of coverage is discussed in further detail in section IV.A.1 of this document.

When evaluating and establishing/amending 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 on 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 product classes for this final determination are discussed in further detail in section IV.A.2 of this document.

*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 quantify the efficiency of their product and as the basis for certifying to DOE that their product complies with the applicable energy conservation standards and as the basis for any representations regarding the energy use or energy efficiency of the product. (42 U.S.C. 6295(s) and 42 U.S.C. 6293(c)). Similarly, DOE must use these test procedures to evaluate whether a basic model complies with the applicable energy conservation standard(s) adopted pursuant to EPCA. (42 U.S.C. 6295(s); 10 CFR 429.110(e))

The test procedure for determining AFUE, $P_{W,\ SB}$, and $P_{W,\ OFF}$ is established at 10 CFR part 430, subpart B, appendix N. AFUE is an annualized fuel efficiency metric that accounts for fossil fuel consumption in active, standby, and off modes. $P_{W,\ SB}$ and $P_{W,\ OFF}$ are measurements of the standby mode and off mode electrical power consumption, respectively, in watts. The test procedure for consumer furnaces was last amended by a final rule published in the **Federal Register** on January 15, 2016 (''January 2016 TP Final Rule''). 81 FR 2628.[12]

The revisions to the consumer furnaces test procedure in the January 2016 TP Final Rule included:

- Clarification of the electrical power term ''PE'';
- Adoption of a smoke stick test for determining use of minimum default draft factors;
- Allowance for the measurement of condensate under steady-state conditions;
- Reference to manufacturer's installation and operation manual and clarifications for when that manual does not specify test set-up;
- Specification of duct-work requirements for units that are installed without a return duct;
- Specification of testing requirements for units with multi-position configurations; and
- Revision of the requirements regarding AFUE reporting precision.

81 FR 2628, 2629–2630 (Jan. 15, 2016).

The changes in the January 2016 TP Final Rule were mandatory for representations of furnace efficiency made on or after July 13, 2016. As such, the most current version of the test procedure (published in January 2016) has now been in place for several years.

*D. Standby Mode and Off Mode*

As discussed in section II.A of this document, EPCA requires any final rule for new or amended energy conservation standards promulgated after July 1, 2010, to address standby mode and off mode energy use. (42 U.S.C. 6295(gg)(3))

''Standby mode'' and ''off mode'' energy use are defined in the DOE test procedure for residential furnaces (*i.e.,* ''Uniform Test Method for Measuring the Energy Consumption of Consumer Furnaces Other Than Boilers,'' 10 CFR part 430, subpart B, appendix N; ''appendix N''). In that test procedure, DOE defines ''standby mode'' as any mode in which the furnace is connected to a main power source and offers one or more of the following space heating functions that may persist: (a) to facilitate the activation of other modes (including activation or deactivation of active mode) by remote switch (including thermostat or remote control), internal or external sensors, and/or timer; and (b) continuous functions, including information or status displays or sensor-based functions. 10 CFR part 430, subpart B, appendix N, section 2. ''Off mode'' for consumer furnaces is defined as a mode in which the furnace is connected to a main power source and is not providing any active mode or standby mode function, and where the mode may persist for an indefinite time. The existence of an off switch in off position (a disconnected circuit) is included within the classification of off mode. 10 CFR part 430, subpart B, appendix N, section 2. An ''off switch'' is defined as the switch on the furnace that, when activated, results in a measurable change in energy consumption between the standby and off modes. 10 CFR part 430, subpart B, appendix N, section 2. Currently, the standby mode and off mode energy conservation standards for NWOFs and EFs are outlined in 10 CFR 430.32(e)(1)(iv) and are shown in Table II.2 of this document. Compliance with

[12] On March 13, 2023, DOE published in the **Federal Register** a test procedure final rule for consumer boilers, which are a type of furnace under EPCA (*see* 42 U.S.C. 6291(23)) but are not included within the scope of this rulemaking (*see* section IV.A.1 of this document). 88 FR 15510. This test procedure final rule separated the test method for consumer boilers from the test method for other types of furnaces and moved the boilers test method to a new appendix EE to 10 CFR part 430, subpart B. Accordingly, it amended appendix N so as to remove provisions applicable only to boilers, but it did not materially change the test method for the oil, electric, and weatherized gas furnaces that are the subject of this rulemaking.

the Federal standards for standby mode and off mode electricity consumption for NWOFs, MHOFs, and EFs, as measured by standby power consumption in watts (''$P_{W, SB}$'') and off mode power consumption in watts (''$P_{W, OFF}$''), was required on May 1, 2013.

In the November 2022 Preliminary Analysis, DOE analyzed amended standby/off mode standards for NWOFs, MHOFs, and EFs. DOE did not consider amended standby mode and off mode standards for WGFs and WOFs, because DOE has previously concluded in a DFR published in the **Federal Register** on June 27, 2011 that these products are packaged with either an air conditioner or a heat pump and that the standards for those products, specified in terms of power consumption in watts and seasonal energy efficiency ratio (''SEER''), already account for the standby mode and off mode energy consumption for these classes of furnaces. 76 FR 37408, 37433. Based on market analysis conducted for the November 2022 Preliminary Analysis and updated for this final determination, DOE concludes that WGFs and WOFs continue to be packaged with an air conditioner or heat pump.

In the analysis for the November 2022 Preliminary Analysis, DOE established the baseline for NWOFs, MHOFs, and EFs as the current Federal standby mode and off mode standards (*see* Table II.2). DOE also defined and identified baseline components as those that consumed the most electricity during standby mode and off mode operation. For intermediate efficiency levels, DOE utilized a design-option approach to identify design options that could be applied to the baseline design to reduce standby mode and off mode energy consumption. Above the baseline efficiency level, DOE implemented design options in the order of incremental energy savings relative to baseline until all available design options were employed (*i.e.,* at a max-tech level). DOE identified two design options between the baseline and max-tech designs that were used as the basis for intermediate standby mode and off mode design options. Specifically, DOE replaced the linear transformer found in models at the baseline with a low-loss transformer (''LL–LTX'') for the first intermediate efficiency level and replaced the linear power supply found in baseline models with a switching mode power supply (''SMPS'') for the second intermediate efficiency level.

The max-tech standby mode and off mode efficiency level in the November 2022 Preliminary Analysis was based on a combination of the two design options that were analyzed for the intermediate efficiency levels. To reach max-tech, DOE analyzed using an LL–LTX in combination with an SMPS to reach the minimum standby mode or off mode power consumption (without eliminating other consumer- or performance-related electronic features). For this design option, a transformer is only needed to step down the voltage for the thermostat because the SMPS is able to step down the voltage for the other components of the furnace. As such, a smaller, lower-cost LL–LTX is used at the max-tech level, as compared to the LL–LTX used at EL 1 (*i.e.,* the first intermediate efficiency level). Since the November 2022 Preliminary Analysis, DOE has not identified any additional design options that could reduce standby mode and off mode energy consumption.

In the November 2023 NOPD, DOE found that there was some degree of uncertainty with respect to the appropriateness of the standby mode/off mode efficiency levels analyzed in the November 2022 Preliminary Analysis—particularly for products that are in development but also possibly in some products already on the market. There was also uncertainty related to the potential impacts that standby mode and off mode power consumption standards could have on overall system energy consumption, taking into account the power needs for features such as safety sensors or other improvements to functionality that would benefit the consumer. Consequently, DOE determined that it lacked the necessary information and requisite evidence to amend the standby mode and off mode standards and did not propose to amend the standby mode/off mode power standards for NWOFs, MHOFs, and EFs. 88 FR 83426, 83433–83434 (Nov. 29, 2023). This assessment has not materially changed since the time of the November 2023 NOPD.

Lennox agreed with DOE's conclusion that no new standards for standby mode and off mode are appropriate. The commenter stated that increasing the stringency of standby power levels would inhibit innovations that benefit consumers, save more significant amounts of energy, and implement additional safety features. (Lennox, No. 32 at pp. 1–3) Lennox also agreed with DOE's conclusion that separate standby mode and off mode power standards are not appropriate for weatherized gas furnace products, as these products are packaged with air conditioners or heat pumps that account for standby mode and off mode energy use in the respective energy conservation standards for those products. (*Id.* at p. 3)

In this final determination, for reasons similar to those explained in the November 2023 NOPD, DOE concludes that amended standby mode/off mode standards for NWOFs, MHOFs, and EFs are not justified at this time.

### *E. Technological Feasibility*

#### 1. General Considerations

As discussed, a determination that amended energy conservation standards are not needed must be based on consideration of whether amended standards would 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))

To determine whether potential amended standards would be technologically feasible, DOE first develops a list of all known technologies and design options that could improve the efficiency of the products that are the subject of the determination. DOE considers technologies incorporated in commercially-available products or in working prototypes to be ''technologically feasible.'' 10 CFR part 430, subpart C, appendix A, sections 6(b)(3)(i) and 7(b)(1). Section IV.A.3 of this document discusses the technology options identified and considered by DOE for this analysis for oil, electric, and weatherized gas furnaces.

After DOE has determined which, if any, technologies and design options are technologically feasible, it further evaluates each technology and design option in light of the following additional screening criteria: (1) practicability to manufacture, install, and service; (2) adverse impacts on product utility or availability; (3) adverse impacts on health or safety; and (4) unique-pathway proprietary technologies. 10 CFR part 430, subpart C, appendix A, sections 6(b)(3)(ii)–(v) and 7(b)(2)–(5). Those technology options that are ''screened out'' based on these criteria are not considered further. Those technology and design options that are not screened out are considered as the basis for higher efficiency levels that DOE could consider for potential amended standards. Section IV.A.4 of this document discusses the results of this screening analysis conducted for this final determination.

2. Maximum Technologically Feasible Levels

EPCA requires that for any proposed rule that prescribes an amended or new energy conservation standard or prescribes no amendment or no new standard for a type (or class) of covered product, DOE must determine the maximum improvement in energy efficiency or maximum reduction in energy use that is technologically feasible for each type (or class) of covered products. (42 U.S.C. 6295(p)(1)) Accordingly, in the engineering analysis, DOE identifies the maximum technologically feasible efficiency level currently available on the market for oil, electric, and weatherized gas furnaces. DOE also defines such ''max-tech'' efficiency level, representing the maximum theoretical efficiency that can be achieved through the application of all available technology options retained from the screening analysis.[13] In many cases, the max-tech efficiency level is not commercially available because it is not currently economically feasible. The max-tech levels that DOE determined for this analysis are described in section IV.B.1.c of this final determination.

*F. Energy Savings*

1. Determination of Savings

For each efficiency level (''EL'') evaluated, DOE projects anticipated energy savings from application of the EL to the oil, electric, and weatherized gas furnace products purchased during the 30-year period that begins in the assumed year of compliance with potential amended standards (2030–2059).[14] The savings are measured over the entire lifetime of products purchased during the 30-year analysis period. DOE quantifies 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 such products would likely evolve in the absence of amended energy conservation standards.

DOE uses its NIA spreadsheet models to estimate national energy savings from potential amended standards for the products analyzed. 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 the products at the locations where they are used. For electricity, DOE reports national energy savings in terms of primary energy savings, which is the savings in the energy that is used to generate and transmit the site electricity. For natural gas, the primary energy savings are considered to be equal to the site energy savings. DOE also calculates national energy savings (''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.[15] DOE's approach is based on the calculation of an FFC multiplier for each of the energy types used by covered products. Section IV.G of this document provides more information on FFC energy savings.

2. Significance of Savings

As discussed, a determination that amended standards are not needed must be based on consideration of whether amended standards will result in significant conservation of energy, among other factors. (42 U.S.C. 6295(m)(1)(A) and 42 U.S.C. 6295(n)(2))

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.[16] For example, for some covered products, most of the energy consumption occurs during periods of peak energy demand. The impacts of these products on the energy infrastructure can be more pronounced than the impacts of products with relatively constant demand. Accordingly, DOE evaluates the significance of energy savings on a case-by-case basis. The significance of energy savings is further discussed in section V.B.1 of this final determination.

*G. Cost-Effectiveness*

As discussed, a determination that amended standards are not needed must be based on consideration of whether amended standards would be cost-effective, among other factors. (42 U.S.C. 6295(m)(1)(A) and 42 U.S.C. 6295(n)(2))

In evaluating cost-effectiveness, EPCA requires DOE to consider savings in operating costs throughout the estimated average life of the covered product in the type (or class) compared to any increase in the price, initial charges, or maintenance expenses for the covered product that are likely to result from the standard. (42 U.S.C. 6295(n)(2)(c) and 42 U.S.C. 6295(o)(2)(B)(i)(II)) Cost-effectiveness is also one of the factors that DOE considers under 42 U.S.C. 6295(o)(2)(B) in determining whether new or amended standards are economically justified. (42 U.S.C. 6295(o)(2)(B)(i)(II))

In determining cost-effectiveness of potential amended standards for covered products, DOE generally conducts LCC and PBP analyses that estimate the costs and benefits to users from potential standards. Section IV.E of this document provides more information on the LCC and PBP analyses conducted for this final determination. 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. The results of this analysis are discussed in section V.C.2 of this document.

*H. Further Considerations*

In determining whether a potential, more-stringent 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 product subject to the standard;

(2) The savings in operating costs throughout the estimated average life of the covered product in the type (or class) compared to any increase in the price, initial charges for, or maintenance expenses of the covered product that are likely to result from the standard;

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

(4) Any lessening of the utility or the performance of the covered product 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;

[13] In applying these design options, DOE would only include those that are compatible with each other that when combined, would represent the theoretical maximum possible efficiency.

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

[15] The FFC metric is discussed in DOE's statement of policy and notice of policy amendment. 76 FR 51281 (August 18, 2011), as amended at 77 FR 49701 (August 17, 2012).

[16] 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).

(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))

The following sections discuss how DOE has addressed each of these seven factors in this final determination.

1. Economic Impact on Manufacturers and Consumers

In determining the impacts of a potential new or amended standard on manufacturers, DOE conducts an MIA. DOE first uses an annual cash-flow approach to determine the quantitative impacts. This step includes both a short-term assessment—based on the cost and capital requirements during the period between when a regulation is issued and when entities must comply with the regulation—and a long-term assessment over a 30-year period. The industry-wide impacts analyzed include: (1) industry net present value, which values the industry on the basis of expected future cash flows; (2) cash flows by year; (3) changes in revenue and income; and (4) other measures of impact, as appropriate. Since DOE has determined not to amend standards for oil, electric, and weatherized gas furnaces, this final determination will have no cash-flow impacts on manufacturers. Accordingly, DOE did not conduct an MIA for this final determination.

For individual consumers, measures of economic impact include the changes in LCC and PBP associated with new or amended standards. These measures are discussed further in the following section. For consumers in the aggregate, DOE also calculates the national NPV of the consumer costs and benefits expected to result from particular standards. DOE also evaluates the impacts of potential standards on identifiable subgroups of consumers that may be affected disproportionately by a standard. Since DOE has determined not to amend standards for oil, electric, and weatherized gas furnaces, this final determination will have no disproportionate impact on identifiable subgroups of consumers. Accordingly, DOE did not conduct a subgroup analysis for this final determination.

2. Savings in Operating Costs Compared To Increase in Price

EPCA requires DOE to consider the savings in operating costs throughout the estimated average life of the covered product in the type (or class) compared to any increase in the price of, or in the initial charges for, or maintenance expenses of, the covered product that are likely to result from a standard. (42 U.S.C. 6295(m)(1); 42 U.S.C. 6295(n)(2), and 42 U.S.C. 6295(o)(2)(B)(i)(II)) DOE conducts this comparison in its LCC and PBP analyses.

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

3. Energy Savings

EPCA requires DOE, in determining the economic justification of an amended standard, to consider the total projected energy savings that are expected to result directly from the standard. (42 U.S.C. 6295(o)(2)(B)(i)(III))

As discussed in section IV.G of this document, DOE uses the NIA spreadsheet models to project national energy savings that are expected to result directly from an amended standard.

4. Lessening of Utility or Performance of Products

In establishing product classes and in evaluating design options and the impact of potential standard levels, DOE evaluates potential standards that would not lessen the utility or performance of the considered product. (42 U.S.C. 6295(o)(2)(B)(i)(IV)) Since DOE has determined not to amend standards for oil, electric, and weatherized gas furnaces, this final determination will not impact the utility of such products.

5. Impact of Any Lessening of Competition

EPCA directs DOE to consider the impact of any lessening of competition, as determined in writing by the Attorney General, that is likely to result from a standard. (42 U.S.C. 6295(o)(2)(B)(i)(V)) Since DOE has determined not to amend standards for oil, electric, and weatherized gas furnaces, DOE did not transmit a copy of its determination to the Attorney General for anti-competitive review.

6. Need for National Energy Conservation

DOE also considers the need for national energy conservation in determining whether a new or amended standard is economically justified. (42 U.S.C. 6295(o)(2)(B)(i)(VI)) The energy savings from the standards are likely to provide improvements to the security and reliability of the Nation's energy system. Reductions in the demand for electricity also may result in reduced costs for maintaining the reliability of the Nation's electricity system. DOE generally conducts a utility impact analysis to estimate how standards may affect the Nation's needed power generation capacity. However, since DOE has determined not to amend standards for oil, electric, and weatherized gas furnaces, DOE did not conduct this analysis.

DOE maintains that environmental and public health benefits associated with the more efficient use of energy are important to take into account when considering the need for national energy conservation. Amended standards are likely to result in environmental benefits in the form of reduced emissions of air pollutants and greenhouse gases associated with energy production and use. DOE generally conducts an emissions analysis to estimate how amended standards may affect these emissions. DOE also generally estimates the economic value of emissions reductions resulting from an amended standard. However, since DOE has determined not to amend standards for oil, electric, and weatherized gas furnaces, DOE did not conduct this analysis.

7. Other Factors

In determining whether an energy conservation standard is economically justified, DOE may consider any other factors that the Secretary deems to be relevant. (42 U.S.C. 6295(o)(2)(B)(i)(VII)) To the extent DOE identifies any relevant information regarding economic justification that does not fit into the other categories described previously, DOE could consider such information under ''other factors.''

## IV. Methodology and Discussion of Related Comments

The following sections of this document address each key component of the analyses DOE has performed for this final determination with respect to oil, electric, and weatherized gas furnaces. Comments received from interested parties are addressed in each relevant section.

### *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 final determination include: (1) a determination of the scope and identification of 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 for improving efficiency. The key findings of DOE's market assessment are summarized in the following sections.

1. Scope of Coverage

As mentioned in section III.B of this document, in assessing the scope of this rulemaking, DOE relied on the definition of ''furnace'' in 10 CFR 430.2. Any product meeting the definition of a ''furnace'' that is also an oil, electric, and weatherized gas furnace was included in the scope of DOE's analysis for this final determination. Non-weatherized gas furnaces and mobile home gas furnaces were considered in a separate rulemaking.[17]

a. Electric Furnaces

A basic EF is composed of an electric resistance heating element and blower assembly. (Additionally, there are products that include electrically powered heat pumps, but these are separately covered products not addressed here.) The electric resistance heating elements of EFs are highly efficient, and the efficiency of these units already approaches 100 percent. DOE is unaware of any technology options that can improve the efficiency of electric furnaces, so DOE has determined that more-stringent standards for EFs would not be technologically feasible. Therefore, DOE concludes that the energy savings potential from amended standards for EFs would be minimal. Consequently, DOE did not consider amended AFUE standards for EFs in this rulemaking.

b. Weatherized Oil-Fired Furnaces

DOE is not aware of any WOFs on the market, and, therefore, DOE did not analyze amended standards for that product class. DOE has concluded that because there are no WOFs on the market, there would be no potential energy savings from amended standards.

2. Product Classes

When evaluating and establishing or amending energy conservation standards, DOE may establish separate standards for a group of covered products (*i.e.,* establish a separate product class) if DOE determines that separate standards are justified based on the type of energy used, or if DOE determines that the product's capacity or other performance-related feature justifies a different standard. (42 U.S.C. 6295(q)) In making a determination whether a performance-related feature justifies a different standard, DOE considers such factors as the utility of the feature to the consumer and other factors DOE determines are appropriate. (*Id.*)

In this case, DOE divides furnaces into seven product classes based on fuel type (gas, oil, or electric), whether the furnace is weatherized or not, and whether the furnace is designed for use only in mobile homes or not. The current product classes for furnaces are (1) NWGFs, (2) MHGFs, (3) NWOFs, (4) MHOFs, (5) WGFs, (6) WOFs, and (7) EFs. 10 CFR 430.32(e)(1)(ii). As noted previously, NWGFs and MHGFs are being addressed in a separate rulemaking process.[18] Therefore, the product classes that DOE considered for this final determination are NWOFs, MHOFs, WGFs, WOFs, and EFs. However, for the reasons discussed in sections IV.A.1.a and IV.A.1.b of this document, amended energy conservation standards were not analyzed for EFs or WOFs.

In summary, DOE assessed amended energy conservation standards in terms of AFUE for the NWOF, MHOF, and WGF product classes in this final determination. Again, for the reasons discussed in section III.D of this document, DOE did not analyze new or amended standby mode/off mode power standards for any product classes this time.

This final determination maintains the product classes currently established for oil, electric, and weatherized gas furnaces.

3. Technology Options

DOE develops information in the technology assessment that characterizes the technologies and design options that manufacturers may use to attain higher-efficiency performance.

In the November 2023 NOPD, DOE identified several technology options that would be expected to improve the efficiency of oil and weatherized gas furnaces in terms of AFUE, as measured by the DOE test procedure. To develop a list of technology options, DOE examined the efficiency-improving technologies used in consumer furnaces today. These technology options provide insight into the technological improvements typically used to increase the energy efficiency of consumer furnaces.

For this final determination, DOE has reviewed the consumer furnaces market and confirmed that the technology options identified in the November 2023 NOPD continue to reflect the market. The identified technology options are shown in Table IV.1.

[17] *See* Docket No. EERE–2014–BT–STD–0031, which can be accessed at *www.regulations.gov.*

[18] *See* Docket No. EERE–2014–BT–STD–0031.

TABLE IV.1—LIST OF TECHNOLOGY OPTIONS CONSIDERED FOR THIS FINAL DETERMINATION

| Technology option | Description |
|---|---|
| Condensing Secondary Heat Exchanger | The secondary heat exchanger allows more heat to be extracted from the flue gases before the products of combustion exit through the flue to the vent system by condensing any water vapor and releasing the resulting latent heat. |
| Heat Exchanger Improvements | Improvements to the heat exchanger can be achieved by modifying baseline designs of standard furnaces to incorporate any combination of: (1) increased heat exchanger surface area, (2) heat exchanger surface features, and/or (3) heat exchanger baffles and turbulators. Improving the heat exchanger for fossil fuel-fired furnaces can increase the rate of heat transfer from the hot combustion gases to the circulation air that is distributed to the heated space. This improved heat transfer increases thermal efficiency and AFUE. |
| Two-Stage and Modulating Combustion | Two-stage and modulating combustion allow furnaces to meet heating load requirements more precisely. When low heating load conditions exist, a two-stage or modulating furnace can operate at a reduced input rate for an extended period of burner on-time to meet the reduced heating load. This improves comfort by reducing large fluctuations in room temperature. Because burner on-time increases, however, fuel use does not drastically decrease, so efficiency gains are typically small. |
| Pulse Combustion | Pulse combustion burners operate on self-sustaining resonating pressure waves that alternately rarefy the combustion chamber (drawing a fresh fuel-air mixture into the chamber) and pressurize it (causing ignition by compression heating of the mixture to its flash point). Pulse combustion systems feature high heat transfer rates, can self-vent, and can operate as isolated combustion systems. Because the pulse combustion process is highly efficient, the burners are generally used with condensing appliances. |
| Premix Burners | Premix burners completely premix the primary air and fuel prior to combustion, thereby eliminating the need for secondary air. These burners allow for more precise control over the air-fuel ratio, so that the level of excess air can be set for optimal performance. Premix burners are often utilized to control production of emissions, in particular $NO_X$. The premix burners used in consumer furnaces on the market today are capable of achieving ''ultra-low $NO_X$'' levels. |
| Burner Derating | Burner derating (*i.e.,* reducing burner firing rate while keeping heat exchanger geometry and surface area the same) will increase the ratio of heat transfer surface area to energy input, thereby increasing the AFUE. |
| Insulation Improvements | If the jacket loss test is performed, insulation improvements would reduce jacket losses and increase AFUE. Insulation can be improved by modifying the baseline furnace design through the use of increased jacket insulation or advanced forms of insulation. |
| Off-Cycle Dampers | Off-cycle (which refers to the burner off-cycle) dampers restrict the intake and exhaust airflow through the venting system during standby mode by closing when the burner is not operating, thereby trapping residual heat in the heat exchanger. During the burner off-cycle, a furnace can lose heat by natural convection and conduction through the combustion air inlet and flue. Installing a damper at these points can prevent heat from escaping and minimize off-cycle heat losses. Dampers have no effect on the steady-state performance of the furnace; however, they can reduce standby losses. The AFUE metric captures both steady-state and standby performance of the furnace, and thus any heated air that is retained in the system during the standby mode improves the furnace's AFUE.<br>Off-cycle dampers include: (1) electro-mechanical flue dampers, which are installed downstream of the heat exchanger, are activated by an external source of electricity, and open and close immediately when combustion starts and stops, (2) electro-mechanical burner inlet dampers, which are installed at the combustion-air inlet to the burner box and are designed to automatically close off the air passage and restrict the airflow through the heat exchanger when the burner is off. |
| Direct Venting | A direct venting system consists of a pipe that provides the burner with a direct connection to a combustion air source on the exterior of the building. This external connection allows the furnace to utilize outdoor air for combustion, which could result in an improvement in AFUE. |
| Concentric Venting | Concentric venting is accomplished by running the inlet and exhaust vents concentrically. The flue gases are exhausted through a central vent pipe, and the intake combustion air passes through a concentric duct surrounding it. This arrangement creates a counter-flow heat exchanger that recovers some heat from the flue gases to preheat the combustion air. It provides an efficiency advantage compared to non-concentric venting systems, as the concentric vent essentially serves as a shell-in-tube heat exchanger to recover heat. |
| Low-Pressure, Air-Atomized Oil Burner | To overcome the low input limitations of conventional oil burners, Brookhaven National Laboratory developed a low-pressure, air-atomized oil burner that can operate at firing rates as low as 0.25 gallons of oil per hour (10 kW). In addition, it can operate with low levels of excess combustion air (less than 10 percent) for lean-burning, ultra-clean combustion. A lower level of excess air generally improves AFUE rating. This single-stage burner design is also capable of firing fuel at high and low input rates, which are manually actuated by a switch, allowing it to closely match the smaller heating loads of well-insulated modern homes. The ability to derate the flame also greatly enhances the effectiveness of the heat exchanger, which improves steady-state efficiency. |

TABLE IV.1—LIST OF TECHNOLOGY OPTIONS CONSIDERED FOR THIS FINAL DETERMINATION—Continued

| Technology option | Description |
|---|---|
| High-Static Oil Burner | A modification of the conventional flame retention head burner is the high-static pressure flame retention head oil burner. These burners employ an air guide to direct air onto the optimal point on the blower wheel and a scroll insert to create high static pressure in the combustion chamber while maintaining consistent airflow. This higher pressure enables the furnace to overcome restrictive flow passages in compact, more efficient heat exchangers. These types of burners are also able to operate at lower levels of excess air, giving them a nearly five-percent AFUE advantage over flame retention head burners. |
| Delayed-Action Oil Pump Solenoid Valve | A delayed-action oil pump solenoid valve is installed between the oil pump and the burner nozzle to supplement the fuel pump regulator by delaying the fuel release by 3 to 6 seconds after the igniter and burner blower start until the oil pressure reaches the level required to fully discharge the oil into the combustion chamber without dripping. This ensures that the oil burns more completely. Testing at Brookhaven National Laboratory indicates that the typical efficiency benefit of delayed-action solenoid valves is expected to be less than one-percent AFUE. |

As detailed in section IV.A.5 of this document, for each technology option identified, DOE applies screening criteria before considering it further in the analysis.

4. Screening Analysis

As discussed, DOE conducts a screening analysis to evaluate whether to further consider each identified technology and design option. 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 commercially-available 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 commercially-available 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.

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

If DOE determines that a technology fails to meet one or more of these listed criteria, it is excluded from further consideration in the engineering analysis. The following sections include DOE's evaluation of each technology option against the screening analysis criteria.

a. Screened-Out Technologies

Based on DOE's research, DOE screened out the technology options on the basis of each screening criteria shown in Table IV.2 from further consideration as options to improve the AFUE (as measured by the DOE test procedure) of NWOFs, MHOFs, and WGFs. The reasons for exclusion associated with each technology are marked in the table with an *X*. Additional details about the reasons for exclusion are discussed in this section.

TABLE IV.2—TECHNOLOGY OPTIONS SCREENED OUT

| Excluded technology option | Applicable product class(es) | Screening criteria (X = basis for screening out) | | | | |
|---|---|---|---|---|---|---|
| | | Technological feasibility | Practicability to install, manufacture, and service | Impacts on product utility or product availability | Adverse impacts on health or safety | Unique-pathway proprietary technologies |
| Pulse combustion | WGF | | | | X | |
| Burner derating | WGF, NWOF, MHOF | | | X | | |
| Low-pressure, air-atomized oil burner | NWOF, MHOF | X | | | | |

Pulse Combustion

In contrast to natural draft and induced draft furnaces, pulse combustion furnaces generate positive pressure in the heat exchanger. Although these products are generally safe, this could create a potential safety problem if the heat exchanger breaches, because combustion products can contaminate the circulation airstream.

Pulse combustion gas furnaces were available in the United States for more than two decades. However, they were withdrawn from the market within the past 20 years because manufacturers found that competing technologies, such as condensing secondary heat exchangers, cost significantly less to manufacture and operate. In light of the ability of furnace manufacturers to cost-effectively achieve high efficiencies without the use of pulse combustion, the technology's risks do not outweigh its benefits for consumer furnace applications. Accordingly, DOE did not

further analyze this technology option as part of this final determination.

Burner Derating

Because heat output rate is directly related to burner size, burner derating reduces the amount of heated air available to the consumer. This reduction in heat output rate adversely affects the utility to consumers. Therefore, DOE did not consider this technology option.

Low-Pressure, Air-Atomized Oil Burner

While tests performed at the Brookhaven National Laboratory seem to have successfully demonstrated enhanced AFUE performance under the DOE test procedure in oil boilers that employed prototype low-pressure air-atomized burners, the prototype burner was never tested on a furnace. Therefore, the technological feasibility of the burner prototype for incorporation into a residential oil-fired furnace remains unknown, so DOE did not consider low-pressure, air-atomized oil burners to be a viable technology for efficiency improvement for this final determination.

b. Remaining Technologies

After a thorough review of each technology, DOE concludes that all of the remaining identified technologies not ''screened out'' meet all of the screening criteria. In summary, DOE retained (*i.e.,* did not screen out) the technology options listed below:

- Condensing secondary heat exchanger
- Heat exchanger improvements
- Two-stage and modulating combustion
- Premix burners
- Insulation improvements
- Off-cycle dampers
- Direct venting
- Concentric venting
- High-static oil burner
- Delayed-action oil pump solenoid valve

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/service; do not result in adverse impacts on product utility, product availability, health, or safety; and do not utilize unique-pathway proprietary technologies). DOE considers these remaining technology options as the basis for higher efficiency levels that DOE could consider for potential amended standards.

5. Impact From Other Rulemakings

Lennox commented that manufacturers are facing unprecedented regulatory change elsewhere and significant cumulative regulatory burdens, which further supports DOE's determination not to increase the AFUE efficiency standards and not to increase standby and off mode standards for oil, electric, and weatherized gas consumer furnaces. (Lennox, No. 32 at pp. 3–4) Lennox stated that the related rulemakings include the EPA phasedown to lower-global warming potential (''GWP'') refrigerants, the energy conservation standards final rule for NWGFs/MHGFs, the National and Regional Cold Climate Heat Pump Specifications, the DOE energy conservation standards for air-cooled, three-phase air conditioners and heat pumps below 65,000 Btu/h and air-cooled, three-phase, variable refrigerant flow (''VRF'') air conditioners and heat pumps below 65,000 Btu/h, the DOE test procedure for VRF systems, and the EPA ENERGY STAR 4.0 for Light Commercial Heating, Ventilation, and Air Conditioning (''HVAC''). (*Id.* at p. 4) AHRI commented that most of the consumer furnace market (*i.e.,* NWGFs) is obligated to increase efficiency to 95-percent AFUE by December 2028, which is one step below max-tech and which is expected to place a significant economic burden on the industry. (AHRI, No. 36 at p. 2)

In response, DOE notes that the Department is not amending the energy conservation standards for oil, electric, and weatherized gas consumer furnaces, and, therefore, it does not expect this rulemaking to contribute to the cumulative regulatory burden on manufacturers.

*B. Engineering and Cost Analysis*

The purpose of the engineering analysis is to establish the relationship between the efficiency and manufacturer production cost (''MPC'') of the subject products (*i.e.,* NWOFs, MHOFs, and WGFs). There are two elements to consider in the engineering analysis: (1) the selection of efficiency levels to analyze (*i.e.,* the ''efficiency analysis''), and (2) the determination of product cost at each efficiency level (*i.e.,* the ''cost analysis''). In determining the performance of higher-efficiency products, DOE considers those technologies and design option combinations not eliminated by the screening analysis. For each product class, DOE estimates the baseline cost, as well as the incremental cost for the product at efficiency levels above the baseline. The output of the engineering analysis is a set of cost-efficiency ''curves'' that are used in downstream analyses (*i.e.,* the LCC and PBP analyses and the NIA).

DOE recently conducted an engineering analysis to determine the cost-efficiency relationship for oil and weatherized gas consumer furnaced for the November 2023 NOPD. 88 FR 83426, 83439–83446 (Nov. 29, 2023). For this final determination, DOE analyzed cost trends across the consumer oil and weatherized gas furnace market as part of the market and technology assessment (see section IV.A of this document) and found that oil and weatherized gas consumer furnace efficiencies have not changed substantially since the NOPD analysis. Thus, as discussed in section IV.B.1 of this document, DOE maintained the efficiency levels from the November 2023 NOPD in the final determination analysis. Additionally, DOE examined its most recent inputs to its manufacturing cost analysis (*e.g.,* raw material prices, component prices, labor rates) and found that, although MPC values for each efficiency level may have increased, the incremental MPCs would not significantly change from those in the November 2023 NOPD. Therefore, DOE concludes that an updated cost analysis would not impact the results of this final determination, so the Department is using the same methodology and analytical results as those described in the November 2023 NOPD engineering and cost analysis. Further information on this analytical methodology used in the November 2023 NOPD is presented in the following subsections.

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). For this final determination analysis, DOE used the efficiency-level approach.

a. Baseline Efficiency

For each product class, DOE generally selects a baseline model as a reference point for each class, and measures anticipated changes to the product resulting from potential energy conservation standards against the baseline model. The baseline model in each product class represents the characteristics of products 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.

A basic consumer gas furnace comprises a hot surface or direct spark ignition system, tubular in-shot burners, a noncondensing heat exchanger, a blower assembly (including motor and forward-swept fan blade), a mechanical draft combustion fan assembly, and automatic controls. A basic consumer oil-fired furnace comprises an interrupted spark ignition system, power burner, noncondensing heat exchanger, and blower assembly. Details and descriptions of each of these components can be found in chapter 3 of the November 2022 Preliminary Analysis TSD.

The identification of baseline units requires establishing the baseline efficiency level. In cases where there is an existing standard, DOE typically defines ''baseline units'' as units with efficiencies equal to the current Federal energy conservation standards. However, for the MHOF product class, DOE did not identify any currently available units at the minimum standard level (75-percent AFUE), and, therefore, DOE analyzed 80-percent AFUE as the baseline level for MHOFs, as it was the lowest efficiency available on the market.

In the November 2023 NOPD, DOE used the baseline levels presented in Table IV.3 as the baseline efficiency AFUE levels for oil, electric, and weatherized gas furnaces, along with the typical characteristics of a baseline unit.

TABLE IV.3—BASELINE EFFICIENCY LEVELS

| Product class | Baseline AFUE level (%) | Typical characteristics |
|---|---|---|
| NWOF | 83 | —Single-stage burner.<br>—Electronic ignition.<br>—Aluminized-steel heat exchanger.<br>—Indoor blower fan including PSC motor* and forward-curved blower impeller blade. |
| MHOF | 80 | —Single-stage burner.<br>—Electronic ignition.<br>—Aluminized-steel heat exchanger.<br>—Indoor blower fan including PSC motor* and forward-curved blower impeller blade.<br>—Direct venting system.<br>—Built-in evaporator coil cabinet. |
| WGF | 81 | —Draft inducer.<br>—Single-stage burner.<br>—Electronic ignition.<br>—Aluminized-steel tubular heat exchanger.<br>—Indoor blower fan including BPM* motor and forward-curved blower impeller blade. |

*Consumer furnace fans incorporated into NWOFs, MHOFs, and WGFs manufactured on and after July 3, 2019 must meet fan energy rating (''FER'') standards specified in 10 CFR 430.32(y). The blower fan motor (among other factors) can affect FER. Brushless permanent magnet (''BPM'') motors have become the predominant motor type at the baseline AFUE levels for WGFs, and permanent split capacitor (''PSC'') motors, which are less efficient than BPM motors, are common for NWOFs and MHOFs.

Typically, baseline units are representative of the minimum technology and lowest-cost product that manufacturers can produce. Accordingly, in the teardown analysis, DOE examined a variety of baseline units that incorporate the various baseline design options for furnace components.

As stated previously, for this final determination, DOE used the baseline efficiency levels as presented in the November 2023 NOPD.

b. Intermediate Efficiency Levels

In the November 2023 NOPD, DOE also analyzed intermediate efficiency levels for NWOFs and MHOFs. 88 FR 83426, 83440–83441 (Nov. 29, 2023). However, for WGFs, DOE did not find any models on the market between the baseline (81-percent AFUE) and max-tech level (95-percent AFUE) and, therefore, did not analyze any intermediate efficiency levels for this product class. The intermediate efficiency levels analyzed for NWOFs were 85-percent and 87-percent AFUE, and the intermediate efficiency levels analyzed for MHOFs were 83-percent and 85-percent AFUE. To improve efficiency from the baseline to these intermediate efficiency levels, manufacturers generally increase the surface area of the heat exchanger, which increases the heat transfer area and, thus, allows manufacturers to achieve higher efficiencies. The intermediate efficiency levels analyzed were representative of common efficiency levels available on the market. DOE reviewed its own Compliance Certification Database (''CCD''), as well as AHRI's product

certification directories,[19] California Energy Commission's database,[20] manufacturer catalogs, and other publicly-available literature to inform its selection of intermediate efficiency levels.

As stated previously, for this final determination, DOE used the intermediate efficiency levels as presented in the November 2023 NOPD.

c. Maximum Technology (''Max-Tech'') Efficiency Levels

As noted, EPCA requires that any new or amended energy conservation standard be designed to achieve the maximum improvement in energy efficiency that is technologically feasible. (42 U.S.C. 6295(o)(2)(A)) As part of its analysis, DOE identifies the ''maximum available'' efficiency level, representing the highest efficiency unit currently available on the market. DOE also defines a ''max-tech'' efficiency level, representing the maximum theoretical efficiency that can be achieved through the application of all available technology options retained from the screening analysis. In many cases, the max-tech efficiency level is not commercially available because it is not currently economically feasible.

In the November 2023 NOPD, DOE conducted an analysis of the market and a technology assessment and researched current product offerings to determine the max-tech efficiency levels. 88 FR 83426, 83441 (Nov. 29, 2023). The max-tech level identified in each product class corresponded to the highest-AFUE furnace available on the market, which DOE found to correspond to the maximum technologically feasible levels at this time. For NWOFs, DOE identified a design that achieves a max-tech efficiency level of 96-percent AFUE. For MHOFs, the maximum efficiency level that DOE identified was 87-percent AFUE. For WGFs, DOE identified a max-tech efficiency level design that achieves 95-percent AFUE. For WGFs and NWOFs, the max-tech efficiency level is currently achieved by use of a condensing secondary heat exchanger. A constant-airflow BPM (''CA–BPM'') indoor blower motor was also implemented as the motor design option for the max-tech efficiency level for NWOFs, because the only NWOF model on the market available at this level includes a CA–BPM motor, and it was unclear if this level is achievable without using a CA–BPM fan motor. For MHOFs, the max-tech efficiency level is currently achieved by use of a heat exchanger with increased surface area.

As stated previously, for this final determination, DOE used the max-tech efficiency levels as presented in the November 2023 NOPD.

d. Summary of Efficiency Levels Analyzed

The AFUE efficiency levels analyzed along with the technologies that are expected to be used to increase energy efficiency above the baseline efficiency level for NWOFs, MHOFs, and WGFs are presented in Table IV.4, Table IV.5, and Table IV.6, respectively.

TABLE IV.4—AFUE EFFICIENCY LEVELS AND TECHNOLOGIES USED AT EACH EFFICIENCY LEVEL ABOVE BASELINE FOR NWOFS

| Efficiency level | AFUE (%) | Description of technologies typically incorporated |
|---|---|---|
| 0—Baseline | 83 | See Table IV.3 for baseline features. |
| 1 | 85 | Baseline EL + Increased heat exchanger area. |
| 2 | 87 | EL 1 + Increased heat exchanger area. |
| 3—Max-tech | 96 | EL 2 + Addition of condensing secondary heat exchanger (and associated components, sensors, *etc.*) + CA–BPM motor. |

TABLE IV.5—AFUE EFFICIENCY LEVELS AND TECHNOLOGIES USED AT EACH EFFICIENCY LEVEL ABOVE BASELINE FOR MHOFS

| Efficiency level | AFUE (%) | Description of technologies typically incorporated |
|---|---|---|
| 0—Baseline | 80 | See Table IV.3 for baseline features. |
| 1 | 83 | Baseline EL + Increased heat exchanger area. |
| 2 | 85 | EL 1 + Increased heat exchanger area. |
| 3—Max-tech | 87 | EL 2 + Increased heat exchanger area. |

TABLE IV.6—AFUE EFFICIENCY LEVELS AND TECHNOLOGIES USED AT EACH EFFICIENCY LEVEL ABOVE BASELINE FOR WGFS

| Efficiency level | AFUE (%) | Description of technologies typically incorporated |
|---|---|---|
| 0—Baseline | 81 | See Table IV.3 for baseline features. |
| 1—Max-tech | 95 | Baseline EL + Addition of condensing secondary heat exchanger (and associated components, sensors, *etc.*). |

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 product on the market.

[19] AHRI's Directory of Certified Product Performance (Available at: *www.ahridirectory.org/Search/SearchHome*) (last accessed May 6, 2024).

[20] California Energy Commission's MAEDbs (Available at: *cacertappliances.energy.ca.gov/Pages/Search/AdvancedSearch.aspx*) (last accessed May 6, 2024).

The cost approaches generally used by DOE are summarized as follows:

□ *Physical teardowns:* Under this approach, DOE physically dismantles commercially-available products, component-by-component, to develop a detailed bill of materials for the products.

□ *Catalog teardowns:* In lieu of physically deconstructing products, 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 a catalog teardown is feasible (*e.g.,* for tightly integrated products such as fluorescent lamps, which are infeasible to disassemble and for which parts diagrams are unavailable), cost-prohibitive, or 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 November 2023 NOPD, DOE conducted the cost analysis using a combination of physical and catalog teardowns. 88 FR 83426, 83443 (Nov. 29, 2023). DOE estimated the MPC associated with each efficiency level to characterize the cost-efficiency relationship of improving consumer furnace performance, in terms of AFUE.

The units selected for the teardown analysis for the November 2023 NOPD and used in this final determination spanned a range of manufacturers and efficiencies for commercially-available products that are the subject of this rulemaking. Products were selected that have characteristics of typical products on the market at a representative input capacity. Based on information gathered as part of the market and technology assessment (*see* section IV.A of this document), as well as discussions with manufacturers, DOE determined that 80 kBtu/h and 105 kBtu/h were representative input capacities for WGFs and oil furnaces, respectively. Where possible, DOE selected teardowns at those representative capacities. Where needed, catalog teardowns were also conducted to supplement the physical teardowns. DOE estimated the manufacturing cost for each furnace selected for teardown by disassembling the furnace and developing a bill of materials (''BOM''). The resulting BOM provides the basis for the MPC estimates for products at various efficiency levels spanning the full range of efficiencies from the baseline to max-tech.

To account for manufacturers' non-production costs and profit margin, DOE applies a non-production cost multiplier (the manufacturer markup) to the MPC. The resulting 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 whose combined product range includes oil and weatherized gas furnaces. The manufacturer markup estimates are consistent with the manufacturer markups developed for a final rule for furnace fan energy conservation standards published in the **Federal Register** on July 3, 2014. 79 FR 38130. Specifically, DOE estimates the industry average manufacturer markup to be 1.35 for NWOFs, 1.29 for MHOFs, and 1.27 for WGFs.

In this final determination, DOE used the same cost analysis as in the November 2023 NOPD.

a. Teardown Analysis

For the November 2023 NOPD teardown analysis, DOE used a total of 31 teardowns of consumer furnaces as the basis for calculating industry MPCs. The units DOE selected for teardown are manufactured in considerable volume, are commonly available, and have features that DOE believes are representative of the most common characteristics (*i.e.,* input capacity, configuration, and heat exchanger type) of each product class. As discussed previously, most physical teardown units had input capacities of approximately 80 kBtu/h for WGFs or 105 kBtu/h for NWOFs and MHOFs, which DOE considers to be representative of those furnace product classes. For units that were not at the representative capacity, an adjustment was developed to normalize all units to the representative capacity. To the extent possible, all major efficiency levels and technologies were captured in the selection of models for the teardown analysis. WGF and oil furnace teardowns were considered separately.

Whenever possible, DOE examined multiple models from a given manufacturer that capture different design options and used them as direct points of comparison. The teardown selections also minimized the incorporation of non-efficiency-related premium features, which otherwise could inflate the incremental manufacturing cost of achieving higher efficiency levels.

For the November 2023 NOPD, DOE examined products with a variety of indoor blower motor technologies and combustion systems (*i.e.,* single-stage, two-stage, or modulating). DOE also examined products with PSC, constant-torque BPM (''CT–BPM''), and CA–BPM indoor blower motors. As further discussed in section IV.B.2.b of this document, DOE determined the cost of including these technologies and applied the costs in the downstream analyses to estimate the manufacturing cost of going from one technology to another with higher efficiency (*e.g.,* using a CA–BPM instead of a CT–BPM, or two-stage combustion instead of single-stage combustion). Although such changes are not necessarily required due to changes in the AFUE level, DOE included these costs to better reflect the products available on the market such that it represents the products expected to be available in a scenario where the standard were set at that level.

Due to the similarity observed in NWOF and MHOF designs available in the market, DOE has found that the costs associated with increasing the energy efficiency of MHOFs are equivalent to the costs for NWOFs. A MHOF teardown was used to examine key differences between NWOFs and MHOFs and confirmed that the MPCs of MHOFs could be estimated based on the NWOF teardowns. Therefore, in the November 2023 NOPD, DOE based MPC estimates for MHOFs at each efficiency level analyzed largely on teardowns of NWOFs at that efficiency level by determining the differences between the NWOF and MHOF product classes and estimating the costs associated with those differences.

b. Cost Estimation Method

In the November 2023 NOPD, DOE assigned costs of labor, materials, and overhead to each part, whether purchased or produced in-house. DOE then aggregated single-part costs into major assemblies (*e.g.,* packaging, cabinet assembly, heat exchanger, burner system/gas train, exhaust subassembly, fan system, controls) and summarized these costs in a spreadsheet BOM. DOE repeated this same process for every physical and catalog teardown in the engineering analysis.

Analytical inputs related to manufacturer practices and cost structure play an important role in estimating the final cost of a product. DOE used inputs regarding the manufacturing process parameters (*e.g.,* equipment use, labor rates, tooling depreciation, and cost of purchased raw materials) to determine the value for each furnace component. DOE collected

information on labor rates, tooling costs, raw material prices, and other factors to use as inputs into the cost estimates. DOE determined values for these parameters using internal expertise and confidential information available to its contractors, some of which was obtained via confidential interviews with manufacturers. For purchased parts, DOE estimated the purchase price based on volume-variable price quotations and detailed discussions with manufacturers and component suppliers. DOE then summed the values of the furnace components into assembly costs and, finally, the total MPC for the entire furnace.

The MPC includes material, labor, and depreciation costs, as well as the overhead costs associated with the manufacturing facility. Material costs include both raw materials and purchased-part costs. Labor costs include fabrication, assembly, and indirect and overhead (burdened) labor rates. Depreciation costs include production equipment depreciation, tooling depreciation, and building depreciation. The overhead costs associated with the manufacturing facility include indirect process costs, utilities, equipment and building maintenance, and reworking of defective parts/units.

DOE determined the costs of raw materials 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 International,[21] PolymerUpdate,[22] the U.S. Geologic Survey (''USGS''),[23] and the U.S. Bureau of Labor Statistics (''BLS'').[24] Raw material prices for metals, such as those of stainless steel and other sheet metals, are estimated on the basis of five-year averages to smooth out spikes in demand. For other ''raw'' materials such as plastic resins, insulation materials, *etc.,* DOE used prices based on current market data (as of December 2022) rather than a five-year average, because non-metal raw materials have not experienced the same level of price volatility in recent years as metal raw materials.

DOE characterized parts based on whether manufacturers fabricated them in-house or purchased them from outside suppliers. For fabricated parts, DOE estimated the price of intermediate materials (*e.g.,* tube, sheet metal) and the cost of forming them into finished parts. For purchased parts, DOE estimated the purchase prices paid to the original equipment manufacturers (''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 manufacturers whose products were examined in the engineering analysis. DOE determined that the components in Table IV.7 are generally purchased from outside suppliers.

TABLE IV.7—PURCHASED FURNACE COMPONENTS

| Assembly | Purchased subassemblies |
|---|---|
| Burner/Exhaust | Gas valve. |
| | Spark igniter. |
| | Draft inducer assembly. |
| Blower | Indoor blower fan blade. |
| | Indoor blower fan motor. |
| Controls | Control boards. |
| | Capacitors, transformers, contactors, switches, *etc.* |

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.8 lists the factory parameter assumptions used in the analysis. 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, if 100 percent of all units manufactured were at that efficiency level. This production volume was estimated based on historical shipments. These assumptions are generalized to represent typical production and are not intended to model a specific factory.

TABLE IV.8—FACTORY PARAMETER ASSUMPTIONS

| Parameter | Oil furnace estimate | WGF estimate |
|---|---|---|
| Actual Annual Production Volume (units/year) | 5,000 units/year | 500,000 units/year. |
| Purchased Parts Volume | 5,000 units/year | 100,000 units/year. |
| Workdays Per Year (days) | 250 | 250. |
| Assembly Shifts Per Day (shifts) | 1 | 2. |
| Fabrication Shifts Per Day (shifts) | 2 | 2. |
| Fabrication Labor Wages ($/h) | 16 | 16. |
| Assembly Labor Wages ($/h) | 16 | 16. |
| Length of Shift (h) | 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%. |
| Burdened Assembly Labor Wage ($/h) | 24 | 24. |
| Burdened Fabrication Labor Wage ($/h) | 24 | 24. |
| Supervisor Span (workers/supervisor) | 25/1 | 25/1. |
| Supervisor Wage Premium (over fabrication and assembly wage) | 30% | 30%. |

[21] For more information on MEPS International, please visit *www.meps.co.uk/* (last accessed April 15, 2024).

[22] For more information on PolymerUpdate, please visit *www.polymerupdate.com* (last accessed May 9, 2024).

[23] For more information on the USGS metal price statistics, please visit *www.usgs.gov/centers/nmic/commodity-statistics-and-information* (last accessed May 9, 2024).

[24] For more information on the BLS producer price indices, please visit *www.bls.gov/ppi/* (last accessed May 9, 2024).

Indoor Blower Motor Costs

As discussed in section IV.B.1.a of this document, the baseline design for WGFs includes a BPM motor. DOE research suggests that the predominant BPM indoor blower motors sold on the market today are either a CT–BPM or a CA–BPM 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 external static pressure (''ESP'') in order to maintain a desired airflow. This differentiates them from CT–BPM motors, which will maintain torque and likely decrease airflow output in environments with high ESPs. CT–BPMs are capable of achieving airflows similar to CA–BPMs but are generally less expensive. Therefore, for the November 2023 NOPD, DOE considered the baseline design to include a CT–BPM motor for the WGF product class and determined the incremental cost of a CA–BPM motor.

DOE's review of the market for the November 2023 NOPD showed that PSC motors are still being used in some NWOFs and MHOFs, so the final MPC results are presented based on a PSC motor at the baseline through 87-percent AFUE. To account for the variety of motor technologies available on the market, DOE determined the incremental cost associated with use of various types of more-efficient BPM fan motors as compared to baseline PSC motors for NWOFs and MHOFs. Additionally, for NWOFs, a CA–BPM indoor blower motor was implemented as the motor design option for the max-tech efficiency level because the only NWOF model on the market available at this level includes a CA–BPM motor, and it is unclear if this level is achievable without a constant-airflow fan. For the NWOF efficiency levels below max-tech and for all MHOF efficiency levels, DOE calculated the additional cost to switch from a PSC blower motor to either a CT–BPM motor or a CA–BPM motor. As discussed in Chapter 8 of the November 2022 Preliminary Analysis TSD, these costs are applied in the LCC and PBP analyses to determine the MPC of a furnace with each motor technology in order to better represent typical costs to consumers for NWOFs and MHOFs. CA–BPM blower motors are sometimes used as a utility-enhancing feature on units below the max-tech efficiency level. The incremental cost increases for using CT–BPM or CA–BPM motors, as compared to PSC motors, are outlined in Table IV.9.

TABLE IV.9—COST INCREASES FOR BPM BLOWER MOTORS AS COMPARED TO PSC MOTORS

| Product class | Input capacity (kBtu/h) | Incremental cost increase for CT–BPM (2022$) | Incremental cost increase for CA–BPM (2022$) |
|---|---|---|---|
| NWOF, MHOF | 105 | $30.65 | $80.48 |
| WGF | 80 | 37.94 | 59.92 |

Multi-Stage Furnaces

As explained in the November 2023 NOPD (*see* 88 FR 83426, 83445 (Nov. 29, 2023)), the market for WGFs contains a significant number of two-stage furnaces that are rated at the same efficiency as single-stage furnaces. DOE believes consumers sometimes choose to purchase two-stage products for the additional thermal comfort offered by furnaces with multiple stages of heating output. As such, in order to better represent typical costs to consumers, DOE analyzed the cost of multiple burner stages for WGFs. DOE determined that oil units with multi-staging were rare and, thus, not representative of the market, so DOE did not analyze the cost of multiple stages for the NWOF and MHOF product classes. Where applicable, the additional cost to change to a two-stage furnace includes the added cost of a two-stage gas valve, a two-speed inducer assembly, an additional pressure switch, and additional controls and wiring. The additional cost to change to a modulating furnace includes the added cost of a modulating gas valve, an inducer assembly, an upgraded pressure switch, and additional controls and wiring. The incremental costs to implement multi-staging in WGFs are outlined in Table IV.10

TABLE IV.10—MULTI-STAGE BURNER INCREMENTAL COST INCREASE AS COMPARED TO SINGLE-STAGE BURNER

| Adder | Incremental cost increase for multi-stage burners (2022$) |
|---|---|
| Two-Stage | $21.07 |
| Modulating | 75.36 |

Low-$NO_X$ and Ultralow-$NO_X$ Furnaces

Some furnaces are marketed as ''low-$NO_X$,'' which indicates that their $NO_X$ emissions are less than 40 nanograms of $NO_X$ per joule of useful heat energy (''ng/J''). Certain local jurisdictions require natural gas furnaces to comply with $NO_X$ emissions restrictions as low as 14 ng/J,[25] which is referred to as ''ultralow-$NO_X$.'' A common method of reducing furnace $NO_X$ emissions is to slightly delay the natural gas combustion process, which in turn produces a cooler flame and results in suppressed formation of $NO_X$.[26] DOE has observed during its teardown analysis that to achieve low-$NO_X$ operation, manufacturers implement low-$NO_X$ baffles. For ultralow-$NO_X$ operation, DOE used NWGF teardowns to approximate the cost to implement this technology option in WGFs, as DOE understands that the methodology would be the same for both product classes. Through these teardowns of NWGFs, DOE has observed that in order to achieve ultralow-$NO_X$ operation, the in-shot burners typically used in residential furnaces were replaced with a mesh premix burner. In addition, the model used a variable-speed BPM inducer fan motor. DOE identified an ultralow-$NO_X$ WGF on the market and compared the burner construction for the torn-down NWGF and the ultralow-$NO_X$ WGF. DOE found that the approach used for achieving ultralow-$NO_X$ in WGFs is similar to that used in NWGFs. DOE also determined that oil units with ultralow-$NO_X$ operation were rare and, thus, not representative of the market, so the Department did not

[25] Rule 1111 of the South Coast Air Quality Management District of Southern California currently requires that all NWGFs and MHGFs not exceed a 14 ng/J restriction on $NO_X$ emissions. For more information on Rule 1111, *see www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1111.pdf?sfvrsn=4* (last accessed June 28, 2024).

[26] U.S. Environmental Protection Agency, Natural Gas Combustion (available at *www3.epa.gov/ttnchie1/ap42/ch01/final/c01s04.pdf*) (last accessed June 28, 2024).

analyze the cost of ultralow-$NO_X$ for the NWOF and MHOF product classes.

Using raw material price data, teardown data from NWGFs, and manufacturing expertise, DOE estimated the manufacturing cost difference between standard $NO_X$ burners and low-$NO_X$ and ultralow-$NO_X$ burners. For low-$NO_X$, MPC cost values were developed for the implementation of low-$NO_X$ baffles in WGFs at the representative input capacity of 80 kBtu/h. For ultralow-$NO_X$, MPC values were developed for the implementation of a mesh premix burner and variable-speed BPM inducer fan (along with other related components necessary). The resulting MPC estimates to achieve low-$NO_X$ and ultralow-$NO_X$ operation are shown in Table IV.11.

In the LCC and PBP analyses (*see* section IV.E of this document), DOE estimated the fractions of furnaces that are installed in jurisdictions that require low-$NO_X$ or ultralow-$NO_X$ compliance and applied these cost adders to those fractions of furnace installations accordingly. The application of these adders is discussed in more detail in Chapter 8 of the November 2022 Preliminary Analysis TSD.

TABLE IV.11—INCREASE IN MPCS FOR LOW-$NO_X$ AND ULTRALOW-$NO_X$ WGFS

| Adder | Value (2022$) |
|---|---|
| Low-$NO_X$ | $3.10 |
| Ultralow-$NO_X$ | 113.68 |

Shipping Cost

Freight is not a manufacturing cost, but because it is a substantial cost incurred by the manufacturer, DOE accounts for shipping costs separately from other costs. For the November 2023 NOPD, DOE calculated shipping costs based on a typical 53-foot straight-frame trailer with a storage volume of 4,240 cubic feet.

DOE first calculated the cost per cubic foot of space on a trailer based on a cost of $3,643 per shipping load and the standard dimensions of a 53-foot trailer. This cost was determined based on a combination of full truck load freight quotations, manufacturer feedback, and BLS producer price indices for the ''fuels and related products and power'' grouping.[27] Then, DOE examined the average sizes of products in each product class at each efficiency and capacity combination analyzed. DOE estimated the shipping costs by multiplying the product volume by the cost per cubic foot of space on the trailer. Furnace dimensions typically do not change as a result of increases in efficiency, and accordingly, DOE's shipping costs show no change across efficiency levels. In determining volumetric shipping costs, DOE also used manufacturer feedback regarding product mix on each trailer, packing efficiency, and methods and equipment used to load the trailers to revise the shipping costs. Table IV.12 shows the shipping costs for the products analyzed in this rulemaking.

TABLE IV.12—SHIPPING COSTS PER UNIT

| Product class | Representative capacity (kBtu/h) | Per-unit shipping cost (2022$) |
|---|---|---|
| WGF | 80 | $55.69 |
| NWOF | 105 | 19.92 |
| MHOF | 105 | 19.92 |

3. Cost-Efficiency Results

The results of the engineering analysis are reported as cost-efficiency relationships (or ''curves'') in the form of aggregated MPCs for each product class. The final results of the AFUE engineering analysis are the MPCs for WGFs, NWOFs, and MHOFs at each efficiency level. The cost-efficiency results are shown in tabular form in Table IV.13 through Table IV.15 as efficiency versus MPC and MSP. These results include the furnace fan and combustion system staging incorporated into most furnace designs.

TABLE IV.13—COST-EFFICIENCY DATA FOR WGFS WITH A CONSTANT-TORQUE BPM INDOOR BLOWER MOTOR AND A SINGLE-STAGE BURNER

| AFUE | MPC (2022$) | MSP (2022$) |
|---|---|---|
| 81 | $1,412.32 | $1,793.65 |
| 95 | 1,505.40 | 1,911.85 |

TABLE IV.14—COST-EFFICIENCY DATA FOR NWOFS WITH A PSC INDOOR BLOWER MOTOR AND A SINGLE-STAGE BURNER

| AFUE | MPC (2022$) | MSP (2022$) |
|---|---|---|
| 83 | $700.73 | $945.98 |
| 85 | 730.94 | 986.77 |
| 87 | 761.16 | 1,027.57 |
| 96 | 1,334.85 | 1,802.05 |

TABLE IV.15—COST-EFFICIENCY DATA FOR MHOFS WITH A PSC INDOOR BLOWER MOTOR AND A SINGLE-STAGE BURNER

| AFUE | MPC (2022$) | MSP (2022$) |
|---|---|---|
| 80 | $664.47 | $857.16 |
| 83 | 709.79 | 915.63 |
| 85 | 740.01 | 954.61 |
| 87 | 770.23 | 993.59 |

DOE did not receive comments in response to the engineering and cost analysis methodology in the November 2023 NOPD and maintains the same methodology for the final determination.

*C. Markups Analysis*

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

As part of the analysis, DOE identifies key market participants and distribution channels. For the subject consumer furnaces, the main parties in the distribution chains are: (1) manufacturers; (2) wholesalers or distributors; (3) retailers; (4) mechanical contractors; (5) builders; (6) manufactured home manufacturers, and (7) manufactured home dealers/retailers. For this final determination, DOE

[27] U.S. Department of Labor, Bureau of Labor Statistics, *Producer Price Indices* (available at: *data.bls.gov/timeseries/WPU057303?data_tool=XGtable)* (last accessed June 28, 2024).

maintained the same approach as in the NOPD. DOE characterized two distribution channel market segments to describe how NWOFs, MHOFs, and WGFs pass from the manufacturer to residential and commercial consumers: [28] (1) replacements and new owners [29] and (2) new construction.

In the replacement and new owner market, the primary distribution channel for NWOFs, MHOFs, and WGFs is characterized as follow:

Manufacturer → Wholesaler → Mechanical Contractor → Consumer

DOE estimates that the above distribution channel applies to the majority of the shipments of the subject consumer furnaces.[30] As retail, including internet sales, grew significantly in the last five years (previously it was negligible) and some consumers purchase the appliance directly and then have contractors install it, DOE considered additional distribution channels as follows: [31]

Manufacturer → Retailer → Consumer
Manufacturer → Retailer → Mechanical Contractor → Consumer

For mobile home applications, there is another distribution channel considered on top of the aforementioned channels, where the MHOF or WGF is purchased via a mobile home specialty retailer or dealer: [32]

Manufacturer → Mobile Home Specialty Retailer/Dealer → Consumer

In the new construction market, DOE identified three primary distribution channels that involve builders, or manufactured home builders when considering mobile home applications:

Manufacturer → Wholesaler → Mechanical Contractor → Builder → Consumer
Manufacturer → Wholesaler → Builder → Consumer
Manufacturer → Mobile Home Manufacturer → Mobile Home Dealer → Consumer

For both the replacements and new owners/new construction markets, DOE additionally considered the national accounts or direct-from-manufacturer distribution channel, where the manufacturer through a wholesaler sells directly consumers.[33]

Manufacturer → Wholesaler (National Account) → Buyer → Consumer

DOE developed baseline and incremental markups for each actor in the distribution chain to ultimately determine the consumer purchase cost. 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 (*i.e.,* 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.[34]

DOE did not receive comments in response to the markups methodology in the November 2023 NOPD and maintains the same methodology for this final determination.

*D. Energy Use Analysis*

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

DOE estimated the annual energy consumption of oil and weatherized gas consumer furnaces at specific energy efficiency levels across a range of climate zones, building characteristics, and space heating needs. The annual energy consumption includes the natural gas, liquid petroleum gas (''LPG''), oil, and electricity, as applicable, used by the furnace.

For the November 2023 NOPD, DOE developed a building sample based on the Energy Information Administration's (''EIA's'') 2015 Residential Energy Consumption Survey (''RECS 2015'') [35] and 2012 Commercial Building Energy Consumption Survey (''CBECS 2012'').[36] DOE used RECS 2015-reported or CBECS 2012-reported heating energy consumption (based on the existing heating system) to calculate the heating load of each household or building. The heating load represents the amount of heating required to keep a housing unit or building comfortable throughout an average year. DOE assigned the energy efficiency of existing systems based on the design of the distribution systems, a historical distribution of energy efficiencies for NWOFs, MHOFs, and WGFs, and data about the age of the existing furnace. The estimation of heating loads also required calculating the electricity consumption of the blower, because heat from the operation of the blower contributes to space heating. In addition, DOE made adjustments based on historical weather data, projections of building shell efficiency, and building square footage, as well as for homes that had secondary heating equipment that used the same fuel as the furnace. To complete the analysis, DOE calculated the anticipated energy consumption of alternative (more energy-efficient) products if they were to replace existing systems in each housing unit or commercial building.

In the November 2023 NOPD, DOE also included the electricity use of auxiliary equipment, such as condensate pumps and heat tape, which

[28] DOE estimates that five percent of WGFs and three percent of NWOFs are installed in commercial buildings.

[29] New owners are new furnace installations in buildings that did not previously have a NWOF, MHOF, or WGF, or existing owners that are adding an additional consumer furnace. They primarily consist of households that add or switch to these furnaces during a major remodel.

[30] In the residential sector, DOE estimates that this distribution channel is applicable to 90 percent of the shipments for NWOFs and MHOFs and 80 percent for WGFs; in the commercial sector, it is applied to 75 percent of NWOF and 70 percent of WGF distributions.

[31] In the residential sector, DOE estimates that these two distribution channels combined are applicable to five percent of the shipments for NWOFs and MHOFs, and 15 percent for WGFs (in mobile home applications, 10 percent of WGFs distributed to mobile homes is assumed to go through these channels); in the commercial sector, they are applied to 10 percent of NWOF and 15 percent of WGF distributions.

[32] DOE estimates that five percent of MHOFs and 10 percent of WGFs that go to mobile homes are distributed through this channel.

[33] The national accounts channel where the buyer is the same as the consumer is mostly applicable to NWOFs and WGFs installed in small to mid-size commercial buildings, where on-site contractors purchase equipment directly from wholesalers at lower prices due to the large volume of equipment purchased and perform the installation themselves. DOE's analysis assumes that approximately 5 and 15 percent of NWOFs and WGFs installed in the residential and commercial sector, respectively, use the national accounts distribution channel for replacements. For new construction, DOE assumes 10 percent of the subject furnaces installed in the residential sector and 20 percent installed in the commercial sector are distributed through national accounts.

[34] 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.

[35] Energy Information Administration (''EIA''), 2015 Residential Energy Consumption Survey (RECS) (available at: *www.eia.gov/consumption/residential/data/2015*) (last accessed June 28, 2024).

[36] EIA, 2012 Commercial Buildings Energy Consumption Survey (CBECS) (available at: *www.eia.gov/consumption/commercial/*) (last accessed June 28, 2024).

are sometimes installed with higher-efficiency products. The electricity consumption of the auxiliary equipment is added to the total electricity consumption.

EIA recently published the microdata for the 2020 edition of RECS.[37] To assess the impact of using RECS 2020, DOE compared the LCC consumer sample in the July 2022 Consumer Furnace NOPR, which used RECS 2015, (see 87 FR 40590, 40624 (July 7, 2022)) to the consumer sample used in the December 2023 Consumer Furnace final rule consumer sample, which used RECS 2020 (see 88 FR 87502, 87547 (Dec. 18, 2023)). DOE assumed that changes in annual energy heating use between the two RECS editions for those consumer furnaces (*i.e.,* NWGFs and MHGFs) serve as a reasonable proxy for the relative change in oil and weatherized gas furnace energy use. As can be seen by comparing Table 7.4.1 of the TSDs for that NOPR and final rule, the reported estimated annual heating energy consumption by region and efficiency level is similar between the two versions of RECS for households with furnaces, with RECS 2020 showing a slightly lower energy consumption. Given in the space-heating end use for NWGFs compared with NWOFs, MHOFs, WOFs, WGFs, and EFs, and given that the estimated furnace energy use declines when updating to RECS 2020 for consumer furnaces, DOE has concluded that updating the consumer sample to RECS 2020 would not alter but only strengthen the conclusions of this final determination. Therefore, DOE continued to use RECS 2015 as the basis for its consumer sample, as was done in the November 2023 NOPD.

A similar comparison of commercial installations of oil and weather gas furnaces found similar energy use between CBECS 2012 used in the July 2022 Consumer Furnace NOPR (see 87 FR 40590, 40624 (July 7, 2022)) and CBECS 2018 used in the December 2023 Consumer Furnace final rule (see 88 FR 87502, 87547 (Dec. 18, 2023)). DOE also notes that commercial installations of oil and weatherized gas furnaces account for approximately five percent or less of total installations, as show in Table 6.2.1 of the Preliminary Analysis TSD. Given the relatively small number of installations in the commercial sector relative to the residential sector, DOE has concluded that changes between CBECS 2012 and 2018 would not significantly impact overall analytical conclusions. Therefore, for this final determination, DOE continued to use CBECS 2012 as the basis of its commercial consumer sample, as was done in the November 2023 NOPD.

Chapter 7 of the November 2022 Preliminary Analysis TSD provides details on DOE's energy use analysis for oil and weatherized gas furnaces. DOE did not receive comments on its energy use analysis methodology in response to the November 2023 NOPD.

*E. Life-Cycle Cost and Payback Period Analysis*

DOE conducts LCC and PBP analyses to evaluate the economic impacts on individual consumers of potential amended energy conservation standards for oil and weatherized gas furnaces. 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 typically uses the following two metrics to measure consumer impacts:

□ Life-Cycle Cost (LCC) is the total consumer expense of operating the product over the lifetime of that product, consisting of total installed cost (which includes manufacturer selling price, distribution chain markups, sales tax, and installation costs) plus operating costs (*e.g.,* 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.

□ Payback Period (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 the product 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, where appropriate, commercial buildings. As stated previously, DOE developed household and commercial building samples from the from RECS 2015 and CBECS 2012. For each sample household or commercial building, DOE determined the energy consumption for the oil and weatherized gas furnaces and the appropriate energy price. By developing a representative sample of households and commercial buildings, the analysis captured the variability in energy consumption and energy prices associated with the use of oil and weatherized gas furnaces.

Inputs to the LCC calculation include the installed cost to the consumer, operating expenses, the lifetime of the product, and a discount rate. 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 (where applicable)—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. Inputs to the PBP calculation include the installed cost to the consumer and first-year operating expenses. DOE created distributions of values for installation cost, repair and maintenance, product lifetime, discount rates, and sales taxes, with probabilities attached to each value, to account for their uncertainty and variability.

The computer model DOE uses to calculate the LCC relies on a Monte Carlo simulation to incorporate uncertainty and variability into the analysis. The Monte Carlo simulations randomly sample input values from the probability distributions and product user samples. For this proceeding, the Monte Carlo approach is implemented in MS Excel together with the Crystal Ball™ add-on.[38] The model calculated the LCC for products at each efficiency level for 10,000 housing units or commercial buildings per simulation run. The analytical results include a distribution of 10,000 data points showing the range of LCC savings for a given efficiency level relative to the no-new-standards case efficiency distribution. In performing an iteration of the Monte Carlo simulation for a given consumer, product efficiency is chosen based on its probability. If the chosen product efficiency is greater than or equal to the efficiency of the standard level under consideration, the LCC calculation reveals that a consumer is

[37] EIA, 2020 Residential Energy Consumption Survey (RECS) (available at: *www.eia.gov/consumption/residential/data/2020/index.php/*) (last accessed June 11, 2024).

[38] Crystal Ball™ is a commercially-available software tool to facilitate the creation of these types of models by generating probability distributions and summarizing results within Excel (available at: *www.oracle.com/middleware/technologies/crystalball.html*) (last accessed June 11, 2024).

not impacted by the standard level. By accounting for consumers who are already projected to purchase more-efficient products than the baseline product in a given case, DOE avoids overstating the potential benefits from increasing product efficiency.

DOE calculated the LCC and PBP for consumers of oil and weatherized gas furnaces as if each were to purchase a new product in the expected first year of required compliance with new or amended standards. Any amended standards would apply to oil and weatherized gas furnaces manufactured five years after the date on which any new or amended standard is published in the **Federal Register**. (42 U.S.C. 6295(m)(4)(A)(ii)) Therefore, DOE used 2030 as the first year of compliance with any amended standards.

Table IV.16 summarizes the approach and data DOE used to derive inputs to the LCC and PBP analyses. The subsections that follow provide further discussion. Details of the spreadsheet model, and how all inputs to the LCC and PBP analyses are applied, are contained in chapter 8 of the November 2022 Preliminary Analysis TSD and its appendices.

TABLE IV.16—SUMMARY OF INPUTS AND METHODS FOR THE LCC AND PBP ANALYSES *

| Inputs | Source/method |
|---|---|
| Product Cost | Derived by multiplying MPCs by manufacturer and distribution chain markups and sales tax, as appropriate. Used historical data to derive a price-scaling index to project product costs. |
| Installation Costs | Baseline installation cost determined with data from RS Means 2023, manufacturer literature, and expert consultant. DOE assumed increased installation costs for condensing furnaces. |
| Annual Energy Use | The annual energy consumption per unit at each efficiency level (*see* section IV.D of this document).<br>*Variability:* Based on RECS 2015 and CBECS 2012. |
| Energy Prices | *Natural Gas:* Based on EIA's Natural Gas Navigator data for 2022 and RECS 2015 and CBECS 2012 billing data.<br>*Propane and Fuel Oil:* Based on EIA's State Energy Data System (''SEDS'') for 2021.<br>*Electricity:* Based on EIA's Form 861 data for 2022 and RECS 2015 and CBECS 2012 billing data.<br>*Variability:* State energy prices determined for residential and commercial applications.<br>Marginal prices used for natural gas, propane, and electricity prices. |
| 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 | Baseline installation cost determined with data from RSMeans 2023, manufacturer literature, and expert consultant. DOE assumed increased repair and maintenance costs for condensing furnaces. |
| Product Lifetime | Based on shipments data, multi-year RECS, American Housing Survey, American Home Comfort Survey data. Average: 20.2–22.5 years. |
| Discount Rates | For residential end users, approach involves identifying all possible debt or asset classes that might be used to purchase the considered appliances or might be affected indirectly. Primary data source was the Federal Reserve Board's Survey of Consumer Finances. For commercial end users, DOE calculates commercial discount rates as the weighted-average cost of capital using various financial data. |
| Compliance Date | 2030. |

* References for the data sources mentioned in this table are provided in the sections following the table or in chapter 8 of the November 2022 Preliminary Analysis TSD. Energy price trends, product lifetimes, and discount rates are not used for the PBP calculation.

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.

For the November 2023 NOPD, DOE estimated product prices in the year of compliance by using a least-squares power-law fit on the inflation-adjusted, unified price index (historical Producer Price Index (''PPI'') data) for warm-air furnaces from BLS spanning the time period 1990–2018 versus cumulative shipments.[39] DOE did not receive comments on its price learning methodology in response to the November 2023 NOPD and maintains this methodology for this final determination.

2. Installation Cost

The installation cost is the expense to the consumer of installing the furnace, in addition to the cost of the furnace itself. Installation cost includes all labor, overhead, and any miscellaneous materials and parts needed that are associated with the replacement of an existing furnace or the installation of a furnace in a new home, as well as delivery of the new furnace, removal of the existing furnace, and any applicable permit fees. Higher-efficiency furnaces may require a consumer to incur additional installation costs.

For the November 2023 NOPD, DOE used data from RSMeans,[40] manufacturer literature, and expert consultants to estimate the installation cost, including labor costs, for oil and weatherized gas furnaces. DOE's analysis of installation costs accounted for regional differences in labor costs by aggregating city-level labor rates from RSMeans into the 50 distinct States plus Washington, DC to match RECS 2015 and CBECS 2012 data. The installation cost methodology accounts for all potential installation cases, including when a noncondensing furnace is replaced with a condensing furnace, with particular attention to venting issues in replacement applications (*see* descriptions that follow). The installation cost also depends on the furnace installation location, which DOE determined using information from RECS 2015 and CBECS 2012.

For NWOF replacement installations, DOE included a number of additional costs (''adders'') for a fraction of the sample households that have particular features. For noncondensing furnaces, these additional costs included updating flue vent connectors, vent resizing, and chimney relining. For condensing furnaces, these additional costs included adding a new flue vent (polyvinyl chloride (''PVC'')), adding

[39] U.S. Department of Labor, Bureau of Labor Statistics, Produce Price Indices Series ID PCU333415333415C (available at: *www.bls.gov/ppi/*) (last accessed June 28, 2024).

[40] RSMeans Company Inc., RSMeans Cost Data, Kingston, MA (2023) (available at: *www.rsmeans.com/products/online/*) (last accessed June 11, 2024).

combustion air vents for direct vent installations (PVC), adding concealing vent pipes for indoor installations, addressing an orphaned water heater (by updating flue vent connectors, vent resizing, or chimney relining), and removing condensate, all based on manufacturer installation manuals and expert consultant input. Freeze protection (heat tape) is accounted for in the cost of condensate removal for a fraction of NWOFs installed in unconditioned attics.

For WGF installations, DOE included additional cost adders for condensing WGFs to dispose of the condensate created and to prevent freezing of the condensate, as the entire product is outdoors based on manufacturer installation manuals, field study reports, and expert consultant input. DOE also accounted for a fraction of installations in colder climates that could require freeze protection (heat tape), a condensate line being buried below the frost line, or a condensate pump.

DOE did not receive comments regarding its installation cost analysis in response to the November 2023 NOPD. Accordingly, DOE has maintained the same approach for this final determination.

For further information on the derivation of installation costs, see chapter 7 of the November 2022 Preliminary Analysis TSD.

3. Annual Energy Consumption

For each sampled household or commercial building, DOE determined the energy consumption for oil and weatherized gas furnaces at different efficiency levels using the approach described previously in section IV.D of this document.

4. Energy Prices

Energy bills to consumers typically include fixed costs (*i.e.,* costs that do not depend on consumption) and costs that depend on the level of consumption. To estimate the impact of standards on consumer operating costs, DOE calculated average energy prices, which represent the typical cost for a consumer to use energy, including fixed costs, and marginal energy prices, which represent the energy price consumers would pay for reduced consumption. Because marginal energy 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. DOE applied average energy prices for the energy use of the product purchased in the no-new-standards case, and marginal electricity prices for the incremental change in energy use associated with the other efficiency levels considered.

For the November 2023 NOPD, DOE derived 2022 annual residential and commercial electricity prices by State from EIA Form 861M data.[41] DOE obtained 2022 annual residential and commercial natural gas prices by State from EIA's Natural Gas Navigator.[42] DOE collected 2021 average LPG and fuel oil prices by State from EIA's 2021 State Energy Consumption, Price, and Expenditures Estimates and scaled to 2022 prices using *AEO 2023* data.[43] To determine monthly prices for use in the analysis, DOE developed monthly energy price factors for each fuel based on long-term monthly price data. Monthly electricity and natural gas prices were adjusted using seasonal marginal price factors to determine monthly marginal electricity and natural gas prices. These marginal energy prices were used to determine the cost to the consumer of the change in energy consumed. Because marginal price data is only available for residential electricity and natural gas, DOE only developed marginal monthly prices for these fuels. For LPG and fuel oil, DOE used average monthly prices.

To estimate energy prices in future years, DOE multiplied the 2022 energy prices by the projection of annual average price changes for each State from the Reference case in *AEO 2023,* which has an end year of 2050.[44] To estimate price trends after 2050, DOE used the average annual rate of change in prices from 2046 through 2050. *See* chapter 8 of the November 2022 Preliminary Analysis TSD for details.

To assess the impact of updated energy price estimates, DOE compared the energy price estimates in 2030 from the November 2023 NOPD to the projected estimates using updated EIA energy price data from 2023. The results of this comparison are presented in Table IV.17.

TABLE IV.17—SUMMARY OF ENERGY PRICE COMPARISON OF 2023 EIA DATA RELATIVE TO NOVEMBER 2023 NOPD

| Energy type | Percent change in 2030 energy price |
|---|---|
| Electricity | −20 |
| Natural Gas | +1 |
| LPG | +1 |
| Fuel Oil | −16 |

Based upon this review, DOE has determined that energy prices have either not changed significantly, as in the case of natural gas and LPG, or have decreased, as in the case of electricity and fuel oil, relative to the energy prices used in the November 2023 NOPD. Consequently, updating energy prices would either have no impact on analytical results or decrease operating cost savings, thereby further justifying DOE's decision to not amend the existing energy conservation standards for oil and weatherized gas furnaces. DOE did not receive comments regarding energy prices in response to the November 2023 NOPD. As a result, DOE has continued to use the energy prices from the November 2023 NOPD in this determination.

5. Maintenance and Repair Costs

Repair costs are associated with repairing or replacing product components that have failed in an appliance, whereas maintenance costs are associated with maintaining the operation of the product. The maintenance and repair costs (including labor hours, component costs, and frequency) at each considered efficiency level are derived based on *2023 RSMeans Facilities Maintenance and Repair Data,*[45] manufacturer literature, consultant input, and industry reports. DOE also accounted for regional differences in labor costs based on these 2023 RSMeans data.

DOE assumes that condensing furnaces have a higher maintenance cost than noncondensing furnaces, but that this maintenance cost is the same at all noncondensing or condensing efficiency levels within each product class. The additional maintenance cost for condensing furnaces includes maintenance tasks related to the condensate withdrawal system (such as condensate pump or condensate neutralizer filter) and additional

[41] EIA, Form EIA–861M (formerly EIA–826) detailed data (2022) (available at: *www.eia.gov/electricity/data/eia861m/)* (last accessed June 1, 2024).

[42] EIA, Natural Gas Navigator (2022) (available at: *www.eia.gov/naturalgas/data.php*) (last accessed June 1, 2024).

[43] EIA, 2021 State Energy Data System (2021) (available at: *www.eia.gov/state/seds/*) (last accessed June 1, 2024).

[44] EIA, *Annual Energy Outlook 2023 with Projections to 2050* (available at: *www.eia.gov/forecasts/aeo/*) (last accessed June 1, 2024).

[45] RSMeans Company Inc., *RSMeans Facilities Maintenance & Repair Cost Data* (2023) (available at: *www.rsmeans.com/*) (last accessed June 11, 2024).

maintenance related to the cleaning or checking of the heat exchanger (in particular, for condensing oil-fired furnaces using high-sulfur fuel oil).

DOE also assumes that condensing furnaces have a higher repair cost than noncondensing furnaces, but the repair cost is the same at all noncondensing or condensing efficiency levels within each product class.

DOE did not receive comments on its maintenance and repair cost methodology in response to the November 2023 NOPD, and accordingly, the Department has maintained the same methodology for this final determination.

For more details on DOE's methodology for calculating maintenance and repair costs, including all online resources reviewed, see appendix 8E of the November 2022 Preliminary Analysis TSD.

6. Product Lifetime

Product lifetime is the age at which an appliance is retired from service. DOE conducted an analysis of furnace lifetimes based on the methodology described in a journal paper.[46] For the November 2023 NOPD, DOE relied on RECS 1990, 1993, 2001, 2005, 2009, and 2015.[47] DOE also used the U.S. Census's biennial American Housing Survey (''AHS'') from 1974 to 2021, which surveys all housing, noting the presence of a range of appliances.[48] DOE used the appliance age data from these surveys, as well as the historical furnace shipments, to generate an estimate of the survival function. The survival function provides a lifetime range from minimum to maximum, as well as an average lifetime. For oil and weatherized gas furnaces, DOE developed Weibull distributions resulting in an average lifetime of 20.2 to 22.5 years (based on region).

DOE did not receive any comments on the lifetime distributions used in the November 2023 NOPD. As oil and weatherized gas furnaces have not changed significantly since the November 2023 NOPD, DOE maintains the same lifetime distribution in this final determination.

Appendix 8F of the November 2022 Preliminary Analysis TSD provides further details on the methodology and sources DOE used to develop the subject furnace lifetimes.

7. Discount Rates

In the calculation of LCC, DOE applies discount rates appropriate to estimate the present value of future expenditures and savings. DOE estimated a distribution of discount rates for oil and weatherized gas furnaces based on the opportunity cost of funds. DOE estimates discount rates separately for residential and commercial end users.

For residential end users, DOE applies weighted-average discount rates calculated from consumer debt and asset data, rather than marginal or implicit discount rates.[49] 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 timescale 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.

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 triennial Survey of Consumer Finances[50] (''SCF''). 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.

For commercial end users, DOE estimated the weighted-average cost of capital using data from various financial sources. 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 did not receive comments on its discount rate distribution methodology in response to the November 2023 NOPD, and accordingly, the Department has maintained the same methodology for this final determination.

See appendix 8G of the November 2022 Preliminary Analysis TSD for further details on the development of 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 (*i.e.,* market shares) of product efficiencies under the no-new-standards case (*i.e.,* the case without amended or new energy conservation standards) in the compliance year (2030). This approach reflects the fact that some consumers may purchase products with efficiencies greater than the baseline levels, even in the absence of new or amended standards.

For consumer furnaces, DOE had limited historical-shipments data by efficiency level. For NWOFs/MHOFs, DOE reviewed market shares from HARDI 2013–2022 data and BRG 2007–2022 data.[51] [52] The shipments data are not disaggregated between NWOFs and

[46] Lutz, J., *et al.,* ''Using National Survey Data to Estimate Lifetimes of Residential Appliances,'' *HVAC&R Research* (2011) 17(5): p. 28 (available at: *www.tandfonline.com/doi/abs/10.1080/10789669.2011.558166)* (last accessed June 1, 2024).

[47] EIA, *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, 2024).

[48] 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: *www.census.gov/programs-surveys/ahs/*) (last accessed June 1, 2024).

[49] 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, and 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.

[50] 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 June 11, 2024).

[51] Heating, Air-conditioning and Refrigeration Distributors International (HARDI), DRIVE portal (HARDI Visualization Tool managed by D+R International until 2022), proprietary Gas Furnace Shipments Data from 2013–2022 provided to Lawrence Berkeley National Laboratory (LBNL).

[52] BRG Building Solutions. The North American Heating & Cooling Product Markets (2022 Edition) (Available at: *www.brgbuildingsolutions.com/reports-insights*) (last accessed June 28, 2024).

MHOFs, but DOE assigned all shipments data below 83-percent AFUE to MHOFs. For WGFs, DOE had insufficient historical shipments data by efficiency level to develop a reliable efficiency distribution. To cover the lack of available shipments data, DOE referred to CCD [53] for furnaces to develop efficiency distributions based on available models for WGFs.

DOE did not receive additional data or comments on estimated market shares in the no-new-standard case in response to the November 2023 NOPD. Accordingly, DOE used estimates from the November 2023 NOPD for this final determination.

The estimated market shares for the no-new-standards case for oil and weatherized gas furnaces are shown in Table IV.18 of this document. *See* chapter 8 of the November 2022 Preliminary Analysis TSD for further information on the derivation of the efficiency distributions.

TABLE IV.18—NO-NEW-STANDARDS CASE EFFICIENCY DISTRIBUTIONS IN 2030 FOR OIL AND WEATHERIZED GAS FURNACES

| Product class | Efficiency level | Distribution (%) |
|---|---|---|
| NWOF | Baseline | 37.2 |
| | 1 | 60.0 |
| | 2 | 1.5 |
| | 3 | 1.3 |
| MHOF | Baseline | 95 |
| | 1 | 2 |
| | 2 | 3 |
| | 3 | 0 |
| WGF | Baseline | 96 |
| | 1 | 4 |

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

9. Payback Period Analysis

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

The inputs to the PBP calculation for each efficiency level are the change in total installed cost of the product and the change in the first-year annual operating expenditures relative to the baseline. DOE refers to this as a ''simple PBP'' because it does not consider changes over time in operating cost savings. The PBP calculation uses the same inputs as the LCC analysis when deriving first-year operating costs, except that discount rates are not needed.

DOE did not receive comments on its PBP calculation in response to the November 2023 NOPD, and accordingly, the Department has maintained the same methodology for this final determination.

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

In response to the November 2023 NOPD, Chiafullo suggested that DOE should avoid any regulation that would essentially require people who currently use natural gas in their homes to switch to electric energy. The commenter stated that, in the event of changes to the energy efficiency standards for consumer furnaces, consumers would be faced with the prohibitive cost of switching from gas-powered to electric appliances, coupled with the fact that owners of electric appliances would need generators when the electricity is out. (Chiafullo, No. 31 at p. 1)

In response, DOE has determined that energy conservation standards for standards for oil, electric, and weatherized gas furnaces do not need to be amended and, hence, there will be no market impact associated with this final determination.

DOE did not receive additional historical shipments data to update shipments projections in response to the November 2023 NOPD. DOE notes that although there may be additional historical data available for 2023, including an additional year of historical data would be expected to have a minimal impact on projected shipments over the shipments analysis period (2030–2059). Additionally, the November 2023 NOPD relied on *AEO 2023,* which remains the most recent available edition for *AEO* for many key inputs related to future product demand. For these reasons, DOE continues to use shipments from the November 2023 NOPD for this final determination.

As discussed in the November 2023 NOPD, DOE estimates that the shipments of NWOFs and MHOFs have declined by more than 70 percent over the past 20 years. 88 FR 83426, 83459 (Nov. 29, 2023). Shipments for oil furnaces have accounted for less than 1 percent of the consumer furnaces market over the past 10 years, and

[53] U.S. Department of Energy Compliance Certification Database (''CCD'') (Available at: *www.regulations.doe.gov/certification-data/*) (last accessed June 28, 2024).

[54] 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.

shipments for weatherized gas have accounted for seven percent of the consumer furnace market over the past 20 years. *Id.* Additionally, DOE estimates shipments of both oil and weatherized gas consumer furnaces have been flat or declining over time. *Id.* These trends have been considered as a part of this final determination in section V.C.4 of this document.

*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 energy conservation standards at specific efficiency levels.[55] (''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.[56] For the present analysis, DOE projected the energy savings, operating cost savings, product costs, and NPV of consumer benefits over the lifetime of oil and weatherized gas furnaces sold from 2030 through 2059.

DOE evaluates the impacts of new or amended standards by comparing a case without such standards with standards-case projections. The no-new-standards case characterizes energy use and consumer costs for each product class in the absence of new or amended energy conservation standards. For this projection, DOE considers historical trends in efficiency and various forces that are likely to affect the mix of efficiencies over time. DOE compares the no-new-standards case with projections characterizing the market for each product class if DOE adopted new or amended standards at specific energy efficiency levels 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.19 summarizes the inputs and methods DOE used for the NIA for the final determination. Discussion of these inputs and methods follows the table. See chapter 10 of the November 2022 Preliminary Analysis TSD for details.

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

| Inputs | Method |
|---|---|
| Shipments | Annual shipments from shipments model. |
| Compliance Date of Standard | 2030. |
| Efficiency Trends | *No-new-standards case:* Based on historical data.<br>*Standards cases:* Roll-up in the compliance year and then DOE-estimated growth in shipment-weighted efficiency in all the standards cases, except max-tech. |
| Annual Energy Consumption per Unit. | Annual weighted-average values are a function of energy use at each EL. Incorporates projection of future energy use based on *AEO 2023* projections for heating degree days (''HDD''), cooling degree days (''CDD''), and building shell efficiency index. |
| Total Installed Cost per Unit | Annual weighted-average values are a function of cost at each EL.<br>Incorporates projection of future product prices based on historical data. |
| Annual Energy Cost per Unit | Annual weighted-average values as a function of the annual energy consumption per unit and energy prices. |
| Repair and Maintenance Cost per Unit. | Annual weighted-average values increase for condensing levels. |
| Energy Price Trends | *AEO 2023* projections (to 2050) and extrapolation after 2050. |
| Energy Site-to-Primary and FFC Conversion. | A time-series conversion factor based on *AEO 2023.* |
| Discount Rate | 3% and 7%. |
| 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 (2030).

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.

To develop standards case efficiency trends after 2030, DOE estimated growth in shipment-weighted efficiency in the standards cases, except in the max-tech standards case.

2. National Energy Savings

The NES analysis involves a comparison of national energy consumption of the considered products between each potential standards case and the case with no new or amended energy conservation standards. DOE calculated the national energy consumption by multiplying the number of units (*i.e.,* 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 standards case. DOE estimated energy consumption and savings based on site energy and converted the electricity consumption and savings to primary

[55] The NIA accounts for impacts in the United States and U.S. territories.

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

energy (*i.e.,* the energy consumed by power plants to generate site electricity) using annual conversion factors derived from *AEO 2023.* For natural gas and LPG, primary energy consumption is the same as site energy consumption. 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. In the November 2023 NOPD, DOE applied a rebound effect of 15 percent for residential applications by reducing the site energy savings (and the associated primary and FFC energy savings) for oil and weatherized gas furnaces. However, for commercial applications, DOE applied no rebound effect in order to be consistent with other recent standards rulemakings.

DOE did not receive comments on rebound in response to the November 2023 NOPD. Accordingly, DOE has maintained the same approach for this final determination.

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 NIAs and emissions analyses included in future energy conservation standards rulemakings. 76 FR 51281 (August 18, 2011). After evaluating the approaches discussed in the August 18, 2011 notice, DOE published a statement of amended policy in 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 (August 17, 2012). NEMS is a public domain, multi-sector, partial equilibrium model of the U.S. energy sector [57] that EIA uses to prepare its *Annual Energy Outlook.* The FFC factors incorporate losses in production and delivery in the case of natural gas (including fugitive emissions) and additional energy used to produce and deliver the various fuels used by power plants. The approach used for deriving FFC measures of energy use and emissions is described in appendix 10B of the November 2022 Preliminary Analysis TSD.

The Joint Advocates commented that because the annual operating costs for baseline NWOFs exceed $2,000 and NWOFs have an outsized impact on greenhouse gas emissions, improved standards for NWOFs are particularly important for improving energy affordability and contributing to decarbonization goals. (Joint Advocates, No. 34 at p. 2)

In response, DOE notes that NWOF shipments have declined by more than 70 percent over the past 20 years and are likely to continue to decrease over the analysis period. Given the projected declining market for NWOFs, their contribution to greenhouse gas emissions is likewise projected to decrease over the analysis period in the absence of standards. Furthermore, DOE notes that, given the small role of oil furnaces in the overall furnace market and their low sales volume relative to the consumer boiler and consumer water heater markets, manufacturers faced with amended standards may deprioritize updates for these product classes and instead choose to exit the market. Although the existing oil-fired furnace market currently has a diversity of competitors, the loss of a few manufacturers could lead to shifts in market competition and availability of products that cover the full range of capacities. Such scenario may impact consumer's ability to obtain a suitable replacement for a failed NWOF.

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 (which include energy costs and repair and maintenance costs), and (3) a discount factor to calculate the present value of costs and savings. DOE calculates net savings each year as the difference between the no-new-standards case and each standards case in terms of total savings in operating costs versus total increases in installed costs. DOE calculates operating cost savings over the lifetime of each product shipped during the projection period.

As discussed in section IV.E.1 of this document, DOE developed oil and weatherized gas furnaces price trends based on historical PPI data and cumulative shipments. DOE applied the same trends to project prices for each product class at each considered efficiency level. By 2059, which is the end date of the projection period, the average oil and weatherized gas furnace price is projected to drop 17 percent relative to 2022. DOE's projection of product prices is described further in chapter 10 of the November 2022 Preliminary Analysis TSD.

The operating cost savings are energy cost savings minus any repair and maintenance cost increases. Energy cost savings are calculated using the estimated energy savings in each year and the projected price of the appropriate form of energy. To estimate energy prices in future years, DOE multiplied the national-average energy prices by the projection of annual national-average residential (or commercial, as appropriate) energy price changes in the *AEO 2023* Reference case, which has an end year of 2050. To estimate price trends after 2050, DOE used the average annual rate of change in prices from 2046 through 2050. Repair and maintenance cost for each of the efficiency levels is calculated in the LCC, and repair and maintenance cost increases are calculated as the repair and maintenance cost differential between efficiency levels.

In calculating the NPV, DOE multiplies the net savings in future years by a discount factor to determine their present value. For this final determination, 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.[58] 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.

## V. Analytical Results and Conclusions

The following section addresses the results from DOE's analyses with respect to the considered energy conservation standards for oil and weatherized gas furnaces. It addresses the efficiency levels (''ELs'') examined by DOE (see section IV.B.1 of this

[57] For more information on NEMS, refer to *The National Energy Modeling System: An Overview May 2023,* DOE/EIA (May 2023) (Available at: *www.eia.gov/outlooks/archive/0581(2023).pdf* (last accessed July 22, 2024).

[58] U.S. Office of Management and Budget, *Circular A–4: Regulatory Analysis* (Available at: *www.whitehouse.gov/omb/information-for-agencies/circulars*) (last accessed June 11, 2024). DOE used the prior version of Circular A–4 (September 17, 2003) in accordance with the effective date of the November 9, 2023 version (Available at: *www.whitehouse.gov/wp-content/uploads/legacy_drupal_files/omb/circulars/A4/a-4.pdf*) (last accessed June 11, 2024).

document) and the projected impacts of each of these levels if adopted as energy conservation standards for the subject oil and weatherized gas furnaces. Additional details regarding DOE's analyses are contained in the November 2022 Preliminary Analysis TSD supporting this document.

*A. Economic Impacts on Individual Consumers*

DOE analyzed the economic impacts on oil and weatherized gas furnace consumers by looking at the effects that potential amended energy conservation standards at each EL would have on the LCC and PBP. This approach allowed DOE to assess the potential standards' cost-effectiveness (*i.e.,* the savings in operating costs throughout the estimated average life of oil and weatherized gas furnaces compared to any increase in the price of, or in the initial charges for, or maintenance expenses of, oil and weatherized gas furnaces which are likely to result from the imposition of a standard). 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. Chapter 8 of the November 2022 Preliminary Analysis TSD provides detailed information on the LCC and PBP analyses.

Table V.1 through Table V.6 show the average LCC and PBP results for the ELs considered for each product class of oil and weatherized gas furnaces. In the first of each pair of tables, the simple payback is measured relative to the baseline level. In the second table, the impacts are measured relative to the efficiency distribution in the no-new-standards case in the compliance year. The LCC and PBP results for oil and weatherized gas furnaces include both residential and commercial users. Because some consumers purchase products with higher efficiency in the no-new-standards case, the average savings are less than the difference between the average LCC of the baseline product and the average LCC at each EL. The savings refer only to consumers who are affected by a standard at a given EL. Those who already purchase a product with efficiency at or above a given EL are not affected. Consumers for whom the LCC increases at a given EL experience a net cost.

TABLE V.1—AVERAGE LCC AND PBP RESULTS FOR NWOFS

| Efficiency level | Average costs (*2022$*) | | | | Simple payback (*years*) | Average lifetime (*years*) |
|---|---|---|---|---|---|---|
| | Installed cost | First year's operating cost | Lifetime operating cost | LCC | | |
| Baseline | 4,333 | 2,132 | 32,211 | 36,544 | ..... | 22.2 |
| 1 | 4,392 | 2,086 | 31,528 | 35,920 | 1.3 | 22.2 |
| 2 | 4,451 | 2,043 | 30,876 | 35,327 | 1.3 | 22.2 |
| 3 | 5,898 | 1,920 | 29,212 | 35,110 | 7.4 | 22.2 |

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

TABLE V.2—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR NWOFS

| Efficiency level | Life-cycle cost savings | |
|---|---|---|
| | Average LCC savings * (*2022$*) | Percentage of consumers that experience net cost (%) |
| 1 | 608 | 0.5 |
| 2 | 820 | 1.4 |
| 3 | 1015 | 37.0 |

**Note:** The savings represent the average LCC for affected consumers.

TABLE V.3—AVERAGE LCC AND PBP RESULTS FOR MHOFS

| Efficiency level | Average costs (*2022$*) | | | | Simple payback (*years*) | Average lifetime (*years*) |
|---|---|---|---|---|---|---|
| | Installed cost | First year's operating cost | Lifetime operating cost | LCC | | |
| Baseline | 3,377 | 1,142 | 17,913 | 21,290 | ..... | 22.6 |
| 1 | 3,465 | 1,107 | 17,371 | 20,836 | 2.5 | 22.6 |
| 2 | 3,523 | 1,085 | 17,030 | 20,553 | 2.5 | 22.6 |
| 3 | 3,581 | 1,063 | 16,705 | 20,286 | 2.6 | 22.6 |

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

TABLE V.4—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR MHOFS

| Efficiency level | Life-cycle cost savings | |
|---|---|---|
| | Average LCC savings * (*2022$*) | Percentage of consumers that experience net cost (%) |
| 1 | 452 | 0.8 |
| 2 | 724 | 0.9 |
| 3 | 971 | 1.0 |

**Note:** The savings represent the average LCC for affected consumers.

TABLE V.5—AVERAGE LCC AND PBP RESULTS FOR WGFS

| Efficiency level | Average costs (*2022$*) | | | | Simple payback (*years*) | Average lifetime (*years*) |
|---|---|---|---|---|---|---|
| | Installed cost | First year's operating cost | Lifetime operating cost | LCC | | |
| Baseline | 5,533 | 471 | 7,215 | 12,748 | ..... | 20.6 |
| 1 | 5,822 | 433 | 6,698 | 12,519 | 7.5 | 20.6 |

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

TABLE V.6—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR WGFS

| Efficiency level | Life-cycle cost savings | |
|---|---|---|
| | Average LCC Savings * (*2022$*) | Percentage of consumers that experience net cost (%) |
| ..... | ..... | |
| 1 | 223 | 40.4 |

**Note:** The savings represent the average LCC for affected consumers.

In response to the November 2023 NOPD, Lennox agreed with DOE's conclusion that more-stringent efficiency levels would cause many consumers to have net costs. (Lennox, No. 32 at p. 3) Lennox stated that the long payback period and high percentage of consumers with net costs support the idea that amended standards are not justified for weatherized gas furnaces. (*Id.*) In contrast, the Joint Advocates commented that the potential utility bill savings resulting from updated standards would particularly benefit low-income households and that DOE's proposed determination to refrain from updating the standards is potentially sacrificing millions of dollars in consumer savings. (Joint Advocates, No. 34 at p. 2)

As required by EPCA, DOE's determination considers whether amended standards would result in significant conservation of energy, be technologically feasible, and be 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)) For these product classes, DOE expects that manufacturers would need to make significant investments in developing new model lines for the subject furnaces in order to meet more-stringent, amended standards. Although this analysis finds positive LCC savings at the considered ELs, given the relatively small market for oil and weatherized gas furnaces and declining shipments, DOE expects that such savings are unlikely to be realized because manufacturers may exit the market in response to amended standards, thereby resulting in certain products or capacities becoming unavailable to consumers. Consequently, DOE has determined that it is unable to conclude that amended energy conservation standards for oil-fired furnaces and weatherized gas furnaces would be economically justified.

*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. National Energy Savings

To estimate the energy savings attributable to potential amended energy conservation standards for oil and weatherized gas furnaces, DOE compared their energy consumption under the no-new-standards case to their anticipated energy consumption under each EL. The savings are measured over the entire lifetime of products purchased during the 30-year period that begins in the year of anticipated compliance with amended standards (2030–2059).

Table V.8 presents DOE's projections of the national energy savings for each EL considered for the analysis. The savings were calculated using the approach described in section IV.G.2 of this document.

TABLE V.7—CUMULATIVE NATIONAL ENERGY SAVINGS FOR OIL AND WEATHERIZED GAS FURNACES; 30 YEARS OF SHIPMENTS (2030–2059)

| Product class | Efficiency level | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| | FFC Energy Savings (quads) | | |
| Non-Weatherized Oil Furnace | 0.004 | 0.01 | 0.05 |
| Mobile Home Non-Weatherized Oil Furnace | 0.0004 | 0.001 | 0.001 |
| Weatherized Gas Furnace | 0.66 | ..... | ..... |

OMB Circular A–4 [59] 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 final determination, DOE undertook a sensitivity analysis using nine years, rather than 30 years, of product shipments. The choice of a nine-year period is a proxy for the timeline in EPCA for the review of certain energy conservation standards and potential revision of and compliance with such revised standards.[60] The review timeframe established in EPCA is generally not synchronized with the product lifetime, product manufacturing cycles, or other factors specific to oil and weatherized gas furnaces. 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 nine-year analytical period are presented in Table V.9. The impacts are counted over the lifetime of oil and weatherized gas furnace products purchased during the period of 2030–2038.

TABLE V.8—CUMULATIVE NATIONAL ENERGY SAVINGS FOR OIL AND WEATHERIZED GAS FURNACES; 9 YEARS OF SHIPMENTS (2030–2038)

| Product class | Efficiency level | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| | FFC Energy Savings (quads) | | |
| Non-Weatherized Oil Furnace | 0.002 | 0.01 | 0.02 |
| Mobile Home Non-Weatherized Oil Furnace | 0.0002 | 0.0004 | 0.001 |
| Weatherized Gas Furnace | 0.20 | ..... | ..... |

In response to the November 2023 NOPD, Lennox commented that the energy savings for the furnace categories addressed by the NOPD would not be significant. (Lennox, No. 32 at p. 3)

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 ELs considered for oil and weatherized gas furnaces. In accordance with OMB Circular A–4, DOE calculated NPV using both a 7-percent and a 3-percent real discount rate. Table V.10 shows the consumer NPV results with impacts counted over the lifetime of products purchased during the period of 2030–2059.

TABLE V.9—CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR OIL AND WEATHERIZED GAS FURNACES; 30 YEARS OF SHIPMENTS (2030–2059)

| Discount rate | Product class | Efficiency level (EL) | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| | | billion 2022$ | | |
| 3% | Non-Weatherized Oil Furnace | 0.06 | 0.20 | 0.20 |

[59] U.S. Office of Management and Budget, *Circular A–4: Regulatory Analysis* (Available at: *www.whitehouse.gov/omb/information-for-agencies/circulars*) (last accessed June 11, 2024). DOE used the prior version of Circular A–4 (Sept. 17, 2003) in accordance with the effective date of the November 9, 2023 version (Available at: *www.whitehouse.gov/wp-content/uploads/legacy_drupal_files/omb/circulars/A4/a-4.pdf*) (last accessed June 11, 2024).

[60] EPCA requires DOE to review its standards at least once every six years, and requires, for certain products, a three-year period after any new standard is promulgated before compliance is required, except that in no case may any new standards be required within six years of the compliance date of the previous standards. (42 U.S.C. 6295(m)) 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 six-year review to the three-year compliance period adds up to nine years, DOE notes that it may undertake reviews at any time within the six-year period and that the three-year compliance date may yield to the six-year backstop. A nine-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 five years rather than three years.

TABLE V.9—CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR OIL AND WEATHERIZED GAS FURNACES; 30 YEARS OF SHIPMENTS (2030–2059)—Continued

| Discount rate | Product class | Efficiency level (EL) | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| | | billion 2022$ | | |
| | Mobile Home Non-Weatherized Oil Furnace | 0.01 | 0.01 | 0.01 |
| | Weatherized Gas Furnace | 1.88 | ..... | ..... |
| 7% | Non-Weatherized Oil Furnace | 0.02 | 0.08 | 0.03 |
| | Mobile Home Non-Weatherized Oil Furnace | 0.002 | 0.003 | 0.005 |
| | Weatherized Gas Furnace | 0.45 | ..... | ..... |

The NPV results based on the aforementioned nine-year analytical period are presented in Table V.11 of this document. The impacts are counted over the lifetime of oil and weatherized gas furnace products purchased during the period of 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.

TABLE V.10—CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR OIL AND WEATHERIZED GAS FURNACES; 9 YEARS OF SHIPMENTS (2030–2038)

| Discount rate | Product class | Efficiency level (EL) | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| | | billion 2022$ | | |
| 3% | Non-Weatherized Oil Furnace | 0.03 | 0.11 | 0.12 |
| | Mobile Home Non-Weatherized Oil Furnace | 0.003 | 0.01 | 0.01 |
| | Weatherized Gas Furnace | 0.67 | ..... | ..... |
| 7% | Non-Weatherized Oil Furnace | 0.02 | 0.05 | 0.02 |
| | Mobile Home Non-Weatherized Oil Furnace | 0.002 | 0.003 | 0.004 |
| | Weatherized Gas Furnace | 0.22 | ..... | ..... |

*C. Final Determination*

As discussed previously, in order to make a final determination that the energy conservation standards for oil, electric, and weatherized gas furnaces do not need to be amended, EPCA requires that DOE analyze whether amended standards would result in significant conservation of energy, be technologically feasible, and be cost-effective. (42 U.S.C. 6295(m)(1)(A) and 42 U.S.C. 6295(n)(2)) An evaluation of cost-effectiveness requires DOE to consider savings in operating costs throughout the estimated average life of the covered product in the type (or class) compared to any increase in the price, initial charges, or maintenance expenses for the covered product 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)) The criteria considered under 42 U.S.C. 6295(m)(1)(A) and the additional analysis relating to economic justification are discussed in the paragraphs that follow.

1. Technological Feasibility

EPCA requires that DOE consider whether amended energy conservation standards for oil, electric, and weatherized gas furnaces would be technologically feasible. (42 U.S.C. 6295(m)(1)(A) and 42 U.S.C. 6295(n)(2)(B)) DOE has determined that technology options are available that can improve the efficiency of oil and weatherized gas furnaces. These technology options are being used in commercially-available oil and weatherized gas furnaces and, therefore, are technologically feasible. (*See* section IV.A.4 of this document for further information.) Hence, DOE has determined that amended energy conservation standards for oil and weatherized gas furnaces would be technologically feasible. However, as discussed in section IV.A.3 of this document, DOE is not aware of any technology options that would improve the efficiency of electric furnaces. Therefore, DOE has determined that amended energy conservation standards for electric furnaces are not technologically feasible.

2. Cost-Effectiveness

EPCA requires DOE to consider whether amended energy conservation standards for the subject furnaces 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 product that are likely to result from 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)) DOE conducted an LCC analysis to estimate the net costs/benefits to users from increased efficiency in the considered oil and weatherized gas furnace product classes. As shown in Table V.1 through Table V.6, for all product classes, all the considered efficiency levels result in positive LCC savings, with the percentage of consumers experiencing net cost ranging from 0.5 percent at EL 1 to 37 percent at max-tech for NWOFs, approximately 1 percent at all ELs for MHOFs, and 40 percent at the only considered efficiency level for WGFs.

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.10 and Table V.11 of this document) 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.

3. Significant Conservation of Energy

EPCA also requires that DOE consider whether amended energy conservation standards for the subject furnaces would result in significant conservation of energy. (42 U.S.C. 6295(m)(1)(A) and 42 U.S.C. 6295(n)(2)(A))

To estimate the energy savings attributable to potential amended standards for oil and weatherized gas furnaces, 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).

As shown in Table V.8, DOE estimates that amended standards would results in FFC energy savings of 0.004 quads at EL 1 to 0.05 quads at max-tech level for NWOFs, 0.0004 quads at EL 1 to 0.001 quads at max-tech level for MHOFs, and 0.66 quads at EL 1 (max-tech level) for WGFs, over a 30-year analysis period (2030–2059).

4. Further Considerations

a. Oil Furnaces

As discussed in section IV.F of this document, DOE estimates that the shipments of NWOFs and MHOFs have declined by more than 70 percent over the past 20 years and only accounted for less than 1 percent of the overall consumer furnace market in the past 10 years. DOE considered this declining trend and the small market share for oil furnaces in the furnace shipments model and projected that the shipments of NWOFs and MHOFs will continue to decline over the analysis period (*i.e.,* 2030–2059). DOE also considered that the shipments of NWOFs and MHOFs could decline faster than current projections, which may lead to further reductions in energy savings from potential amended standards.

As the oil furnace market has contracted, the industry has seen consolidation. DOE estimates there were 11 OEMs of NWOFs selling into the U.S. market at the time of the June 2011 DFR that set current standard levels for oil furnaces. Since then, manufacturers have merged, been acquired, and left the market. Currently there are seven OEMs of NWOFs selling into the U.S. market. DOE estimated the NWOF market to be approximately 36,000 units per year and the MHOF market to be approximately 2,000 units per year in 2023. These products together are less than 1 percent of the overall U.S. residential furnace market, which is approximately 4.2 million shipments per year in 2023. The size of the market could make cost recovery challenging for manufacturers. With the small market size and continued trend of diminishing sales, the timeframe for recouping investments may be longer than acceptable for manufacturers. Given the small role of oil furnaces in the overall furnace market and the low sales relative to the consumer boiler and consumer water heater markets, manufacturers may deprioritize updates for these product classes. The existing oil-fired furnace market currently has a diversity of competitors; however, the loss of a few manufacturers could lead to shifts in market competition.

b. Weatherized Gas Furnaces

DOE estimates that the shipments of WGFs have been approximately 0.35 million per year for the past 10 years and accounted for approximately 7 percent of the overall consumer furnace market over the past 20 years, as stated in section IV.F of this document. DOE considered the small market share for WGFs in the furnace shipments model and projected that the shipments of WGFs will be approximately flat and account for less than 8 percent of the overall consumer furnace market over the analysis period (*i.e.,* 2030–2059). DOE also considered that the shipments of WGFs could be less than current projections, which may lead to reductions in energy savings from potential amended standards.

WGFs have the largest potential energy savings of the product classes in this rulemaking. However, DOE recognizes challenges for the industry at the max-tech level, which requires condensing furnace designs. DOE identified eight OEMs of WGFs. Only one OEM offers models that can meet the max-tech level. Models that meet the max-tech level account for 1 percent of all WGF listings.

All other OEMs would need to invest in new WGF designs to meet a condensing efficiency level. DOE expects that developing new condensing model lines would require significant investment. If manufacturers plan to continue offering the same diversity of models, they would need to redesign nearly 1,500 basic models, or 99 percent of what is available on the market today. Designing condensing models would require the incorporation of a secondary heat exchanger and condensate management system. Manufacturers would likely need to reconfigure their existing heat exchanger to optimize airflow over the secondary heat exchanger, which could require investments in product redesign and retooling for hard-tooled portions of the heat exchanger. Manufacturers may also have to choose between adding the secondary heat exchanger within the physical limitations of the existing chassis dimension or adopting a new chassis size, which has the potential to be capital-intensive. The added production of the secondary heat exchanger could necessitate additional floor space and increased assembly and fabrication times.

DOE observed that the range of heating capacities offered at EL 1 do not cover the same range of capacities as noncondensing models. Condensing WGF models range from 60 to 96 kBtu/h, whereas noncondensing WGF models span capacities from 40 to 150 kBtu/h. DOE is concerned that amended standards for WGFs may limit capacity availability for consumers.

5. Summary

Based on the reasons stated in the foregoing discussion, DOE has determined that the energy conservation standards for oil, electric, and weatherized gas furnaces do not need to be amended.

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))

As explained elsewhere in this document, DOE has determined that amended energy conservation standards for electric furnaces are not technologically feasible. Oil-fired furnaces and WGFs have relatively small markets, and shipments of these products are expected to flatten or decline; manufacturers facing increased standards for these product categories may opt to focus on products with larger market shares, resulting in certain products or capacities becoming unavailable for consumers, as well as

further consolidation of the market. Consequently, DOE has determined that it is unable to conclude that amended standards for oil-fired furnaces and WGFs would be economically justified. Therefore, for these reasons as well as those discussed throughout this document, DOE is unable to conclude that amended standards for furnaces at any of the efficiency levels analyzed would meet the applicable statutory criteria.

## VI. Procedural Issues and Regulatory Review

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

Executive Order (''E.O.'') 12866, ''Regulatory Planning and Review,'' 58 FR 51735 (Oct. 4, 1993), 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 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 this preamble, this final regulatory action is consistent with these principles.

Section 6(a) of E.O. 12866 also requires agencies to submit ''significant regulatory actions'' to OIRA for review. OIRA has determined that this final regulatory action does not constitute a ''significant regulatory action'' under section 3(f) of E.O. 12866, as amended by E.O. 14094. 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'') and a final regulatory flexibility analysis (''FRFA'') for any rule that by law must be proposed for public comment, unless the agency certifies that the rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. As required by E.O. 13272, ''Proper Consideration of Small Entities in Agency Rulemaking,'' 67 FR 53461 (August 16, 2002), DOE published procedures and policies in the **Federal Register** on February 19, 2003, to ensure that the potential impacts of its rules on small entities are properly considered during the rulemaking process. 68 FR 7990. DOE has made its procedures and policies available on the Office of the General Counsel's website (*www.energy.gov/gc/office-general-counsel*).

DOE reviewed this final determination under the provisions of the Regulatory Flexibility Act and the policies and procedures published on February 19, 2003. Because DOE is not amending standards for oil, electric, and weatherized gas furnaces, the determination will not amend any energy conservation standards. On the basis of the foregoing, DOE certifies that the final determination will have no significant economic impact on a substantial number of small entities. Accordingly, DOE has not prepared an FRFA for this final determination. DOE has transmitted 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 of 1995*

This final determination, which concludes that no amended energy conservation standards for oil, electric, and weatherized gas furnaces are needed, imposes 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 has analyzed this final 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 has determined that this rule qualifies for categorical exclusion A4 because it is an interpretation or ruling in regard to an existing regulation and otherwise meets the requirements for application of a categorical exclusion. *See* 10 CFR 1021.410. Accordingly, neither an environmental assessment nor an environmental impact statement is required.

### *E. Review Under Executive Order 13132*

E.O. 13132, ''Federalism,'' 64 FR 43255 (August 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 final determination and has 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 final determination. 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,'' 61 FR 4729 (Feb. 7, 1996), 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. Regarding the review required by section 3(a), section 3(b) of E.O. 12988 specifically requires that Executive agencies make every reasonable effort to ensure that the regulation: (1) clearly specifies the preemptive effect, if any; (2) clearly specifies any effect on existing Federal law or regulation; (3) provides a clear legal standard for affected conduct while promoting simplification and burden reduction; (4) specifies the retroactive effect, if any; (5) adequately defines key terms, and (6) addresses other important issues affecting clarity and general draftsmanship under any guidelines issued by the Attorney General. Section 3(c) of E.O. 12988 requires Executive agencies to review regulations in light of applicable standards in section 3(a) and section 3(b) to determine whether they are met or it is unreasonable to meet one or more of them. DOE has completed the required review and determined that, to the extent permitted by law, this final 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 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)) UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal governments on a proposed ''significant intergovernmental mandate,'' and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect them. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. 62 FR 12820. DOE's policy statement is also available at: *www.energy.gov/sites/prod/files/gcprod/documents/umra_97.pdf.*

DOE examined this final determination according to UMRA and its statement of policy and determined that the final 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 proposed rule or policy that may affect family well-being. When developing a Family Policymaking Assessment, agencies must assess whether: (1) the action strengthens or erodes the stability or safety of the family and, particularly, the marital commitment; (2) the action strengthens or erodes the authority and rights of parents in the education, nurture, and supervision of their children; (3) the action helps the family perform its functions, or substitutes governmental activity for the function; (4) the action increases or decreases disposable income or poverty of families and children; (5) the proposed benefits of the action justify the financial impact on the family; (6) the action may be carried out by State or local government or by the family, and whether (7) the action establishes an implicit or explicit policy concerning the relationship between the behavior and personal responsibility of youth, and the norms of society. In evaluating the above factors, DOE has concluded that it is not necessary to prepare a Family Policymaking Assessment as none of the above factors are implicated. Further, this final determination would not have any financial impact on families nor any impact on the autonomy or integrity of the family as an institution.

*I. Review Under Executive Order 12630*

Pursuant to E.O. 12630, ''Governmental Actions and Interference with Constitutionally Protected Property Rights,'' 53 FR 8859 (March 18, 1988), DOE has determined that this final 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 final determination under the OMB and DOE guidelines and has concluded that it is consistent with applicable policies in those guidelines.

*K. Review Under Executive Order 13211*

E.O. 13211, ''Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use,'' 66 FR 28355 (May 22, 2001), requires Federal agencies to prepare and submit to OIRA at OMB a Statement of Energy Effects for any proposed significant energy action. A ''significant energy action'' is defined as any action by an agency that promulgates or is expected to lead to promulgation of a final rule, and that: (1) is a significant regulatory action under Executive Order 12866, or any successor order, and is likely to have a significant adverse effect on the supply, distribution, or use of energy; or (2) is designated by the Administrator of OIRA as a significant energy action. For any significant energy action, the agency must give a detailed statement of any adverse effects on energy supply, distribution, or use should the proposal be implemented, and of reasonable alternatives to the action and their expected benefits on energy supply, distribution, and use.

This final determination, which does not amend energy conservation standards for oil, electric, and weatherized gas furnaces, is not a significant regulatory action under E.O.

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. Therefore, it is not a significant energy action, and 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.[61] 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 (''NAS'') to review DOE's analytical methodologies to ascertain whether modifications are needed to improve DOE's analyses. DOE is in the process of evaluating the resulting December 2021 report.[62]

*M. Congressional Notification*

As required by 5 U.S.C. 801, DOE will report to Congress on the promulgation of this final determination prior to its effective date. The report will state that it has been determined that the final determination does not fall within the scope of 5 U.S.C. 804(2).

## VII. Approval of the Office of the Secretary

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

## Signing Authority

This document of the Department of Energy was signed on October 10, 2024, 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 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 October 10, 2024.

**Treena V. Garrett,**

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

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**BILLING CODE 6450–01–P**

[61] ''Energy Conservation Standards Rulemaking Peer Review Report'' (2007) (Available at: *www.energy.gov/eere/buildings/downloads/energy-conservation-standards-rulemaking-peer-review-report-0*) (last accessed June 28, 2024).

[62] The December 2021 NAS report is available at *www.nationalacademies.org/our-work/review-of-methods-for-setting-building-and-equipment-performance-standards* (Last accessed July 24, 2024).