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**[6450-01-P]**

**DEPARTMENT OF ENERGY**

**10 CFR Part 430**

**[Docket Number EERE–2014–BT–STD–0005]**

**RIN: 1904–AD15**

# Energy Conservation Program: Energy Conservation Standards for Residential Conventional Ovens

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

**ACTION:** Notice of proposed rulemaking (NOPR) and public meeting.

**SUMMARY:** The Energy Policy and Conservation Act of 1975 (EPCA), as amended, prescribes energy conservation standards for various consumer products and certain commercial and industrial equipment, including residential conventional ovens**.** EPCA also requires the U.S. Department of Energy (DOE) to determine whether more-stringent, amended standards would be technologically feasible and economically justified, and would save a significant amount of energy. In this notice, DOE proposes new and amended energy conservation standards for residential conventional ovens. The notice also announces a public meeting to receive comment on these proposed standards and associated analyses and results.

**DATES:** DOE will hold a public meeting on Tuesday, July 14, 2015, from 9 a.m. to 4 p.m., in Washington, DC. The meeting will also be broadcast as a webinar. See section VII Public Participation for webinar registration information, participant instructions, and information about the capabilities available to webinar participants.

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

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

Any comments submitted must identify the NOPR for Energy Conservation Standards for residential conventional cooking products, and provide docket number EE-2014–BT–STD–0005 and/or regulatory information number (RIN) number 1904-AD15. Comments may be submitted using any of the following methods:

1. Federal eRulemaking Portal: www.regulations.gov. Follow the instructions for submitting comments.

2. E-mail: ConventionalCookingProducts2014STD0005@ee.doe.gov. Include the docket number and/or RIN in the subject line of the message.

3. Mail: Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Program, Mailstop EE-2J, 1000 Independence Avenue, SW., Washington, DC, 20585-0121. If possible, please submit all items on a CD. It is not necessary to include printed copies.

4. Hand Delivery/Courier: Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Program, 950 L'Enfant Plaza, SW., Suite 600, Washington, DC, 20024. Telephone: (202) 586-2945. If possible, please submit all items on a CD, in which case it is not necessary to include printed copies.

Written comments regarding the burden-hour estimates or other aspects of the collection-of-information requirements contained in this proposed rule may be submitted to Office of Energy Efficiency and Renewable Energy through the methods listed above and by e-mail to Chad_S_Whiteman@omb.eop.gov.

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

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

A link to the docket web page can be found at: http://www.regulations.gov/#!docketDetail;D=EERE-2014-BT-STD-0005. This web page will contain a link to the docket for this notice on the regulations.gov site. The regulations.gov web page will contain simple instructions on how to access all documents, including public comments, in the docket. See section VII for further information on how to submit comments through www.regulations.gov.

For further information on how to submit a comment, review other public comments and the docket, or participate in the public meeting, contact Ms. Brenda Edwards at (202) 586-2945 or by email: Brenda.Edwards@ee.doe.gov.

**FOR FURTHER INFORMATION CONTACT:**

Mr. John Cymbalsky, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Program, EE-2J, 1000 Independence Avenue, SW., Washington, DC, 20585-0121. Telephone: (202) 287-1692. E-mail: kitchen_ranges_and_ovens@ee.doe.gov.

Ms. Celia Sher, U.S. Department of Energy, Office of the General Counsel, GC-33, 1000 Independence Avenue, SW., Washington, DC, 20585-0121. Telephone: (202) 287-6122. E-mail: Celia.Sher@hq.doe.gov.

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## I. Synopsis of the Proposed Rule

Title III, Part B[1] of the Energy Policy and Conservation Act of 1975 (EPCA or the Act), Pub. L. 94-163 (42 U.S.C. 6291-6309, as codified), established the Energy Conservation Program for Consumer Products Other Than Automobiles.[2] These products include residential conventional ovens, the subject of this rulemaking.

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

Pursuant to EPCA, any new or amended energy conservation standard must be designed to achieve the maximum improvement in energy efficiency that is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A)) Furthermore, the new or amended standard must result in a significant conservation of energy. (42 U.S.C. 6295(o)(3)(B)) In accordance with these and other statutory provisions discussed in this notice, DOE proposes new and amended energy conservation standards for residential conventional ovens. The proposed standards, which are the maximum allowable integrated annual energy consumption (IAEC), are shown in Table I-1. The integrated annual energy consumption includes active mode (including fan-only mode for conventional ovens), standby mode, and off mode energy use. These proposed standards, if adopted, would apply to all products listed in Table I-1 and manufactured in, or imported into, the United States on or after the date three years after the publication of any final rule for this rulemaking. The proposed standards correspond to trial standard level (TSL) 2, which is described in section V.A. DOE also notes that any newly adopted performance standards for conventional ovens resulting from this current rulemaking would not affect the current prescriptive standards prohibiting constant burning pilots for all gas cooking products (10 CFR 430.32(j)).

**Table I -1. Proposed Energy Conservation Standards for Conventional Ovens**

| Product Class | Maximum Integrated Annual Energy Consumption (IAEC) |
|---|---|
| Electric Standard Oven, Free-standing | 122.5 + (31.8 × Rated Cavity Volume in cubic feet) kWh/yr |
| Electric Standard Oven, Built-In/Slide-In | 128.6 + (31.8 × Rated Cavity Volume in cubic feet) kWh/yr |
| Electric Self-Clean Oven, Free-Standing | 163.2 + (42.3 × Rated Cavity Volume in cubic feet) kWh/yr |
| Electric Self-Clean Oven, Built-In/Slide-In | 169.1 + (42.3 × Rated Cavity Volume in cubic feet) kWh/yr |
| Gas Standard Oven, Free-Standing | 492.9 + (214.4 × Rated Cavity Volume in cubic feet) kWh/yr |
| Gas Standard Oven, Built-In/Slide-In | 499.5 + (214.4 × Rated Cavity Volume in cubic feet) kWh/yr |
| Gas Self-Clean Oven, Free-Standing | 746.7 + (214.4 × Rated Cavity Volume in cubic feet) kWh/yr |
| Gas Self-Clean Oven, Built-In/Slide-In | 755.5 + (214.4 × Rated Cavity Volume in cubic feet) kWh/yr |

**Note**: The Rated Cavity Volume is the volume of the oven cavity in cubic feet as measured using the final DOE test procedure at 10 CFR part 430, subpart B, appendix I.

As discussed in section III.B, DOE has decided to defer its decision regarding whether to adopt amended energy conservation standards for conventional cooking tops, pending further rulemaking. In both the test procedure NOPR published on January 30, 2013 (78 FR 6232, the January 2013 TP NOPR) and the test procedure supplemental NOPR (SNOPR) published on December 3, 2014 (79 FR 71894, the December 2014 TP SNOPR), DOE proposed amendments to the cooking products test procedure in Appendix I to subpart B of Title 10 of the CFR part 430 that would allow for the testing of active mode energy consumption of induction cooking tops. After reviewing public comments on the December 2014 TP SNOPR, conducting interviews with manufacturers, and performing additional analyses, DOE believes further study is required before a cooking top test procedure can be established that produces test results which measure energy use during a representative average use cycle, is repeatable and reproducible, and is not unduly burdensome to conduct. For these reasons, this NOPR is limited to addressing energy conservation standards for conventional ovens. As discussed in section III.A, the proposed standards would cover conventional ovens, including conventional ovens that are a part of conventional ranges. DOE intends to complete the rulemaking process for conventional cooking tops once additional key data and information become available.

## A. Benefits and Costs to Consumers

Table I-2 presents DOE's evaluation of the economic impacts of the proposed standards on consumers of residential conventional ovens, as measured by the average life-cycle cost (LCC) savings and the simple payback period (PBP).[3] The average LCC savings are positive for all product classes, and the PBP is less than the average lifetime of the equipment, which is estimated to be 15 years for electric and 17 years for gas ovens.

**Table I-2. Impacts of Proposed Energy Conservation Standards (TSL 2) on Consumers of Residential Conventional Ovens**

| Product Class | Average LCC Savings* (2014$) | Simple Payback Period (years) |
|---|---|---|

[3] The average LCC savings are measured relative to the base-case efficiency distribution, which depicts the market in the compliance year (see section IV.F.9). The simple PBP, which is designed to compare specific efficiency levels, is measured relative to the baseline model.

| | | |
|---|---|---|
| Electric Standard Oven, Free-standing | $15.18 | 4.0 |
| Electric Standard Oven, Built-in/Slide-in | $15.25 | 4.0 |
| Electric Self-Clean Oven, Free-Standing | $14.10 | 0.9 |
| Electric Self-Clean Oven, Built-in/Slide-in | $14.20 | 0.9 |
| Gas Standard Oven, Free-Standing | $289.73 | 1.7 |
| Gas Standard Oven, Built-in/Slide-in | $289.77 | 1.7 |
| Gas Self-Clean Oven, Free-Standing | $282.80 | 1.2 |
| Gas Self-Clean Oven, Built-In/Slide-in | $282.85 | 1.2 |

*Calculation does not include households with zero LCC savings (no impact)

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

B. Impact on Manufacturers

The industry net present value (INPV) is the sum of the discounted cash flows to the industry from the base year through the end of the analysis period (2015 to 2048). Using a real discount rate of 9.1 percent, DOE estimates that the industry net present value (INPV) for manufacturers of residential conventional ovens is $783.5 million in 2014$. Under the proposed standards, DOE expects that manufacturers may lose up to 11.0 percent of their INPV, which is approximately $86.4 million in 2014$. Additionally, based on DOE's interviews with the manufacturers of residential conventional ovens, DOE does not expect any plant closings or significant loss of employment.

DOE's analysis of the impacts of the proposed standards on manufacturers is described in section IV.J of this NOPR notice.

## C. National Benefits and Costs[4]

DOE's analyses indicate that the proposed standards would save a significant amount of energy. The lifetime energy savings from residential conventional oven products purchased in the 30-year period that begins in the assumed year of compliance with the proposed standards (2019–2048), relative to the base case without the proposed standards, amount to 0.71 quadrillion Btu (quads).[5] This represents a savings of 11.2 percent relative to the energy use of these products in the base case.

The cumulative net present value (NPV) of total consumer costs and savings of the proposed standards for ovens in residential conventional cooking products ranges from $4.7 billion (at a 7-percent discount rate) to $11.0 billion (at a 3-percent discount rate). This NPV expresses the estimated total value of future operating-cost savings minus the estimated increased product costs for products purchased in 2019–2048.

In addition, the proposed standards would have significant environmental benefits. The energy savings described above are estimated to result in cumulative

[4] All monetary values in this section are expressed in 2013 dollars and, where appropriate, are discounted to 2014.

[5] A quad is equal to $10^{15}$ British thermal units (Btu). The quantity refers to full-fuel-cycle (FFC) energy savings. FFC energy savings includes the energy consumed in extracting, processing, and transporting primary fuels (i.e., coal, natural gas, petroleum fuels), and thus presents a more complete picture of the impacts of energy efficiency standards. For more information on the FFC metric, see section IV.H.2.
A quad is equal to $10^{15}$ British thermal units (Btu).

emission reductions of 41.1 million metric tons (Mt)[6] of carbon dioxide ($CO_2$), 221.2 thousand tons of methane, 29.5 thousand tons of sulfur dioxide ($SO_2$), 69 thousand tons of nitrogen oxides ($NO_X$), 0.52 thousand tons of nitrous oxide ($N_2O$), and 0.09 tons of mercury (Hg).[7] The cumulative reduction in $CO_2$ emissions through 2030 amounts to 7.5 Mt, which is equivalent to the emissions resulting from the annual electricity use of 0.7 million homes.

The value of the $CO_2$ reductions is calculated using a range of values per metric ton of $CO_2$ (otherwise known as the Social Cost of Carbon, or SCC) developed by a recent Federal interagency process.[8] The derivation of the SCC values is discussed in section IV.L. Using discount rates appropriate for each set of SCC values (see Table I-4), DOE estimates the present monetary value of the $CO_2$ emissions reduction is between $0.3 billion and $4.1 billion, with a value of $1.3 billion using the central SCC case represented by $41.2/t in 2015.[9] DOE also estimates the present monetary value of the $NO_X$ emissions reduction, is $0.1 billion at a 7-percent discount rate and $0.2 billion at a 3-percent discount rate.[10]

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

[7] DOE calculated emissions reductions relative to the Annual Energy Outlook 2014 (AEO 2014) Reference case, which generally represents current legislation and environmental regulations for which implementing regulations were available as of October 31, 2013.

[8] Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. Interagency Working Group on Social Cost of Carbon, United States Government. May 2013; revised November 2013. http://www.whitehouse.gov/sites/default/files/omb/assets/inforeg/technical-update-social-cost-of-carbon-for-regulator-impact-analysis.pdf.

[9] The values only include $CO_2$ emissions, not $CO_2$ equivalent emissions; other gases with global warming potential are not included.

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

Table I-3 summarizes the national economic costs and benefits expected to result from the proposed standards for residential conventional ovens.

**Table I-3. Summary of National Economic Benefits and Costs of Proposed Energy Conservation Standards for Residential Conventional Ovens***

| Category | Present Value Billion 2014$ | Discount Rate |
|---|---|---|
| **Benefits** | | |
| Operating Cost Savings | 5.0 | 7% |
| | 11.6 | 3% |
| $CO_2$ Reduction Monetized Value ($12.2.0/t case)** | 0.3 | 5% |
| $CO_2$ Reduction Monetized Value ($41.2/t case)** | 1.3 | 3% |
| $CO_2$ Reduction Monetized Value ($63.4/t case)** | 2.1 | 2.5% |
| $CO_2$ Reduction Monetized Value ($121/t case)** | 4.1 | 3% |
| $NO_X$ Reduction Monetized Value† | 0.1 | 7% |
| | 0.2 | 3% |
| Total Benefits†† | 6.4 | 7% |
| | 13.2 | 3% |
| **Costs** | | |
| Incremental Installed Costs | 0.3 | 7% |
| | 0.6 | 3% |
| **Total Net Benefits** | | |
| Including Emissions Reduction Monetized Value†† | 6.1 | 7% |
| | 12.6 | 3% |

* This table presents the costs and benefits associated with residential conventional ovens shipped in 2019−2048. These results include impacts to consumers which accrue after 2048 from the products purchased in 2019−2048. The results account for the incremental variable and fixed costs incurred by manufacturers due to any final standard, some of which may be incurred in preparation for the rule.

** The $CO_2$ values represent global monetized values of the SCC, in 2014$, in 2015 under several scenarios of the updated SCC values. The first three cases use the averages of SCC distributions calculated using 5%, 3%, and 2.5% discount rates, respectively. The fourth case represents the 95$^{th}$ percentile of the SCC distribution calculated using a 3% discount rate. The SCC time series incorporate an escalation factor.

† The $/ton values used for $NO_X$ are described in section IV.L.2.

†† Total Benefits for both the 3% and 7% cases are derived using the series corresponding to average SCC with 3-percent discount rate ($40.5/t case).

The benefits and costs of these proposed standards, for products sold in 2019-2048, can also be expressed in terms of annualized values. The annualized monetary values are the sum of (1) the annualized national economic value of the benefits from consumer operation of products that meet the new or amended standards (consisting primarily of operating cost savings from using less energy, minus increases in equipment purchase and installation costs, which is another way of representing consumer NPV), and (2) the annualized monetary value of the benefits of emission reductions, including $CO_2$ emission reductions.[11]

Although DOE believes that the values of operating savings and $CO_2$ emission reductions are both important, two issues are relevant. First, the national operating savings are domestic U.S. consumer monetary savings that occur as a result of market transactions, whereas the value of $CO_2$ reductions is based on a global value. Second, the assessments of operating cost savings and $CO_2$ savings are performed with different methods that use different time frames for analysis. The national operating cost savings is measured for the lifetime of residential conventional ovens shipped in 2019–2048. Because $CO_2$ emissions have a very long residence time in the atmosphere,[12] the SCC

[11] To convert the time-series of costs and benefits into annualized values, DOE calculated a present value in 2014, the year used for discounting the NPV of total consumer costs and savings. For the benefits, DOE calculated a present value associated with each year's shipments in the year in which the shipments occur (e.g., 2020 or 2030), and then discounted the present value from each year to 2014. The calculation uses discount rates of 3 and 7 percent for all costs and benefits except for the value of $CO_2$ reductions, for which DOE used case-specific discount rates, as shown in Table I.3. Using the present value, DOE then calculated the fixed annual payment over a 30-year period, starting in the compliance year that yields the same present value.

[12] The atmospheric lifetime of $CO_2$ is estimated of the order of 30–95 years. Jacobson, MZ (2005). "Correction to "Control of fossil-fuel particulate black carbon and organic matter, possibly the most effective method of slowing global warming."" J. Geophys. Res. 110. pp. D14105.

values in future years reflect future climate-related impacts resulting from the emission of $CO_2$ that continue well beyond 2100.

Estimates of annualized benefits and costs of the proposed standards are shown in Table I-4. The results under the primary estimate are as follows. Using a 7-percent discount rate for benefits and costs other than $CO_2$ reduction, for which DOE used a 3-percent discount rate along with the average SCC series that has a value of $41.2/t in 2015, the cost of the proposed standards is $33.5 million per year in increased equipment costs, while the benefits are $494 million per year in reduced equipment operating costs, $74 million in $CO_2$ reductions, and $9 million in reduced $NO_X$ emissions. In this case, the net benefit amounts to $543 million per year. Using a 3-percent discount rate for all benefits and costs and the average SCC series that has a value of $41.2/t in 2015, the cost of the proposed standards is $33.1 million per year in increased equipment costs, while the benefits are $648 million per year in reduced operating costs, $74 million in $CO_2$ reductions, and $13 million in reduced $NO_X$ emissions. In this case, the net benefit amounts to $701 million per year.

**Table I-4. Annualized Benefits and Costs of Proposed Energy Conservation Standards for Residential Conventional Ovens**

| | **Discount Rate** | **Primary Estimate*** | **Low Net Benefits Estimate*** | **High Net Benefits Estimate*** |
|---|---|---|---|---|
| | | **million 2014$/year** | | |
| **Benefits** | | | | |
| Operating Cost Savings | 7% | 494 | 457 | 542 |
| | 3% | 648 | 593 | 719 |
| $CO_2$ Reduction Monetized Value ($12.2/t case)* | 5% | 21 | 20 | 24 |
| $CO_2$ Reduction Monetized Value ($41.2/t case)* | 3% | 74 | 68 | 81 |
| $CO_2$ Reduction Monetized Value ($63.4/t case)* | 2.5% | 108 | 100 | 119 |
| $CO_2$ Reduction Monetized Value ($121/t case)* | 3% | 228 | 211 | 252 |
| $NO_X$ Reduction Monetized Value† | 7% | 9.24 | 8.66 | 10.11 |
| | 3% | 13.43 | 12.46 | 14.80 |
| Total Benefits†† | 7% plus $CO_2$ range | 524 to 731 | 485 to 677 | 576 to 804 |
| | 7% | 577 | 534 | 634 |
| | 3% plus $CO_2$ range | 682 to 889 | 625 to 817 | 758 to 986 |
| | 3% | 734 | 674 | 815 |
| **Costs** | | | | |
| Consumer Incremental Product Costs | 7% | 34 | 34 | 33 |
| | 3% | 33 | 34 | 33 |
| **Net Benefits** | | | | |
| Total†† | 7% plus $CO_2$ range | 491 to 697 | 451 to 642 | 543 to 771 |
| | 7% | 543 | 499 | 601 |
| | 3% plus $CO_2$ range | 649 to 856 | 592 to 783 | 725 to 953 |
| | 3% | 701 | 640 | 783 |

* This table presents the annualized costs and benefits associated with residential conventional ovens shipped in 2019−2048. These results include benefits to consumers which accrue after 2048 from the products purchased in 2014−2043. The results account for the incremental variable and fixed costs incurred by manufacturers due to any final standard, some of which may be incurred in preparation for the rule. The Primary, Low Benefits, and High Benefits Estimates utilize projections of energy prices from the AEO 2015[13] Reference case, Low Estimate, and High Estimate, respectively. In addition, incremental product costs reflect a medium decline rate in the Primary Estimate, a low decline rate in the Low Benefits Estimate, and a high decline rate f in the High Benefits Estimate. The methods used to derive projected price trends are explained in section IV.F.1.

** The $CO_2$ values represent global monetized values of the SCC, in 2014$, in 2015 under several scenarios of the updated SCC values. The first three cases use the averages of SCC distributions calculated using 5%, 3%, and 2.5% discount rates, respectively. The fourth case represents the $95^{th}$ percentile of the SCC distribution calculated using a 3% discount rate. The SCC time series incorporate an escalation factor.

† The $/ton values used for $NO_X$ are described in section IV.L.2.

†† Total Benefits for both the 3% and 7% cases are derived using the series corresponding to the average SCC with 3-percent discount rate ($41.2/t case). In the rows labeled "7% plus $CO_2$ range" and "3% plus $CO_2$ range," the operating cost and $NO_X$ benefits are calculated using the labeled discount rate, and those values are added to the full range of $CO_2$ values.

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

## D. Conclusion

DOE has tentatively concluded that the proposed standards represent the maximum improvement in energy efficiency that is technologically feasible and economically justified, and would result in the significant conservation of energy. DOE further notes that products achieving these standard levels are already commercially available for at least some, if not most, product classes covered by this proposal. Based on the analyses described above, DOE has tentatively concluded that the benefits of the proposed standards to the Nation (energy savings, positive NPV of consumer benefits,

[13] http://www.eia.gov/forecasts/AEO/

consumer LCC savings, and emission reductions) would outweigh the burdens (loss of INPV for manufacturers and LCC increases for some consumers).

DOE also considered more-stringent energy efficiency levels as trial standard levels, and is considering them in this rulemaking. However, DOE has tentatively concluded that the potential burdens of the more-stringent energy efficiency levels would outweigh the projected benefits. Based on consideration of the public comments DOE receives in response to this notice and related information collected and analyzed during the course of this rulemaking effort, DOE may adopt energy efficiency levels presented in this notice that are either higher or lower than the proposed standards, or some combination of level(s) that incorporate the proposed standards in part.

## II. Introduction

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

### A. Authority

Title III, Part B of the Energy Policy and Conservation Act of 1975 (EPCA or the Act), Pub. L. 94-163 (42 U.S.C. 6291-6309, as codified) established the Energy Conservation Program for Consumer Products Other Than Automobiles, a program covering most major household appliances (collectively referred to as "covered products”), which includes residential cooking products[14], and specifically residential conventional ovens, that are the subject of this rulemaking. (42 U.S.C. 6292(a)(10)) EPCA prescribed energy conservation standards for these products (42 U.S.C. 6295(h)(1)), and directed DOE to conduct rulemakings to determine whether to amend these standards. (42 U.S.C. 6295(h)(2)) (DOE notes that under 42 U.S.C. 6295(m), the agency must periodically review its already established energy conservation standards for a covered product. Under this requirement, the next review that DOE would need to conduct must occur no later than six years from the issuance of a final rule establishing or amending a standard for a covered product.)

Pursuant to EPCA, DOE’s energy conservation program for covered products consists essentially of four parts: (1) testing; (2) labeling; (3) the establishment of Federal energy conservation standards; and (4) certification and enforcement procedures. The Federal Trade Commission (FTC) is primarily responsible for labeling, and DOE implements the remainder of the program. 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. 6293) Manufacturers of covered products must use the prescribed DOE test procedure as the basis for certifying to DOE that their products comply with the applicable energy conservation standards adopted under EPCA and when making representations to the public regarding

[14] DOE’s regulations define kitchen ranges and ovens, or “cooking products”, as one of the following classes: conventional ranges, conventional cooking tops, conventional ovens, microwave ovens, microwave/conventional ranges and other cooking products. (10 CFR 430.2) Based on this definition, in this notice, DOE interprets kitchen ranges and ovens to refer more generally to all types of cooking products including, for example, microwave ovens.

the energy use or efficiency of those products. (42 U.S.C. 6293(c) and 6295(s)) Similarly, DOE must use these test procedures to determine whether the products comply with standards adopted pursuant to EPCA. Id. The DOE test procedures for residential conventional cooking products currently appear at title 10 of the Code of Federal Regulations (CFR) part 430, subpart B, appendix I (Appendix I).

DOE must follow specific statutory criteria for prescribing new or amended standards for covered products. As indicated above, any new or amended standard for a covered product must be designed to achieve the maximum improvement in energy efficiency that is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A)) Furthermore, DOE may not adopt any standard that would not result in the significant conservation of energy. (42 U.S.C. 6295(o)(3)) Moreover, DOE may not prescribe a standard: (1) for certain products, including residential conventional ovens, if no test procedure has been established for the product, or (2) if DOE determines by rule that the standard is not technologically feasible or economically justified. (42 U.S.C. 6295(o)(3)(A)–(B)) In deciding whether a standard is economically justified, DOE must determine whether the benefits of the standard exceed its burdens. (42 U.S.C. 6295(o)(2)(B)(i)) DOE must make this determination after receiving comments on the proposed standard, and by considering, to the greatest extent practicable, the following seven statutory factors:

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

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

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

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

6. The need for national energy and water conservation; and

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

EPCA, as codified, also contains what is known as an “anti-backsliding” provision, which prevents the Secretary from prescribing any amended standard that either increases the maximum allowable energy use or decreases the minimum required energy efficiency of a covered product. (42 U.S.C. 6295(o)(1)) Also, the Secretary may not prescribe an amended or new standard if interested persons have established by a preponderance of the evidence that the standard is likely to result in the unavailability in the United States of any covered product type (or class) of performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially the same as those generally available in the United States. (42 U.S.C. 6295(o)(4))

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

Additionally, 42 U.S.C. 6295(q)(1) specifies requirements when promulgating a standard for a type or class of covered product that has two or more subcategories. DOE must specify a different standard level than that which applies generally to such type or class of products for any group of covered products that have the same function or intended use if DOE determines that products within such group (A) consume a different kind of energy from that consumed by other covered products within such type (or class); or (B) have a capacity or other performance-related feature which other products within such type (or class) do not have and such feature justifies a higher or lower standard. (42 U.S.C. 6294(q)(1)) In determining whether a performance-related feature justifies a different standard for a group of products, DOE must consider such factors as the utility to the consumer of the feature and other factors DOE deems appropriate. Id. Any rule prescribing such a standard must include an explanation of the basis on which such higher or lower level was established. (42 U.S.C. 6295(q)(2))

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

Finally, pursuant to the amendments contained in section 310(3) of EISA 2007, any final rule for new or amended energy conservation standards promulgated after July 1, 2010, are 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 the standard, or, if that is not feasible, adopt a separate standard for such energy use for that product. (42 U.S.C. 6295(gg)(3)(A)–(B)) DOE's current test procedures for residential conventional cooking products address standby mode and off mode energy use. In this rulemaking, DOE intends to incorporate such energy use into any amended energy conservation standards it adopts in the final rule.

DOE has also reviewed this proposed regulation pursuant to Executive Order 13563. 76 FR 3281 (Jan. 21, 2011). EO 13563 is supplemental to and explicitly reaffirms the principles, structures, and definitions governing regulatory review established in Executive Order 12866. To the extent permitted by law, agencies are required by Executive Order 13563 to: (1) propose or adopt a regulation only upon a reasoned determination that its benefits justify its costs (recognizing that some benefits and costs are difficult to quantify); (2) tailor regulations to impose the least burden on society, consistent with obtaining regulatory objectives, taking into account, among other things, and to the extent practicable, the costs of cumulative regulations; (3) select, in choosing among alternative regulatory approaches, those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity); (4) to the extent feasible, specify performance objectives, rather than specifying the behavior or manner of compliance that regulated entities must adopt; and (5) identify and assess available alternatives to direct regulation, including providing economic incentives to encourage the desired behavior, such as user fees or marketable permits, or providing information upon which choices can be made by the public.

DOE emphasizes as well that Executive Order 13563 requires agencies to use the best available techniques to quantify anticipated present and future benefits and costs as accurately as possible. In its guidance, the Office of Information and Regulatory Affairs has emphasized that such techniques may include identifying changing future compliance costs that might result from technological innovation or anticipated behavioral changes. For the reasons stated in the preamble, DOE believes that the NOPR is consistent with these principles, including the requirement that, to the extent permitted by law, benefits justify costs and that net benefits are maximized. Consistent with EO 13563, and the range of impacts analyzed in this rulemaking, the energy efficiency standards proposed herein by DOE achieve maximum net benefits. For further discussion of how this NOPR achieves maximum net benefits, see section V.

## B. Background

### 1. Current Standards

In a final rule published on April 8, 2009 (April 2009 Final Rule), DOE prescribed the current energy conservation standards for residential cooking products to prohibit constant burning pilots for all gas cooking products (i.e., gas cooking products both with or without an electrical supply cord) manufactured on or after April 9, 2012. 74 FR 16040, 16041–16044. DOE's regulations, codified at 10 CFR 430.2, define conventional cooking tops, conventional ovens, and conventional ranges as classes of cooking products. As noted in the April 2009 Final Rule, DOE considered standards for conventional cooking tops and conventional ovens separately, and noted that any cooking top or oven standard would apply to the individual components of the conventional range. 74 FR 16040, 16053.

Based on DOE’s review of gas cooking products available on the market in the United States, DOE notes that there may be confusion regarding how the current standards apply to different pilot ignition systems. Specifically, DOE is aware of a gas range that is designed to heat and cook food based on the principle of heat storage. A low input rate burner continuously heats the cooking top surface and cast iron oven cavities, and maintains these components at a constant temperature. A secondary “pilot burner” is used to ignite the main burner and this pilot remains lit between cooking cycles as well as when the main burner is shut off for short periods of non-use. Although the secondary pilot may provide additional heating to the body of the range, its primary function is to ignite the main burner, and would thus be considered a constant burning pilot because it is a continuous gas flame used to ignite the gas at the main burner. It is the main burner that provides the primary source of heat for the cooking function of the range.

In this NOPR, DOE is clarifying that a constant burning pilot in conventional cooking products is considered to be a continuous gas flame having the primary purpose to ignite the gas at the burner(s) that is (are) used to heat or cook food and which remains lit between cooking cycles. The design and configuration, including whether it incorporates any air premixing or whether it has a secondary heating function, does not exclude the device from consideration as constant burning pilot.

DOE also notes that any newly adopted performance standards for conventional cooking products resulting from this current rulemaking would not affect the current prescriptive standards prohibiting constant burning pilots for all gas cooking products.

2. History of Standards Rulemaking for Residential Conventional Cooking Products

The National Appliance Energy Conservation Act of 1987 (NAECA), Pub. L. No. 100-12, amended EPCA to establish prescriptive standards for gas cooking products, requiring gas ranges and ovens with an electrical supply cord that are manufactured on or after January 1, 1990, not to be equipped with a constant burning pilot light. NAECA also directed DOE to conduct two cycles of rulemakings to determine if more stringent or additional standards were justified for kitchen ranges and ovens. (42 U.S.C. 6295 (h)(1)–(2))

DOE undertook the first cycle of these rulemakings and published a final rule on September 8, 1998, which found that no standards were justified for conventional electric cooking products at that time. In addition, partially due to the difficulty of conclusively demonstrating that elimination of standing pilots for conventional gas cooking products without an electrical supply cord was economically justified, DOE did not include amended standards for conventional gas cooking products in the final rule. 63 FR 48038. For the second cycle of rulemakings, DOE published the April 2009 Final Rule amending the energy conservation standards for conventional cooking products to prohibit constant burning pilots for all gas cooking products (i.e., gas cooking products both with or without an electrical supply cord) manufactured on or after April 9, 2012. DOE decided to not adopt energy conservation standards pertaining to the cooking efficiency of conventional electric cooking products because it determined that such standards would not be technologically feasible and economically justified at that time. 74 FR 16040, 16041–16044.[15]

EPCA also requires that, not later than 6 years after the issuance of a final rule establishing or amending a standard, DOE publish a NOPR proposing new standards or a notice of determination that the existing standards do not need to be amended. (42 U.S.C.

[15] As part of the April 2009 Final Rule, DOE decided not to adopt energy conservation standards pertaining to the cooking efficiency of microwave ovens. DOE also published a final rule on June 17, 2013 adopting energy conservation standards for microwave oven standby mode and off mode. 78 FR 36316. DOE is not considering energy conservation standards for microwave ovens as part of this rulemaking.

6295(m)(1)) Based on this provision, DOE must publish by March 31, 2015, either a NOPR proposing new standards for conventional electric cooking products and/or amended standards for conventional gas cooking products[16] or a notice of determination that the existing standards do not need to be amended.

On February 12, 2014, DOE published a request for information (RFI) notice (the February 2014 RFI) to initiate the mandatory review process imposed by EPCA. As part of the RFI, DOE sought input from the public to assist with its determination on whether new or amended standards pertaining to conventional cooking products are warranted. 79 FR 8337. In making this determination, DOE must evaluate whether new or amended standards would (1) yield a significant savings in energy use and (2) be both technologically feasible and economically justified. (42 U.S.C. 6295(o)(3)(B))

## III. General Discussion

### A. Scope of Coverage

As discussed in section II.A, 6292(a)(10) of EPCA covers kitchen ranges and ovens, or "cooking products." DOE's regulations define "cooking products" as consumer products that are used as the major household cooking appliances. They are designed to cook or heat different types of food by one or more of the following sources of heat: gas, electricity, or microwave energy. Each product may consist of a horizontal cooking top

[16] As discussed in section III.A, DOE is also tentatively planning to consider new energy conservation standards for gas cooking products with higher burner input rates, which were previously excluded from standards.

containing one or more surface units[17] and/or one or more heating compartments. They must be one of the following classes: conventional ranges, conventional cooking tops, conventional ovens, microwave ovens, microwave/conventional ranges and other cooking products. (10 CFR 430.2) In this NOPR, DOE is considering energy conservation standards for certain residential conventional cooking products, namely, conventional ovens.

DOE notes that conventional ranges are defined in 10 CFR 430.2 as a class of kitchen ranges and ovens which is a household cooking appliance, consisting of a conventional cooking top and one or more conventional ovens. In this rulemaking, DOE is not considering gas and electric conventional ranges as a distinct product category and is not basing its product classes on that category. Instead, DOE plans to consider energy conservation standards for conventional cooking tops and conventional ovens separately. Because ranges consist of both a cooking top and oven, any potential cooking top or oven standards would apply to the individual components of the range. DOE invites comment on its proposal to develop two distinct component standards under separate timetables, and whether issues of product design and development, consumer utility, and more broadly, cumulative regulatory burden concerns that could arise as a result of its proposal (see sections IV.J and VII.E). DOE anticipates issuing a NOPR for energy conservation standards for cooktops in the next year. In this NOPR, DOE is proposing to clarify in the definitions of conventional cooking tops and conventional ovens, in 10 CFR 430.2, that these include the individual cooking top or oven portion of a conventional range.

[17] The term surface unit refers to burners for gas cooking tops, electric resistance heating elements for electric cooking tops, and inductive heating elements for induction cooking tops.

As part of the most recent standards rulemaking for conventional cooking products, DOE decided to exclude residential conventional gas cooking products with higher burner input rates, including products marketed as “commercial-style” or “professional-style,” from consideration of energy conservation standards due to a lack of available data for determining efficiency characteristics of those products. DOE considers these products to be gas cooking tops with burner input rates greater than 14,000 British thermal units (Btu)/hour (h) and gas ovens with burner input rates greater than 22,500 Btu/h. 74 FR 16040, 16054 (Apr. 8, 2009); 72 FR 64432, 64444–64445 (Nov. 15, 2007). DOE also stated that the current DOE cooking products test procedures may not adequately measure performance of gas cooking tops and ovens with higher burner input rates. 72 FR 64432, 64444–64445 (Nov. 15, 2007).

As part of the February 2014 RFI, DOE stated that it tentatively planned to consider energy conservation standards for all residential conventional cooking products, including gas cooking products with higher burner input rates. In addition, DOE stated that it may consider developing test procedures for these products and determine whether separate product classes are warranted. 79 FR 8337, 8340 (Feb. 12, 2014).

The Association of Home Appliance Manufacturers (AHAM) and Whirlpool Corporation (Whirlpool) commented that because there is no test procedure to test commercial-style products, they cannot effectively comment on how these products should be treated in a standards rulemaking, nor can DOE effectively evaluate their energy use. (AHAM, STD No. 9 at p. 2[18]; Whirlpool, STD No. 13 at p. 2) AHAM added that nothing has changed since DOE determined in the April 2009 Final Rule that it lacks efficiency data to determine whether commercial-style cooking products should be excluded from the rulemaking, and thus, DOE cannot make a tentative conclusion to consider energy conservation standards for commercial-style products. (AHAM, STD No. 9 at pp. 2–3) In response to the December 2014 TP SNOPR, Sub Zero Group, Inc. (Sub Zero) stated that DOE's conclusion that the existing test procedure in Appendix I should be used to test ovens with high input rates is incorrect. Sub Zero commented that, due to the lack of data, complexity, and small potential for energy savings, DOE should exempt commercial-style or "high performance" products from coverage. (Sub Zero, TP No. 20 at p. 3[19])

Pacific Gas and Electric Company (PG&E), Southern California Gas Company (SCGC), San Diego Gas and Electric (SDG&E), and Southern California Edison (SCE) (collectively, the California investor-owned utilities (IOUs)) supported DOE's decision to consider standards for professional-style gas cooking products and commented that DOE should refer to American National Standards Institute (ANSI) Standard Z83.11-2006/CSA Standard 1.8-2006 (R2011), "Gas Food Service Equipment," when developing a definition for these products. (California IOUs, STD No. 11 at p. 1)

[18] A notation in the form "AHAM, STD No. 9 at p. 2" identifies a written comment (1) made by AHAM; (2) recorded in document number 9 that is filed in the docket of this energy conservation standards rulemaking (Docket No. EERE–2014–BT–STD–0005) and maintained in the Resource Room of the Building Technologies Program; and (3) which appears on page 2 of document number 9.

[19] A notation in the form "Sub Zero, TP No. 20 at p. 3" identifies a written comment (1) made by Sub Zero; (2) recorded in document number 20 that is filed in the docket of the concurrent cooking products test procedures rulemaking (Docket No. EERE-2012-BT-TP-0013) and maintained in the Resource Room of the Building Technologies Program; and (3) which appears on page 3 of document number 20.

As discussed in section III.B, DOE proposed to amend the conventional cooking top test procedure in Appendix I to, among other things, measure the energy use of gas cooking tops with high burner input rates and to clarify that the existing conventional oven test procedure is appropriate for ovens with high burner input rates, including products marketed as commercial-style. See 79 FR 71894 (Dec. 3, 2014). DOE notes that the current definitions for "conventional cooking top," "conventional oven," and "conventional range" in 10 CFR 430.2 already cover conventional gas cooking products with higher burner input rates, as these products are household cooking appliances with surface units or compartments intended for the cooking or heating of food by means of a gas flame. As a result, DOE is proposing energy conservation standards for all residential conventional cooking products, including gas cooking products with higher burner input rates. As discussed in section IV.A.2, DOE is not considering establishing a separate product class for gas cooking products with higher burner input rates that are marketed as "commercial-style" and, as a result, DOE is not proposing separate definitions for these products.

Natural Resources Defense Council (NRDC) commented that DOE should separately define commercial and residential gas cooking products. NRDC noted that because of the availability of residential gas cooking tops with higher burner input rates previously associated with commercial use, these burner types are not what define commercial units. NRDC stated that the definitions should be based on more fundamental distinctions between commercial and residential products, such as configuration of the burners on the cooking top, number of burners, or number of high-input rate burners. (NRDC, STD No. 12 at p. 2) As part of this rulemaking, DOE is considering energy conservation standards for residential conventional cooking products. As discussed above, this includes residential conventional gas cooking products with high burner input rates, including those marketed as commercial-style. For these products, DOE tentatively concludes that the existing definitions for conventional cooking top, conventional oven, and conventional range accurately describe the products that are the subject of this rulemaking. In addition, DOE clarifies that the proposed scope of coverage for this rulemaking relates only to consumer products. Thus, this rule applies to those residential conventional cooking products that are of a type which, to any significant extent, are distributed into commerce for personal use or consumption. (See 42 U.S.C. 6291(1)). These consumer products can be distinguished from commercial/industrial equipment, which are of a type not sold for consumer use. (42 U.S.C. 6311(2)(A)) Thus, DOE is not proposing to define commercial cooking products as part of this rulemaking.

DOE notes that the test procedures for conventional ranges, cooking tops, and ovens found at Appendix I do not address all possible types of combined cooking products (i.e., residential products that combine a conventional cooking product with other appliance functionality, which may or may not include another cooking product), such as microwave/conventional ovens or any other products that may combine a conventional cooking product with other appliance functionality that is not a conventional cooking product. DOE stated in the February 2014 RFI that because test procedures are not available addressing products that combine a conventional cooking product with other appliance functionality that is not a conventional cooking product (e.g., microwave/conventional ovens), DOE is not considering energy conservation standards for such products at this time. 79 FR 8337, 8340 (Feb. 12, 2014).

AHAM and Whirlpool agreed with DOE's tentative determination to not consider standards for combined cooking products. (AHAM, STD No. 9 at p. 3; Whirlpool STD No. 13 at p. 2) AHAM stated that combined products are too diverse and probably do not occupy enough of the market to justify coverage by DOE. AHAM stated that DOE has not provided sufficient analysis on each of these products to justify their coverage, nor has DOE provided adequate definitions. Thus, AHAM continues to oppose the inclusion of combined products in the scope of covered products in the conventional cooking products rulemakings. (AHAM, STD No. 9 at p. 3) In the absence of comments opposing this determination and for the reasons discussed above, DOE is not considering energy conservation standards in this NOPR for products that may combine a conventional cooking product with other appliance functionality that is not a conventional cooking product.

## B. Further Rulemaking to Consider Energy Conservation Standards for Conventional Cooking Tops

As part of this rulemaking, DOE intends only to address energy conservation standards for conventional ovens, including conventional ovens that are a part of conventional ranges. In response to the concurrent cooking products test procedure proposed rulemaking, DOE received a number of comments from interested parties that presented information and arguments for deferring the rulemaking process to consider standards for conventional cooking tops until a representative, repeatable, and reproducible test procedure could be developed. DOE also conducted a series of manufacturer interviews and performed additional testing in order to confirm stakeholder comments that additional study was warranted before establishing both a test procedure and amended standards for conventional cooking tops. These comments and DOE's response are discussed below.

In the January 2013 TP NOPR, DOE proposed amendments to the cooking products test procedure in Appendix I to subpart B of Title 10 of the CFR part 430 that would allow for testing the active mode energy consumption of induction cooking products; i.e., conventional cooking tops and ranges equipped with induction heating technology for one or more surface units on the cooking top. DOE proposed to incorporate induction cooking tops by amending the definition of "conventional cooking top" to include induction heating technology. Furthermore, DOE proposed to require for all cooking tops the use of test equipment compatible with induction technology. Specifically, DOE proposed to replace the solid aluminum test blocks currently specified in the test procedure for cooking tops with hybrid test blocks comprising two separate pieces: an aluminum body and a stainless steel base. 78 FR 6232, 6234 (Jan. 30, 2013).

AHAM commented that DOE should rely on the finalized version of the test procedure (i.e., the October 2012 TP Final Rule) and not a proposed test procedure when evaluating energy conservation standards, particularly given the significant opposing comments that question the validity of the proposed test procedure for cooking tops (as discussed in AHAM's comments on the January 2013 TP NOPR). Accordingly, AHAM stated that DOE should address AHAM's and other stakeholder comments regarding induction cooking and finalize amendments to the test procedure before using those amendments to conduct any analysis for the standards rulemaking, or else proceed without addressing induction cooking products in this round of standards rulemaking. (AHAM, STD No. 9 at pp. 3–4, 6, 7)

AHAM and Whirlpool commented that a test procedure should be developed to address commercial-style cooking products if DOE plans to evaluate them in a standards analysis. (AHAM, STD No. 9 at p. 2; Whirlpool, STD No. 13 at p. 1) AHAM also commented that DOE should either proceed without addressing commercial-style products as it did for the April 2009 Final Rule or delay the rulemaking analysis until there is a finalized test procedure that can measure commercial-style products. (AHAM, STD No. 9 at p. 4, 6, 7) AHAM added that it cannot provide data regarding the differences between residential-style and commercial-style gas cooking products without a test procedure to measure higher input rated burners. (AHAM, STD No. 9 at p. 7) The California IOUs supported amending the test procedure to measure the energy use of residential conventional gas cooking products with higher burner input rates. (California IOUs, STD No. 11 at p. 2)

In the December 2014 TP SNOPR, DOE modified its proposal from the January 2013 TP NOPR to specify different test equipment that would allow for measuring the energy efficiency of induction cooking tops, and would include an additional test block size for electric surface units with large diameters (both induction and electric resistance). 79 FR 71894 (Dec. 3, 2014). In addition, DOE proposed methods to test non-circular electric surface units, electric surface units with flexible concentric cooking zones, and full-surface induction cooking tops. Id. In the December 2014 TP SNOPR, DOE also proposed amendments to add a larger test block size to test gas cooking top burners with higher input rates. Id.

AHAM formally requested an extension of the comment period for the December 2014 TP SNOPR, citing the difficulty the members had procuring the specified hybrid test block materials, and noting that many manufacturers were not able to properly assess the new specifications, testing variation, repeatability, and reproducibility of the proposed test procedure before the comment period closed. (AHAM, TP No. 14 at p. 1) AHAM also expressed concern with DOE's choice to pursue an accelerated rulemaking schedule for cooking products, stating that DOE's deadlines did not allow for a thorough technical examination. AHAM believes DOE has not conducted adequate outreach to manufacturers, has not been sufficiently transparent in its data collection and analysis, and has failed to adhere to its own Process Improvement Rule, which calls for all of the above. AHAM asked DOE to conduct more substantive dialogue with stakeholders that would result in more in-depth comments on the test procedure SNOPR and advised DOE that the cooking top test procedure as proposed in the December 2014 TP SNOPR may result in technical problems. (AHAM, TP No. 18 at pp. 1-2)

Both the BSH Home Appliances Corporation (BSH) and General Electric Appliances (GE) confirmed that delays associated with acquiring the hybrid test block materials meant they needed additional time to evaluate DOE’s proposed cooking top test procedure. (BSH, TP No. 16 at p. 2; GE, TP No. 17 at p. 1) BSH commented that the proposed hybrid test block method fails to cover several aspects which are necessary to enhance the reproducibility of measuring cooking top energy consumption, such as test load sizing and positioning, and recommended DOE take into account important specifications which are already fixed in International Electrotechnical Commission (IEC) Standard 60350-2 Edition 2, “Household electric appliances – Part 2: Hobs – Method for measuring performance” (IEC Standard 60350-2). (BSH, TP No. 16 at p. 1) Further, both manufacturers and AHAM suggested that DOE specify additional test block diameters because the test block sizes proposed by DOE do not adequately reflect the surface unit sizes currently available on the market. (BSH, TP No. 16 at p. 5; GE, TP No. 17 at p 2; AHAM, TP No. 18 at p. 2)

Stakeholders also expressed a significant number of concerns with the use of thermal grease. GE noted that since receiving DOE's proposal, it has not been able to replicate the DOE test results using the methods described. (GE, TP No. 17 at p. 2) Specifically, GE observed that the aluminum body slid off the stainless steel base during the test, that the thermal grease dried out, and that the amount of grease between the blocks changed from one test to another. (GE, TP No. 17 at p. 2) Both manufacturers and AHAM requested that DOE specify an operating temperature range for the thermal grease as well as an application thickness to address these issues, but also noted that the thermal conductivity and viscosity of the grease may still change over time or after repeated use at high temperatures. (BSH, TP No. 16 at p. 11; GE, TP No. 17 at p. 2; AHAM, TP No. 18 at p. 3) GE further commented that the variation introduced by the hybrid test block due to block construction, flatness, thermal grease, and inadequate sizing, may be small sources of variation individually, but collectively, these issues result in a test method that is incapable of being able to reliably discern efficiency differences between similar products, alternate technology options, and product classes. Thus, GE believes the test method proposed for conventional cooking tops in the December 2014 TP SNOPR results in too much variability to serve as the basis for establishing a standard. (GE, TP No. 17 at p. 3)

The California IOUs also stated that they prefer an alternative to the hybrid test block and recommended that DOE require water-heating test methods to measure the cooking efficiency of conventional cooking tops. Specifically, the California IOUs requested that DOE align the residential cooking product test methods with existing industry test procedures, such as ASTM F1521-12 and IEC Standard 60350-2. (California IOUs, TP No. 19 at p. 1) The California IOUs commented that they plan to conduct additional testing to better characterize the differences between the water-heating and hybrid test block test procedures, and will provide these results to DOE. According to the California IOUs, the differences in test procedure standard deviation between the hybrid test block and water-heating test method as presented in the December 2014 TP SNOPR did not sufficiently show that the hybrid test block method is more repeatable than a water-heating method. (California IOUs, TP No. 19 at p. 2) Additionally, the California IOUs believe cooking efficiencies derived using a water-heating test method are more representative of the actual cooking performance of cooking tops as opposed to a test procedure using hybrid test blocks since many different foods prepared on cooktops will have relatively high liquid content. (California IOUs, TP No. 19 at p. 1)

In February and March of 2015, DOE conducted a series of interviews with manufacturers of conventional cooking products, representing the majority of the U.S. market, regarding the proposed cooking top test procedure. Manufacturers agreed that the hybrid test block method, as proposed, presented many issues which had not yet been addressed, and which left the repeatability and reproducibility of the test procedure in question. These concerns were similar to those expressed in written comments but came from a larger group of contributing manufacturers and included:

- Difficulty obtaining the hybrid test block materials;
- Difficulty obtaining and applying the thermal grease without more detailed specifications (i.e., thermal conductivity alone was not sufficient to identify a grease that performed according to DOE's descriptions in the SNOPR);
- Difficulty testing induction cooking tops that use different programming techniques to prevent overheating (some manufacturers still observed that

power to the heating elements cut off prematurely during testing with the hybrid test block, despite adding thermal grease); and

- The need for larger test block sizes to test electric surface units having 12-inch and 13-inch diameters and gas surface units with high input rates.

Interviewed manufacturers that produce and sell products in Europe overwhelmingly supported the use of water-heating test method and harmonization with IEC Standard 60350-2 for measuring the energy consumption of electric cooking tops. These manufacturers noted that the benefits of pursuing a test method similar to the IEC water-heating method include compatibility with all electric cooking top types, additional cookware diameters to account for the variety of surface unit sizes on the market, and the test load's ability to represent a real-world cooking top load.

For these reasons, DOE has decided to continue the energy conservation standards rulemaking for conventional ovens but to defer its decision regarding adoption of energy conservation standards for conventional cooking tops until a representative, repeatable and reproducible test method for cooking tops is finalized. At such time, DOE will consider further modifications to DOE's cooking top active mode test procedure and, on the basis of such an amended test procedure, DOE will analyze potential energy conservation standards for cooking top energy consumption. DOE invites data and information that will allow it to further conduct the analysis of cooking tops, particularly when using a water-heating method to evaluate energy consumption. DOE anticipates issuing additional notices for cooking top test procedures and standards in order to obtain public input on DOE's updated proposals. As part of these notices, DOE will carefully consider and address any cooking top-related comments on the December 2014 TP SNOPR and the February 2014 RFI that remain relevant.

## C. Test Procedure

DOE's test procedures for conventional ranges, conventional cooking tops, conventional ovens, and microwave ovens are codified at appendix I to subpart B of Title 10 of the CFR part 430.

DOE established the test procedures in a final rule published in the Federal Register on May 10, 1978. 43 FR 20108, 20120–20128. DOE revised its test procedures for cooking products to more accurately measure their efficiency and energy use, and published the revisions as a final rule in 1997. 62 FR 51976 (Oct. 3, 1997). These test procedure amendments included: (1) a reduction in the annual useful cooking energy; (2) a reduction in the number of Self-Clean oven cycles per year; and (3) incorporation of portions of IEC Standard 705-1988, "Methods for measuring the performance of microwave ovens for household and similar purposes," and Amendment 2-1993 for the testing of microwave ovens. Id. The test procedures for conventional cooking products establish provisions for determining estimated annual operating cost, cooking efficiency (defined as the ratio of cooking energy output to cooking energy input), and energy factor (defined as the ratio of annual useful cooking energy output to total annual energy input). 10 CFR 430.23(i); Appendix I.

DOE subsequently conducted a rulemaking to address standby and off mode energy consumption, as well as certain active mode (i.e., fan-only mode) testing provisions, for residential conventional cooking products. DOE published a final rule on October 31, 2012 (77 FR 65942, the October 2012 TP Final Rule), adopting standby and off mode provisions that satisfy the EPCA requirement that DOE include measures of standby mode and off mode energy consumption in its test procedures for residential products, if technically feasible. (42 U.S.C. 6295(gg)(2)(A))

In the December 2014 TP SNOPR, DOE proposed modifications to the test block used to evaluate conventional cooking top energy consumption. As discussed in section III.B, DOE plans to consider further modifications to DOE's cooking top active mode test procedure in a future rulemaking. In the December 2014 TP SNOPR, DOE also proposed to incorporate methods for measuring conventional oven volume, clarified that the existing oven test block must be used to test all ovens regardless of input rate, and provided a method to measure the energy consumption and efficiency of conventional ovens equipped with an oven separator. 79 FR 71894 (Dec. 3, 2014). DOE is proposing energy conservation standards for conventional ovens in this NOPR based on these proposals in the December 2014 TP SNOPR. DOE intends to update the standards rulemaking analyses based on any final amendments related to ovens developed as part of the concurrent test procedure rulemaking. DOE recognizes that interested parties need sufficient time to evaluate the proposed energy conservation standards using the final test procedure for conventional ovens. DOE considers the stated energy conservation standards rulemaking process to provide sufficient time to submit meaningful comments based on a finalized DOE conventional oven test procedure.

## D. Technological Feasibility

### 1. General

In each energy conservation standards rulemaking, DOE conducts a screening analysis based on information gathered on all current technology options and prototype designs that could improve the efficiency of the products or equipment that are the subject of the rulemaking. As the first step in such an analysis, DOE develops a list of technology options for consideration in consultation with manufacturers, design engineers, and other interested parties. DOE then determines which of those means for improving efficiency are technologically feasible. DOE considers technologies incorporated in commercially available products or in working prototypes to be technologically feasible. 10 CFR part 430, subpart C, appendix A, section 4(a)(4)(i).

After DOE has determined that particular technology options are technologically feasible, it further evaluates each technology option in light of the following additional screening criteria: (1) practicability to manufacture, install, and service; (2) adverse impacts on product utility or availability; and (3) adverse impacts on health or safety. 10 CFR part 430, subpart C, appendix A, section 4(a)(4)(ii)-(iv). Section IV.B of this notice discusses the results of the screening analysis for residential conventional ovens, particularly the designs DOE considered, those it screened out, and those that are the basis for the trial standard levels (TSLs) in this rulemaking. For further details on the screening analysis for this rulemaking, see chapter 4 of the NOPR Technical Support Document (TSD).

2. Maximum Technologically Feasible Levels

When DOE proposes to adopt an amended standard for a type or class of covered product, it must determine the maximum improvement in energy efficiency or maximum reduction in energy use that is technologically feasible for such product. (42 U.S.C. 6295(p)(1)) Accordingly, in the engineering analysis, DOE determined the maximum technologically feasible ("max-tech") improvements in energy efficiency for residential conventional ovens, using the design parameters for the most efficient products available on the market or in working prototypes, and information from the previous rulemaking. The max-tech levels that DOE determined for this rulemaking are described in section IV.C.3 of this proposed rule and in chapter 5 of the NOPR TSD.

E. Energy Savings

1. Determination of Savings

For each TSL, DOE projected energy savings from the products that are the subject of this rulemaking purchased in the 30-year period that begins in the year of compliance with new and amended standards (2019 to 2048).[20] The savings are measured over the entire lifetime of products purchased in the 30-year analysis period. DOE quantified the energy savings attributable to each TSL as the difference in energy consumption between each standards case and the base case. The base case represents a

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

projection of energy consumption in the absence of new and amended efficiency standards, and it considers market forces and policies that affect demand for more efficient products.

DOE uses its national impact analysis (NIA) spreadsheet models to estimate energy savings from potential new and amended standards. The NIA spreadsheet model (described in section IV.H of this notice) calculates energy savings in site energy, which is the energy directly consumed by products at the locations where they are used. For electricity, DOE calculates 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 electricity, natural gas, and oil, DOE also calculates full-fuel-cycle (FFC) energy savings. As discussed in DOE's statement of policy and notice of policy amendment, 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 efficiency standards. 76 FR 51281 (Aug. 18, 2011), as amended at 77 FR 49701 (Aug. 17, 2012).

To calculate primary energy savings, DOE derives annual conversion factors from the model used to prepare the Energy Information Administration's (EIA) most recent Annual Energy Outlook (AEO).[21] For FFC energy savings, DOE's approach is based on the calculation of an FFC multiplier for each of the energy types used by covered products or equipment. For more information, see section IV.H.2.

[21] For this NOPR, DOE used AEO 2014. Available at http://www.eia.gov/forecasts/AEO/

2. Significance of Savings

To adopt standards for a covered product, DOE must determine that such action would result in "significant" energy savings. (42 U.S.C. 6295(o)(3)(B)) Although the term "significant" is not defined in the Act, the U.S. Court of Appeals for the District of Columbia Circuit, in Natural Resources Defense Council v. Herrington, 768 F.2d 1355, 1373 (D.C. Cir. 1985), opined that Congress intended "significant" energy savings in the context of EPCA to be savings that were not "genuinely trivial." The energy savings for the proposed standards (presented in section IV.H.2) are nontrivial, and, therefore, DOE considers them "significant" within the meaning of section 325 of EPCA.

## F. Economic Justification

1. Specific Criteria

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

a. Economic Impact on Manufacturers and Consumers

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

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

b. Savings in Operating Costs Compared to Increase in Price

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

The LCC is the sum of the purchase price of a product (including its installation) and the operating expense (including energy, maintenance, and repair expenditures) discounted over the lifetime of the product. The LCC analysis requires a variety of inputs, such as product prices, product energy consumption, energy prices, maintenance and repair costs, product lifetime, and consumer discount rates. To account for uncertainty and variability in specific inputs, such as product lifetime and discount rate, DOE uses a distribution of values, with probabilities attached to each value. For its analysis, DOE assumes that consumers will purchase the covered products in the first year of compliance with amended standards.

The LCC savings for the considered efficiency levels are calculated relative to a base case that reflects projected market trends in the absence of amended standards. DOE identifies the percentage of consumers estimated to receive LCC savings or experience an LCC increase, in addition to the average LCC savings associated with a particular standard level. DOE's LCC and PBP analysis is discussed in further detail in section IV.F.

c. Energy Savings

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

d. Lessening of Utility or Performance of Products

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

e. Impact of Any Lessening of Competition

EPCA directs DOE to consider the impact of any lessening of competition, as determined in writing by the Attorney General, that is likely to result from a proposed standard. (42 U.S.C. 6295(o)(2)(B)(i)(V)) It also directs the Attorney General to determine the impact, if any, of any lessening of competition likely to result from a proposed standard and to transmit such determination to the Secretary within 60 days of the publication of a proposed rule, together with an analysis of the nature and extent of the impact. (42 U.S.C. 6295(o)(2)(B)(ii)) DOE will transmit a copy of this proposed rule to the Attorney General with a request that the Department of Justice

(DOJ) provide its determination on this issue. DOE will publish and respond to the Attorney General's determination in the final rule.

f. 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 new or amended standards are likely to provide improvements to the security and reliability of the nation's energy system. Reductions in the demand for electricity also may result in reduced costs for maintaining the reliability of the nation's electricity system. DOE conducts a utility impact analysis to estimate how standards may affect the nation's needed power generation capacity, as discussed in section IV.M.

New or amended standards also are likely to result in environmental benefits in the form of reduced emissions of air pollutants and greenhouse gases (GHGs) associated with energy production and use. DOE conducts an emissions analysis to estimate how standards may affect these emissions, as discussed in section IV.K. DOE reports the emissions impacts from each TSL it considered in section IV.K of this notice. DOE also estimates the economic value of emissions reductions resulting from the considered TSLs, as discussed in section IV.L.

g. Other Factors

EPCA allows the Secretary of Energy, in determining whether a standard is economically justified, to consider any other factors that the Secretary deems to be relevant. (42 U.S.C. 6295(o)(2)(B)(i)(VII)) To the extent interested parties submit any relevant information regarding economic justification that does not fit into the other categories described above, DOE could consider such information under "other factors."

2. Rebuttable Presumption

As set forth in 42 U.S.C. 6295(o)(2)(B)(iii), EPCA creates a rebuttable presumption that an energy conservation standard is economically justified if the additional cost to the consumer of a product that meets the standard is less than three times the value of the first year's energy savings resulting from the standard, as calculated under the applicable DOE test procedure. DOE's LCC and PBP analyses generate values used to calculate the effects that proposed energy conservation standards would have on the payback period for consumers. These analyses include, but are not limited to, the 3-year payback period contemplated under the rebuttable-presumption test. In addition, DOE routinely conducts an economic analysis that considers the full range of impacts to consumers, manufacturers, the Nation, and the environment, as required under 42 U.S.C. 6295(o)(2)(B)(i). The results of this analysis serve as the basis for DOE's evaluation of the economic justification for a potential standard level (thereby supporting or rebutting the results of any preliminary determination of economic justification). The rebuttable presumption payback calculation is discussed in section IV.F.11 of this proposed rule.

## IV. Methodology and Discussion of Comments

DOE used several analytical tools to estimate the impact of the proposed standards. The first tool is a spreadsheet that calculates the LCC and PBP of potential energy conservation standards. The national impacts analysis uses a spreadsheet set that provides shipments forecasts and calculates national energy savings and net present value resulting from potential energy conservation standards. DOE uses the third spreadsheet tool, the Government Regulatory Impact Model (GRIM), to assess manufacturer impacts of potential standards. These three spreadsheet tools are available at the website for this rulemaking: http://www1.eere.energy.gov/buildings/appliance_standards/rulemaking.aspx?ruleid=85. Additionally, DOE used output from the EIA's Annual Energy Outlook (AEO) 2014, a widely known energy forecast for the United States, for the emissions and utility impact analyses.

### A. Market and Technology Assessment

#### 1. General

For the market and technology assessment, DOE develops information that provides an overall picture of the market for the products concerned, including the purpose of the products, the industry structure, and market characteristics. This activity includes both quantitative and qualitative assessments, based primarily on publicly available information. Chapter 3 of the NOPR TSD contains additional discussion of the market and technology assessment.

2. Product Classes

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

During the previous energy conservation standards rulemaking for cooking products, DOE evaluated product classes for conventional ovens based on energy source (i.e., gas or electric). These distinctions initially yielded two conventional oven product classes: (1) gas ovens; and (2) electric ovens. DOE later determined that the type of oven-cleaning system is a utility feature that affects performance. DOE found that standard ovens and ovens using a catalytic continuous-cleaning process use roughly the same amount of energy. On the other hand, Self-Clean ovens use a pyrolytic process that provides enhanced consumer utility with lower overall energy consumption as compared to either standard or catalytically lined ovens. DOE defined the following product classes in the TSD for the April 2009 Final Rule (2009 TSD)[22] for conventional ovens:

- Electric ovens – standard oven with or without a catalytic line;

[22] The technical support document from the previous residential cooking products standards rulemaking is available at: http://www.regulations.gov/#!documentDetail;D=EERE-2006-STD-0127-0097.

- Electric ovens – self-clean oven;
- Gas ovens – standard oven with or without a catalytic line; and
- Gas ovens – self-clean oven.

As part of the February 2014 RFI, DOE stated that it tentatively plans to maintain the product classes for conventional ovens from the previous standards rulemaking, as presented above. DOE stated that it may consider whether separate product classes are warranted for conventional gas ovens with higher burner input rates. 79 FR 8337, 8341–8342 (Feb. 12, 2014).

Based on DOE's review of gas conventional ovens and ranges available on the U.S. market, and based on manufacturer interviews and testing conducted as part of the engineering analysis described in section IV.C and Chapter 5 of the TSD, DOE notes that the self-cleaning function of the self-clean oven may employ methods other than a high temperature pyrolytic cycle to perform the cleaning action. Specifically, DOE is aware of a type of self-cleaning oven that uses a proprietary oven coating and water to perform a self-clean cycle with a shorter duration and at a significantly lower temperature setting. The self-cleaning cycle for these ovens, unlike catalytically-lined standard ovens that provide continuous cleaning during normal baking, still have a separate self-cleaning mode that is user-selectable and must be tested separately. In this NOPR, DOE is clarifying that a self-clean electric or gas conventional oven is an oven that has a user-selectable mode separate from the normal baking mode, not intended to heat or cook food, which is dedicated to cleaning and removing cooking deposits from the oven cavity walls.

With regard to commercial-style products, AHAM commented that without a definition or test procedure for such products, neither AHAM nor DOE can determine at this stage whether these products would warrant a separate product class. AHAM noted that DOE should first develop a test procedure for these products to allow for analysis of them. (AHAM, No. 9 at p. 12)

Based on DOE's review of the residential conventional gas ovens available on the market, residential-style gas ovens typically have an input rate of 16,000 to 18,000 Btu/h whereas residential gas ovens marketed as commercial-style typically have burner input rates ranging from 22,500 to 30,000 Btu/h.[23] Additional review of both the residential-style and commercial-style gas oven cavities indicated that there is significant overlap in oven cavity volume between the two oven types. Standard residential-style gas oven cavities range from 2.5 to 5.6 cubic feet ($ft^3$) in volume and gas ovens marketed as commercial-style have cavity volumes ranging from 3.0 to 6.0 $ft^3$. Sixty percent of the commercial-style models surveyed had cavity volumes between 4.0 and 5.0 $ft^3$ while fifty percent of the standard models had cavity volumes between 4.0 and 5.0 $ft^3$. The primary differentiating factor between the two oven types was burner input rate, which is greater than 22,500 Btu/h for commercial-style gas ovens.

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[23] However, DOE noted that many gas ranges, while marketed as commercial- or professional-style and having multiple surface units with high input rates, did not have a gas oven with a burner input rate above 22,500 Btu/h.

As discussed in the December 2014 TP SNOPR, DOE determined that the test load for ovens as specified in the existing DOE test procedure in Appendix I is appropriate for gas ovens with burner input rates greater than 22,500 Btu/h. 79 FR at 71915–71916. As a result, DOE conducted testing for this NOPR to determine whether conventional gas ovens with higher burner input rates warrant establishing a separate product class. DOE evaluated the cooking efficiency of the eight conventional gas ovens listed in Table IV-1. Five of these ovens had burners rated at 18,000 Btu/h or less and the remaining three had burner input rates ranging from 27,000 Btu/h to 30,000 Btu/h.

**Table IV-1. Performance Characteristics of Gas Oven Test Sample**

| Test Unit # | Type | Installation Configuration | Burner Input Rate (Btu/h) | Cavity Volume (cubic feet (ft$^3$)) | Measured Cooking Efficiency | Normalized Cooking Efficiency** |
|---|---|---|---|---|---|---|
| 1 | Standard | Freestanding | 18,000 | 4.8 | 6.6% | 7.0% |
| 2 | Standard | Freestanding | 18,000 | 4.8 | 6.0% | 6.3% |
| 3 | Self-Clean | Freestanding | 18,000 | 5.0 | 7.6% | 8.1% |
| 4 | Standard | Freestanding | 16,500 | 4.4 | 6.2% | 6.2% |
| 5 | Self-Clean | Built-in | 13,000 | 2.8 | 9.4% | 8.3% |
| 6 | Standard * | Freestanding | 28,000 | 5.3 | 4.3% | 5.1% |
| 7 | Standard * | Slide-in | 27,000 | 4.4 | 5.2% | 5.2% |
| 8 | Standard * | Freestanding | 30,000 | 5.4 | 3.9% | 4.7% |

* These products are marketed as commercial-style gas ovens.

** Measured cooking efficiency normalized to a fixed cavity volume of 4.3 cubic feet.

The measured cooking efficiencies for ovens with burner input rates above 22,500 Btu/h were lower than for ovens with ratings below 22,500 Btu/h, even after normalizing cooking efficiency to a fixed cavity volume. However, DOE also noted that the conventional gas ovens with higher burner input rates in DOE's test sample were marketed as commercial-style and had greater total thermal mass, including heavier racks and thicker cavity walls, even after normalizing for cavity volume. To determine whether the lower measured efficiency of these ovens was due to the higher input rate burners, DOE isolated the heating element from the thermal mass of the oven by placing 1-inch thick insulation on all surfaces inside the oven cavity, except for the bottom of the cavity where the burner was located, and ran tests according to the DOE test procedure. By adding insulation, heat transfer to the cavity walls was minimized and retained in the cavity to heat the test block. DOE selected test unit 3 and test unit 8 in Table IV-1 for test because of the similarity in cavity volume, their difference in efficiency, and their differing input rate (18,000 Btu/h and 30,000 Btu/h, respectively). Figure IV.1 displays the resulting test block temperature increase as a function of test time, measured with and without insulation lining the interior oven cavity walls.

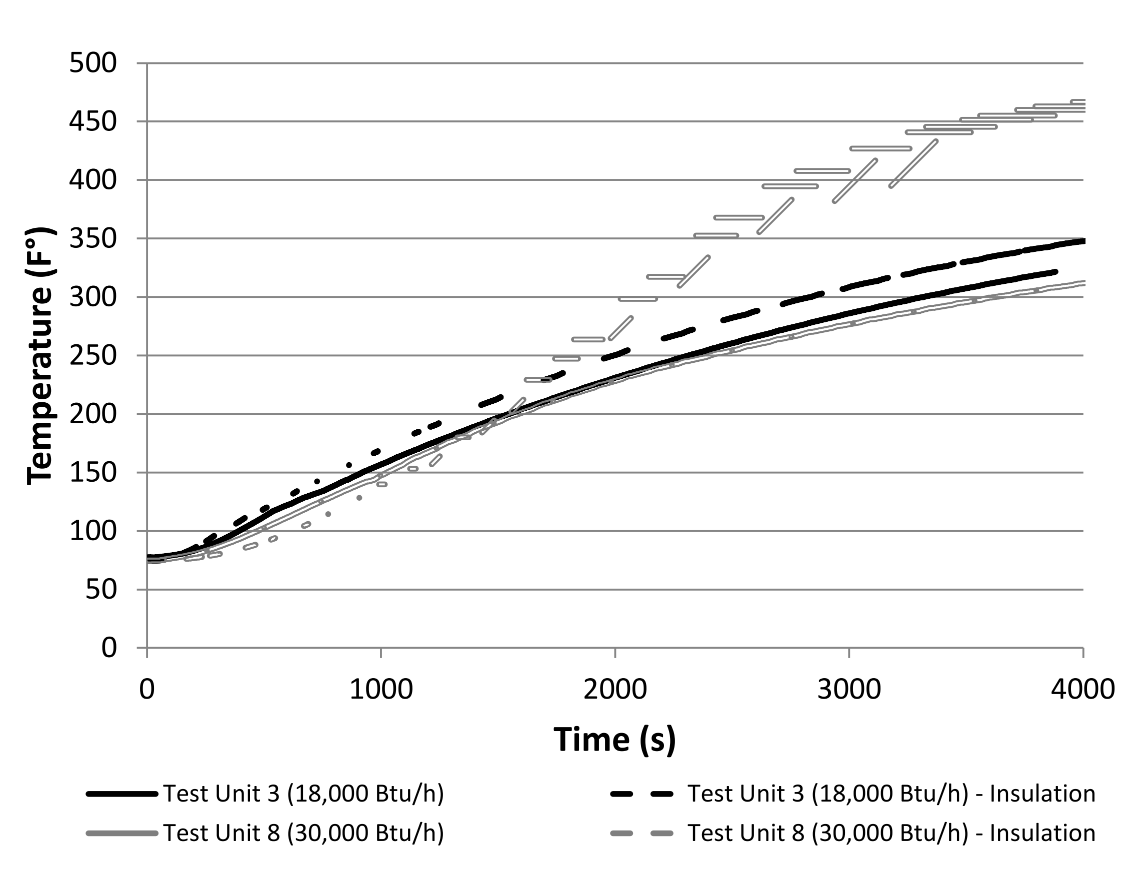


**Figure IV.1 Test Load Temperature With and Without Insulation Lining the Interior Cavity Walls**

Without the added insulation inside the oven cavity, the temperature rise in the test block was similar for each oven, despite the large difference in burner input rate. In contrast, by adding insulation inside the cavity, the test block temperature in the 30,000 Btu/h oven increased at a faster rate than in the 18,000 Btu/h oven. This suggests that much of the energy input to the 30,000 Btu/h oven goes to heating the added mass of the cavity, rather than the test load, resulting in relatively lower measured efficiency.

DOE also investigated the time it took each oven in the test sample to heat the test load to a final test temperature of 234 degrees Fahrenheit (°F) above its initial temperature, specified in the DOE test procedure in Appendix I. As shown in Table IV-2, gas ovens with burner input rates greater than 22,500 Btu/h do not heat the test load significantly faster than the ovens with lower burner input rates, and two out of the three units with the higher burner input rates took longer than the average time to heat the test load. Therefore, DOE preliminarily concludes that there is no unique utility associated with faster cook times that is provided by gas ovens with burner input rates greater than 22,500 Btu/h.

**Table IV-2. Gas Oven Test Times**

| Unit | Type | Burner Input Rate (Btu/h) | Bake Time to Reach 234°F Above Initial Temp (min) | Difference in Time from Avg (min) |
|---|---|---|---|---|
| 1 | Standard | 18,000 | 43.6 | -3.8 |
| 2 | Standard | 18,000 | 43.6 | -3.8 |
| 3 | Self-Clean | 18,000 | 47.2 | -0.2 |
| 4 | Standard | 16,500 | 44.9 | -2.5 |
| 5 | Self-Clean | 13,000 | 48.9 | 1.5 |
| 6 | Standard * | 28,000 | 48.9 | 1.5 |
| 7 | Standard * | 27,000 | 45.4 | -2.0 |
| 8 | Standard * | 30,000 | 57.2 | 9.8 |
| | | Average | 47.4 | - |

* Test units 6, 7, and 8 are marketed as commercial-style ovens.

In response to the December 2014 TP SNOPR, Sub Zero commented that categorizing all ovens under the term conventional cooking suggests that DOE is unaware of the significant positive differences provided to a subset of consumers by commercial-style products. (Sub Zero, TP No. 20 at p. 2) If standards are to be proposed, Sub Zero requested that the product classes be significantly expanded in number to recognize the unique and important utility and performance attributes associated with "high performance" cooking products. (Sub Zero, TP No. 20 at p. 3) Sub Zero suggested that these products offer residential consumers performance similar to that found in restaurants, at a safety and convenience level that is acceptable for residential use. Commercial-style ovens would thus include gas ranges in widths up to 60 inches, gas ovens up to 36 inches wide with high output infrared broilers and convection fans, dual fuel ranges combining gas cooktops with sealed burners and large, electric self-cleaning convection ovens that use hidden bake elements and multiple heating circuits for added control, as well as separate convection elements or multiple convection fans. Sub Zero believes that analysis based largely on the traditional 30-inch wide gas or electric range cannot adequately evaluate the very different performance attributes offered by high performance products which are essential to consumer utility. (Sub Zero, TP No. 20 at p. 2)

In selecting a test sample to support DOE's engineering analysis, discussed in section IV.C.2 and Chapter 5 of the TSD, DOE attempts to capture a wide range of products having features that may result in the determination of additional product classes. DOE included two commercial-style gas ovens greater than 30-inches in width as part of its test sample. DOE is not aware of data showing the improved cooking performance of these products due to the features described in the comments as compared to conventional gas ovens not marketed as commercial-style or commercial-style gas ovens less than or equal to 30 inches in width. All of the commercial-style ovens evaluated by DOE contained features such as infrared broilers, convection fans, and hidden bake elements, but DOE observed that many of the same features were also available in conventional gas ovens with lower input rates. DOE welcomes data demonstrating the improved cooking performance associated with the features for commercial-style gas ovens with widths greater than 30-inches that result in increased energy consumption, but are not available in conventional gas ovens with lower input rates or commercial-style gas ovens with widths of 30 inches or less.

Based on DOE's testing, reverse engineering, and additional discussions with manufacturers, DOE determined that the major differentiation between conventional gas ovens with lower burner input rates and those with higher input rates, including those marketed as commercial-style, was design and construction related to aesthetics rather than improved cooking performance. Further, DOE did not identify any unique utility conferred by commercial-style gas ovens. For the reasons discussed above, DOE is not proposing to establish a separate product class for conventional gas ovens with higher burner input rates.

As discussed in section III.B, in the October 2012 TP Final Rule, DOE amended appendix I to include methods for measuring fan-only mode[24]. Based on DOE's testing of freestanding, built-in, and slide-in conventional gas and electric ovens, DOE noted that all of the built-in and slide-in ovens tested consumed energy in fan-only mode, whereas freestanding ovens did not. The energy consumption in fan-only mode for built-in and slide-in ovens ranged from approximately 1.3 to 37.6 watt-hours (Wh) per cycle (0.25 to 7.6 kWh/yr). Based on DOE's reverse engineering analyses discussed in section IV.C.2, DOE noted that built-in and slide-in products had an additional exhaust fan and vent assembly that was not present in freestanding products. The additional energy required to

[24] Fan-only mode is an active mode that is not user-selectable in which a fan circulates air internally or externally to the cooking product for a finite period of time after the end of the heating function.

exhaust air from the oven cavity is necessary for slide-in and built-in installation configurations to meet safety-related temperature requirements because the oven is enclosed in cabinetry. For these reasons, DOE proposes to include separate product classes for freestanding and built-in/slide-in ovens.

In summary, DOE proposes the product classes listed in Table IV-3 for the NOPR.

**Table IV-3. Proposed Product Classes for Conventional Ovens**

| Product Class | Product Type | Sub-Category | Installation Type |
|---|---|---|---|
| 1 | Electric oven | Standard with or without a catalytic line | Freestanding |
| 2 | | | Built-in/Slide-in |
| 3 | | Self-clean | Freestanding |
| 4 | | | Built-in/Slide-in |
| 5 | Gas oven | Standard with or without a catalytic line | Freestanding |
| 6 | | | Built-in/Slide-in |
| 7 | | Self-clean | Freestanding |
| 8 | | | Built-in/Slide-in |

3. Technology Options

As part of the market and technology assessment, DOE uses information about existing and past technology options and prototype designs to help identify technologies that manufacturers could use to improve energy efficiency. Initially, these technologies encompass all those that DOE believes are technologically feasible. Chapter 3 of the NOPR TSD includes the detailed list and descriptions of all technology options identified for this equipment.

In the February 2014 RFI, DOE stated that based on a preliminary review of the cooking products market and information published in recent trade publications, technical reports, and manufacturer literature, the results of the technology screening analysis performed during the previous standards rulemaking remain largely relevant for this rulemaking. 79 FR 8337, 8341 (Feb. 12, 2014). DOE stated in the February 2014 RFI that it planned to consider the technology options presented in Table IV-4 for conventional ovens. 79 FR 8337, 8342–8343 (Feb. 12, 2014).

**Table IV-4. February 2014 RFI Technology Options for Conventional Ovens**

| |
|---|
| 1. Bi-radiant oven (electric only) |
| 2. Electronic spark ignition (gas only) |
| 3. Forced convection |
| 4. Halogen lamp oven (electric only) |
| 5. Improved and added insulation |
| 6. Improved door seals |
| 7. No oven-door window |
| 8. Oven separator |
| 9. Radiant burner (gas only) |
| 10. Reduced conduction losses |
| 11. Reduced thermal mass |
| 12. Reduced vent rate |
| 13. Reflective surfaces |
| 14. Steam cooking |
| 15. Low-standby-loss electronic controls |

In response to the February 2014 RFI, DOE received a number of comments regarding the technology options for conventional ovens.

AHAM commented that forced convection should not be considered a technology option for gas or electric ovens. AHAM stated that only some foods can be cooked with convection and that accelerating the cooking time or baking rate for other foods will not produce acceptable results. Accordingly, AHAM believes this technology option would impact consumer utility. (AHAM, STD No. 9 at p. 5) DOE recognizes that using forced convection for cooking certain foods may be undesirable. DOE is not considering forced convection as a complete replacement to the conventional bake cooking function. Instead DOE considered forced convection as a separate heating mode in addition to the bake function for the engineering analysis. DOE also notes that the test procedure in Appendix I averages the energy consumption measured during bake-only mode with the energy consumption measured during forced convection mode to calculate the total cooking efficiency and IAEC for the oven, representing equal use of forced convection and bake-only cooking cycles. As a result, DOE is retaining forced convection as a technology option for this NOPR.

AHAM and Whirlpool commented that reducing the vent rate should not be considered because it could result in incomplete combustion. In addition, AHAM stated that it would impact the ability of the product to manage moisture release. (AHAM, STD No. 9 at p. 6; Whirlpool, STD No. 13 at p. 4) As noted in the 2009 TSD, DOE believes that vent size of both standard electric and standard gas ovens could be reduced while maintaining a satisfactory combustion environment. Since all Self-Clean ovens are already designed with this technology, no new improvements are required by the industry to incorporate this technology option. DOE noted in the 2009 TSD that an increase of approximately 0.62 absolute percentage points for standard electric ovens and 0.5 absolute percentage points for standard gas ovens was possible with this technology option. As a result, DOE retained reduced vent rate as a technology option for standard ovens for this NOPR.

AHAM commented that improved door seals may not provide a significant improvement in efficiency. (AHAM, STD No. 9 at p. 6) DOE notes that door seals for standard ovens generally consist of a strip of silicone rubber, while Self-Clean ovens usually incorporate fiberglass seals. Because some venting is required for proper cooking performance, a complete seal on the oven is undesirable. As DOE noted in the 2009 TSD, the oven door seals can be improved further without sealing the oven completely. Based on discussions with manufacturers, DOE believes that fiberglass seals can be installed in standard ovens to improve efficiency. As a result, DOE retained improved door seals as a technology option for standard ovens.

Whirlpool commented that it has already optimized insulation in its ovens for safety reasons. (Whirlpool, STD No. 13 at p. 4) DOE noted in the 2009 TSD that standard ovens used low-density insulation (1.09 pounds (lb)/$ft^3$) whereas self-clean ovens used higher-density insulation (1.90 lb/$ft^3$). Based on interviews with manufacturers for this rulemaking, DOE notes that manufacturers generally use the same amount of insulation for standard ovens versus self-clean ovens, but with different densities. Insulation is added primarily to pass Underwriters Laboratory (UL) surface temperature safety testing requirements, which explains why Self-Clean ovens, which require high temperatures for pyrolysis, tend to have a more effective insulation package. DOE notes that higher-density insulation can be used in standard ovens to improve efficiency. As a result, DOE retained improved insulation as a technology option for standard ovens.

Whirlpool commented that there may be savings associated with steam cooking realized by the user, but these savings would likely not be measured in the DOE test procedure. (Whirlpool, STD No. 13 at p. 4) While there are several residential steam ovens currently on the market, DOE is unaware of any test procedures that accurately measure the energy use of the steam cooking mode while producing repeatable and reproducible results. As a result, DOE is unaware of any data regarding the efficiency of steam cooking. For these reasons, DOE did not consider steam cooking in the analysis.

Whirlpool commented that there could be savings for gas ovens from electronic spark ignition over a glo-bar igniter, which could use 250–500W throughout the cooking cycle. (Whirlpool, STD No. 13 at p. 4) As discussed in section IV.C.2, based on DOE's testing, DOE agrees that switching from a glo-bar to an electronic spark ignition system would result in energy savings. As a result, DOE is maintaining electronic spark ignition as a technology option for this NOPR.

Based on DOE's review of products on the market, DOE notes that radiant burners for gas ovens are only incorporated into broiling, which is a secondary cooking function not measured under the test procedure; energy use is instead measured during the primary bake function. As a result, the benefits of radiant burners are not measured by the current test procedure. Accordingly, DOE eliminated radiant burners in gas ovens from further analysis.

In the previous standards rulemaking, DOE noted that oven separators had only been researched, but never put into production. 72 FR 64432, 64456 (Nov. 15, 2007). Based on DOE's review of products on the market, DOE notes that one manufacturer offers a conventional electric oven with an oven separator. As a result, DOE plans to consider oven separators as a technology option for electric ovens.

In addition to the technology options presented in Table IV-4, DOE considered an additional technology option for optimizing the burner and cavity design for gas ovens based on product testing and reverse engineering analyses conducted for this NOPR. As described in section IV.A.2 and further in section IV.C.2, DOE's testing indicated that reducing the thermal mass of the oven cavity can increase cooking efficiency. Because oven cavity and burner design are interdependent, DOE is proposing to consider optimized burner and cavity design as a technology option for increasing efficiency for gas ovens consistent with products available on the market rather than the reduced thermal mass technology option considered for the previous rulemaking.

Table IV-5 lists the proposed technology options that DOE is considering for the NOPR.

**Table IV-5. Proposed Technology Options for Conventional Ovens**

| |
|---|
| 1. Bi-radiant oven (electric only) |
| 2. Electronic spark ignition (gas only) |
| 3. Forced convection |
| 4. Halogen lamp oven (electric only) |
| 5. Improved and added insulation (standard ovens only) |
| 6. Improved door seals |
| 7. No oven-door window |
| 8. Oven separator (electric only) |
| 9. Reduced conduction losses |
| 10. Reduced vent rate |
| 11. Reflective surfaces |
| 12. Low-standby-loss electronic controls |
| 13. Optimized burner and cavity design |

DOE seeks comment on the use of optimized burner and cavity design (and other options listed in Table IV-5) to meet the proposed efficiency levels discussed in section I.A.1.b. (See section VII.E )

## B. Screening Analysis

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

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

2. Practicability to manufacture, install, and service. If it is determined that mass production and reliable installation and servicing of a technology in commercial products could not be achieved on the scale necessary to serve the relevant market

at the time of the compliance date of the standard, then that technology will not be considered further.

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

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

(10 CFR part 430, subpart C, appendix A, 4(a)(4) and 5(b))

In sum, if DOE determines that a technology, or a combination of technologies, fails to meet one or more of the above four criteria, it will be excluded from further consideration in the engineering analysis. The reasons for eliminating any technology are discussed below.

The subsequent sections include comments from interested parties pertinent to the screening criteria, DOE's evaluation of each technology option against the screening analysis criteria, and whether DOE determined that a technology option should be excluded ("screened out") based on the screening criteria.

1. Screened-Out Technologies

For conventional ovens, DOE screened out added insulation, bi-radiant oven, halogen lamp oven, no oven door window, and reflective surfaces, for the reasons that follow.

Although some analyses have shown reduced energy consumption by increasing the thickness of the insulation in the oven cabinet walls and doors from two inches to four inches, consumer utility would be negatively impacted by the necessary reduction in cavity volume to maintain the same oven footprint and overall cabinet volume. Therefore, DOE screened out added insulation. The improved insulation design option, however, will be retained, because insulation with a higher density (i.e., greater insulating value) does not require additional space and thus would not impact oven cavity size.

The last working prototype of a bi-radiant oven known to DOE was tested in the 1970s. The technology requires a low-emissivity cavity, electronic controls, and highly absorptive cooking utensils. The need for specialized cookware and cavity maintenance issues negatively impact consumer utility. Therefore, DOE screened out bi-radiant ovens from further analysis.

DOE is not aware of any ovens that utilize halogen lamps alone as the heating element, and no data were found or submitted to demonstrate how efficiently halogen elements alone perform relative to conventional ovens. DOE believes that it would not be practicable to manufacture, install, and service halogen lamps for use in consumer cooking products on the scale necessary to serve the relevant market at the time of the standard's effective date. Therefore, DOE screened out halogen lamp ovens.

Whirlpool commented that oven door windows are a key consumer utility and purchase driver, and there may even be more energy used from increased door openings to check on food (associated with no oven door window) versus looking through the window. (Whirlpool, STD No. 13 at p. 4) DOE notes that the 2009 TSD reported a small annual energy savings associated with no oven door window, but that consumer practices of opening the door to inspect the food while cooking could negate any benefit. Comments during manufacturer interviews and comments from stakeholders in previous rulemakings agreed that removing the window was not a feasible option for most ovens. 63 FR 48038, 48040-48041 (Sep. 8, 1998); 72 FR 64432, 64456 (Nov. 15, 2007). Reduced consumer utility and the potential for increased energy use along with decreased safety due to the additional door openings, justify elimination of this design option from further analysis. In addition, DOE addresses the efficiency impact of double-pane or other highly insulated oven door windows by means of the reduced conduction losses design option, which has been retained for further analysis.

Whirlpool commented that reflective surfaces would be very difficult to implement correctly. Whirlpool stated that there would be reduced consumer savings if the surface gets dirty and reduced consumer functionality from the appearance of stains. (Whirlpool, STD No. 13 at p. 4) In the 2009 TSD, DOE noted that manufacturers have stated that it has been very difficult to obtain satisfactory cooking performance with reflective surfaces and that reflective surfaces degrade after the first baking function and continue to degrade through the life of the product. DOE also noted in the 2009 TSD that is uncertain whether, or how much, energy savings is realizable with this technology option. Because of the uncertainty of the potential energy savings and the general lack of sophistication in the technology in terms of maintaining clean, reflective surfaces over the lifetime of the product, DOE screened out this technology option from further analysis.

2. Remaining Technologies

Based on the screening analysis, DOE considered the design options listed in Table IV-6 for conventional ovens.

**Table IV-6. Remaining Conventional Oven Technology Options**

| |
|---|
| 1. Electronic spark ignition (gas only) |
| 2. Forced convection |
| 3. Improved insulation |
| 4. Improved door seals (standard ovens only) |
| 5. Oven separator (electric only) |
| 6. Reduced conduction losses |
| 7. Reduced vent rate |
| 8. Low-standby-loss electronic controls |
| 9. Optimized burner and cavity design (gas only) |

C. Engineering Analysis

The engineering analysis estimates the cost-efficiency relationship of products at different levels of increased energy efficiency. This relationship serves as the basis for the cost-benefit calculations for consumers, manufacturers, and the Nation. In determining the cost-efficiency relationship, DOE estimates the increase in manufacturer cost associated with increasing the efficiency of products from the baseline up to the maximum technologically feasible ("max-tech") efficiency level for each product class.

1. Methodology

DOE typically structures the engineering analysis using one of three approaches: (1) the design-option approach, which provides the incremental costs of adding design options to a baseline model that will improve its efficiency (i.e., lower its energy use); (2) the efficiency-level approach, which provides the incremental costs of moving to higher energy efficiency levels, without regard to the particular design option(s) used to achieve such increases; and (3) the reverse-engineering (or cost-assessment) approach, which provides "bottom-up" manufacturing cost assessments for achieving various levels of increased efficiency, based on teardown analyses (or physical teardowns) that provide detailed data on costs for parts and material, labor, overhead, and equipment, tooling, conveyor, and space investments for models that operate at particular efficiency levels.

In the February 2014 RFI, DOE stated that in order to create the cost-efficiency relationship, it anticipated having to structure its engineering analysis using a design-option approach, supplemented by reverse engineering (physical teardowns and testing of existing products in the market) to identify the incremental cost and efficiency improvement associated with each design option or design option combination. In addition, DOE stated that it intends to consider cost-efficiency data from the 2009 TSD. 79 FR 8337, 8347 (Feb. 12, 2014). DOE maintained this approach for this NOPR. DOE also conducted interviews with manufacturers of conventional ovens to develop a deeper understanding of the various combinations of design options used to increase product efficiency, and their associated manufacturing costs.

2. Product Testing and Reverse Engineering

To develop the cost-efficiency relationships for the engineering analysis, DOE conducted testing and reverse engineering teardowns on products available on the market. Because there are no performance-based energy conservation standards or energy reporting requirements for conventional cooking products, DOE selected test units based on performance-related features and technologies advertised in product literature. DOE's test sample included 1 gas wall oven, 7 gas ranges, 5 electric wall ovens, and 2 electric ranges for a total of 15 conventional ovens covering all of the product classes considered in this NOPR. The test units are described in detail in chapter 5 of the NOPR TSD.

Each test unit was tested according to the oven test procedure clarifications proposed in the December 2014 TP SNOPR. DOE then conducted physical teardowns on each test unit to develop a manufacturing cost model and to evaluate key design features. DOE supplemented its reverse engineering analyses by conducting manufacturer interviews to obtain feedback on efficiency levels, design options, inputs for the manufacturing cost model, and resulting manufacturing costs. DOE used the results from testing, reverse engineering, and manufacturer interviews to develop the efficiency levels and manufacturing costs discussed in sections IV.C.3 and IV.C.4.

Table IV-7 and Table IV-8 present the testing results for the conventional gas and electric ovens, respectively.

**Table IV-7. DOE Conventional Gas Oven Test Results**

| Test Unit # | Oven Product Class | Burner Input Rate (Btu/h) | Cavity Volume ($ft^3$) | Ignition Type | Convection (Y/N) | IAEC (kBtu/yr) |
|---|---|---|---|---|---|---|
| 1 | Gas Standard – Freestanding | 18,000 | 4.8 | Spark | N | 1341.4 |
| 2 | Gas Standard – Freestanding | 18,000 | 4.8 | Glo-bar | N | 1503.7 |
| 3 | Gas Self-Clean - Freestanding | 18,000 | 5.0 | Glo-bar | Y | 1419.0 |
| 4 | Gas Standard – Freestanding | 16,500 | 4.4 | Glo-bar | N | 1516.6 |
| 5 | Gas Self-Clean – Built-in/Slide-in | 13,000 | 2.8 | Glo-bar | N | 1171.3 |
| 6 | Gas Standard – Freestanding | 28,000 | 5.3 | Glo-bar | Y | 2078.9 |
| 7 | Gas Standard – Built-in/Slide-in | 27,000 | 4.4 | Glo-bar | Y | 1938.0 |
| 8 | Gas Standard – Freestanding | 30,000 | 5.4 | Glo-bar | Y | 2315.1 |

**Table IV-8. DOE Conventional Electric Oven Test Results**

| Test Unit # | Oven Product Class | Heating Element Wattage (W) | Cavity Volume ($ft^3$) | Convection (Y/N) | IAEC (kWh/yr) |
|---|---|---|---|---|---|
| 1 | Electric Self-Clean – Freestanding | 3,000 | 5.9* | Y | 266.2 |

| | | | | | |
|---|---|---|---|---|---|
| 2 | Electric Standard – Freestanding | 2,000 | 2.4 | N | 213.7 |
| 3 | Electric Self-Clean – Built-in/Slide-in | 3,400 | 2.7 | N | 158.7 |
| 4 | Electric Standard – Built-in/Slide-in | 2,600 | 4.3 | N | 287.8 |
| 5 | Electric Self-Clean – Built-in/Slide-in | 2,600 | 4.3 | N | 308.8 |
| 6 | Electric Self-Clean – Built-in/Slide-in | 2,600 | 4.3 | Y | 341.8 |
| 7 | Electric Self-Clean – Built-in/Slide-in | 2,800 | 4.3 | N | 370.0 |

* Test Unit 1 was equipped with an oven separator that allowed for splitting the single cavity into two separate smaller cavities with volumes of 2.7 $ft^3$ and 3.0 $ft^3$.

3. Efficiency Levels

a. Baseline Efficiency Levels

A baseline unit is a product that just meets current Federal energy conservation standards. DOE uses the baseline unit for comparison in several phases of the NOPR analyses, including the engineering analysis, LCC analysis, PBP analysis, and NIA. To determine energy savings that will result from an amended energy conservation standard, DOE compares energy use at each of the higher energy ELs to the energy consumption of the baseline unit. Similarly, to determine the changes in price to the consumer that will result from an amended energy conservation standard, DOE compares the price of a unit at each higher EL to the price of a unit at the baseline.

As part of the February 2014 RFI, DOE initially developed baseline efficiency levels by considering the current standards for conventional gas ovens and the baseline efficiency levels for conventional electric ovens from the previous standards rulemaking analysis. DOE developed tentative baseline efficiency levels for the February 2014 RFI considering the current test procedure in appendix I. The baseline efficiency levels proposed in the February 2014 RFI are presented in Table IV-9. DOE developed baseline efficiency levels for standby mode and off mode based on test data presented in the microwave oven test procedure SNOPR.[25] For fan-only mode, DOE developed baseline efficiency levels considering the additional annual energy consumption in fan-only mode based on test data presented in an SNOPR for the conventional cooking products test procedure. 77 FR 31443, 31449 (May 25, 2012). The efficiency levels presented in the February 2014 RFI are based on an oven with a cavity volume of 3.9 $ft^3$.

**Table IV-9. February 2014 RFI Conventional Oven Baseline Efficiency Levels**

| Product Class | 2009 Standards Rulemaking | | Proposed IAEC |
|---|---|---|---|
| | **Energy Factor (EF)** | **Annual Energy Consumption[26]** | |
| Electric Oven – Standard Oven with or without a Catalytic Line | 0.1066 | 274.9 kWh | 370.0 kWh |
| Electric Oven – Self-Clean Oven | 0.1099 | 266.6 kWh | 360.0 kWh |
| Gas Oven – Standard Oven with or without a Catalytic Line | 0.0536 | 1656.7 kBtu | 2076.5 kBtu |
| Gas Oven – Self-Clean Oven | 0.0540 | 1644.4 kBtu | 1965.0 kBtu |

AHAM commented that, while they agreed fan-only mode should be considered, DOE should gather more data before determining appropriate baseline levels. AHAM stated that DOE should update the data collected during the test procedure rulemaking and request information from manufacturers on the energy use in fan-only mode. (AHAM, STD No. 9 at p. 6) Whirlpool commented that fan-only mode power varies greatly for ovens and depends on the size of the oven, insulation, dual or single speed fan,

[25] In the May 2012 microwave oven test procedure SNOPR, DOE considered test procedure amendments for measuring the standby mode and off mode energy consumption of combined cooking products and, as a result, presented standby power data for microwave ovens, conventional cooking tops, and conventional ovens. 77 FR 28805, 28811 (May 16, 2012).

[26] DOE notes that the previous conventional cooking products test procedure in appendix I included the clock energy consumption. As a result, DOE subtracted the clock energy consumption before adding the standby and off mode energy consumption when considering integrated efficiency levels for this standards rulemaking.

single or double oven, etc. Whirlpool stated that it does not currently have fan-only mode data and cannot comment on the appropriateness of DOE's assumptions for fan-only power. (Whirlpool, STD No. 13 at p. 6)

DOE developed baseline efficiency levels for this NOPR considering both data from the previous standards rulemaking and the measured energy use for the test units. As discussed in section IV.C.2, DOE conducted testing for all units in its test sample to measure IAEC, which includes energy use in active mode (including fan-only mode) and standby mode. DOE also requested energy use data as part of the manufacturer interviews. However, because manufacturers are not currently required to conduct testing according to the DOE test procedure, very little energy use information was available.

The baseline efficiency levels for this NOPR differ from those presented in the February 2014 RFI. DOE compared the minimum cooking efficiency measured in its test sample to the minimum cooking efficiency levels assumed for the previous standards rulemaking analysis. Often, the lowest measured efficiency in DOE's test sample for this NOPR was lower than the values for the previous rulemaking.

To update the baseline efficiency levels for conventional ovens, first DOE derived a new relationship between IAEC and cavity volume as discussed in section I.A.1.c. Using the slope from the previous rulemaking, DOE selected new intercepts corresponding to the ovens in its test sample with the lowest efficiency, so that no ovens in the test sample were cut off by the baseline curve. DOE then set baseline standby energy consumption for conventional ovens equal to that of the oven/range with the highest standby energy consumption in DOE’s test sample to maintain the full functionality of controls for consumer utility. While only DOE test data was available to validate the baseline equation for gas ovens, DOE compared the new baseline equation for electric ovens with data available in the Natural Resources Canada (NRCan) databases, which showed that DOE’s assumptions for slopes and intercepts reasonably represented the market. A detailed discussion of DOE’s derivation of the cavity volume relationship is provided Chapter 5 of the NOPR TSD.

In addition to the product classes proposed in the February 2014 RFI, DOE is also proposing separate product classes for freestanding and built-in/slide-in ovens as discussed in section IV.A.2. As a result, DOE developed separate baseline efficiency levels for each proposed product class based on testing conducted for this NOPR. The proposed baseline efficiency levels for this NOPR are presented in Table IV-10. After receiving manufacturer feedback and reviewing products currently on the market, DOE determined that a cavity volume of 3.9 $ft^3$ no longer represents the market average. Thus, efficiency levels are based on an oven with a cavity volume of 4.3 $ft^3$. Additional details on the development of the proposed baseline efficiency levels are included in chapter 5 of the NOPR TSD.

**Table IV-10. Conventional Oven Baseline Efficiency Levels**

| Product Class | Sub Type | Proposed IAEC* |
|---|---|---|
| Electric Oven – Standard Oven with or without a Catalytic Line | Freestanding | 294.5 kWh |
| | Built-in/Slide-in | 301.5 kWh |
| Electric Oven – Self-Clean Oven | Freestanding | 355.0 kWh |
| | Built-in/Slide-in | 361.1 kWh |
| Gas Oven – Standard Oven with or without a Catalytic Line | Freestanding | 2118.2 kBtu |
| | Built-in/Slide-in | 2128.1 kBtu |
| Gas Oven – Self-Clean Oven | Freestanding | 1883.8 kBtu |
| | Built-in/Slide-in | 1893.7 kBtu |

* Proposed IAEC baseline efficiency levels are normalized based on a 4.3 $ft^3$ volume oven.

b. Incremental Efficiency Levels

For each product class, DOE analyzes several efficiency levels and determines the incremental cost at each of these levels. For the February 2014 RFI, DOE tentatively proposed the incremental efficiency levels presented in Table IV-11 through Table IV-14.. DOE developed these levels based primarily on the efficiency levels presented in the 2009 TSD, adjusted to account for the proposed and amended test procedures. DOE also considered efficiency levels for standby mode and off mode associated with changing conventional linear power supplies to switch-mode power supplies and the Commission of the European Communities Regulation 1275/2008 (hereinafter "Ecodesign regulation"), which requires products to have a maximum standby power of 1 W. 79 FR 8337, 8345-8346 (Feb. 12, 2014).The efficiency levels presented in the February 2014 RFI are based on an oven with a cavity volume of 3.9 $ft^3$.

**Table IV-11. February 2014 RFI Gas Standard Oven Efficiency Levels**

| Level | Efficiency Level Source | Proposed IAEC (kBtu) |
|---|---|---|
| Baseline | 2009 TSD (Electric Glo-bar Ignition) | 2076.5 |
| 1 | 2009 TSD (Electric Glo-bar Ignition) + SMPS | 1932.0 |
| 2 | 2009 TSD (Improved Insulation) + SMPS | 1844.2 |
| 3 | 2009 TSD (2 + Electronic Spark Ignition) + SMPS | 1717.7 |
| 4 | 2009 TSD (3 + Improved Door Seals) + SMPS | 1702.6 |
| 5 | 2009 TSD (4 + Reduced Vent Rate) + SMPS | 1695.4 |
| 6 | 2009 TSD (5 + Reduced Conduction Losses) + SMPS | 1685.9 |
| 7 | 2009 TSD (6 + Forced Convection) + SMPS | 1636.0 |
| 8 | 2009 TSD (7) + 1W Standby | 1499.1 |

**Table IV-12. February 2014 RFI Gas Self-Clean Oven Efficiency Levels**

| Level | Efficiency Level Source | Proposed IAEC (kBtu) |
|---|---|---|
| Baseline | 2009 TSD (Baseline) | 1965.0 |
| 1 | 2009 TSD (Baseline) + SMPS | 1820.5 |
| 2 | 2009 TSD (Forced Convection) + SMPS | 1596.9 |
| 3 | 2009 TSD (2) + Electronic Spark Ignition + SMPS | 1482.3 |
| 4 | 2009 TSD (3 + Improved Door Seals) + SMPS | 1472.0 |
| 5 | 2009 TSD (4 + Reduced Conduction Losses) + SMPS | 1467.8 |
| 6 | 2009 TSD (5) + 1 W Standby | 1330.9 |

**Table IV-13. February 2014 RFI Electric Standard Oven Efficiency Levels**

| Level | Efficiency Level Source | Proposed IAEC (kWh) |
|---|---|---|
| Baseline | 2009 TSD (Baseline) | 370.0 |
| 1 | 2009 TSD (Baseline) + SMPS | 327.7 |
| 2 | 2009 TSD (Reduced Vent Rate) + SMPS | 316.1 |
| 3 | 2009 TSD (2 + Improved Insulation) + SMPS | 304.8 |
| 4 | 2009 TSD (3 + Improved Door Seals) + SMPS | 300.9 |
| 5 | 2009 TSD (4 + Reduced Conduction Losses) + SMPS | 300.3 |
| 6 | 2009 TSD (5 + Forced Convection) + SMPS | 295.2 |
| 7 | 2009 TSD (6) + 1 W Standby | 255.0 |

**Table IV-14. February 2014 RFI Electric Self-Clean Oven Efficiency Levels**

| Level | Efficiency Level Source | Proposed IAEC (kWh) |
|---|---|---|
| Baseline | 2009 TSD (Baseline) | 360.0 |
| 1 | 2009 TSD (Baseline) + SMPS | 317.7 |
| 2 | 2009 TSD (Reduced Conduction Losses) + SMPS | 317.0 |
| 3 | 2009 TSD (2 + Forced Convection) + SMPS | 312.0 |
| 4 | 2009 TSD (3) + 1 W Standby | 271.9 |

In response to the February 2014 RFI, AHAM disagreed with DOE's consideration of the 1-W Ecodesign regulation standby requirements because products sold in the European Union are different from the products sold in the United States. (AHAM, STD No. 9 at p. 6) DOE reevaluated the efficiency levels associated with standby power improvements based on design options identified during product testing and reverse engineering rather than considering an efficiency level specifically associated with the 1-W Ecodesign regulation standby requirement.

Laclede commented that DOE's assumption of 3.5 amp ×110 volt continuous consumption of a typical glo-bar ignition module would mean its consuming 385 W (0.385 kW) per hour. Laclede stated that they believe this may be the worst-case scenario and may make it appear that further efficiency improvements are possible. However, Lacelede stated that further efficiency improvements in glo-bar may lead to higher costs for gas cooking products without sufficient economic benefits. Laclede's testing data indicates glo-bar ignition system consumption of only 0.16 kWh. (Laclede, STD No. 8 at p. 2) Laclede also commented that it appears that DOE considers the electric load from glo-bar ignition systems as of no value to the thermal process of cooking in the oven. Laclede contends this electric resistance load in gas ovens most likely does contribute to the cooking process and DOE will need to provide transparent and robust analyses to explain this relationship. (Laclede, STD No. 8 at pp. 2–3)

Based on DOE's testing of units in its test sample, electric glo-bar ignition systems consumed between 330 W and 450 W and ranged between 0.141 kWh and 0.261 kWh per cycle, with an average of 0.202 kWh per cycle. DOE notes that the glo-bar energy consumption may vary depending on burner and cavity design (e.g., burner input rating, cavity volume). DOE also notes that the glo-bar ignition system was not power on throughout the entire cooking cycle and only consumed power when gas flow to the burner was on, turning off when the burner cycled off. As discussed above, DOE updated its efficiency level analysis based on testing conducted for this NOPR. Any contribution of the glo-bar ignition system to heating the load would be accounted for in testing according to the DOE test procedure in Appendix I.

For the NOPR, DOE developed incremental efficiency levels for each product class by first considering information from the 2009 TSD. In cases where DOE identified design options during testing and reverse engineering teardowns, DOE updated the efficiency levels based on the tested data. In addition to the efficiency levels associated with design options identified in the February 2014 RFI, DOE also included an efficiency level for electric ovens based on a test unit equipped with an oven separator that allowed for reducing the cavity volume that is used for cooking. For conventional gas ovens, DOE's testing showed that energy use was correlated to oven burner and cavity design (e.g., thermal mass of the cavity and racks) and can be significantly reduced when optimized. DOE determined the efficiency level associated with optimized burner and cavity design based on the tested units normalized for cavity volume.

Table IV-15 through Table IV-18 show the incremental efficiency levels for each product class, including whether the efficiency level is from the 2009 TSD or based on testing for the NOPR. The efficiency levels are normalized based on an oven with a cavity volume of 4.3 $ft^3$. Details of the derivations of each efficiency level are provided in chapter 5 of the NOPR TSD.

**Table IV-15. Electric Standard Oven Efficiency Levels**

| Level | Efficiency Level Source | Design Option | Proposed IAEC (kWh) | | Relative % Decrease in IAEC |
|---|---|---|---|---|---|
| | | | Freestanding | Built-in / Slide-in | |
| Baseline | NOPR Testing | Baseline | 294.5 | 301.5 | - |
| 1 | NOPR Testing | Baseline + SMPS | 284.6 | 291.4 | -3.37% |
| 2 | 2009 TSD | 1 + Reduced Vent Rate | 271.7 | 278.2 | -4.51% |
| 3 | 2009 TSD | 2 + Improved Insulation | 259.2 | 265.4 | -4.61% |
| 4 | 2009 TSD | 3 + Improved Door Seals | 254.9 | 261.0 | -1.64% |
| 5 | NOPR Testing | 4 + Forced Convection | 244.6 | 250.5 | -4.04% |
| 6 | NOPR Testing | 5 + Oven Separator | 207.8 | 212.8 | -15.04% |
| 7 | 2009 TSD | 6 + Reduced Conduction Losses | 207.3 | 212.2 | -0.27% |

**Table IV-16. Electric Self-Clean Oven Efficiency Levels**

| Level | Efficiency Level Source | Design Option | Proposed IAEC (kWh) | | Relative % Decrease in IAEC |
|---|---|---|---|---|---|
| | | | Freestanding | Built-in / Slide-in | |
| Baseline | NOPR Testing | Baseline | 355.0 | 361.1 | - |
| 1 | NOPR Testing | Baseline + SMPS | 345.1 | 351.0 | -2.78% |
| 2 | NOPR Testing | 1 + Forced Convection | 327.2 | 332.7 | -5.21% |
| 3 | NOPR Testing | 2 + Oven Separator | 278.9 | 283.7 | -14.74% |
| 4 | 2009 TSD | 3 + Reduced Conduction Losses | 278.1 | 282.9 | -0.29% |

**Table IV-17. Gas Standard Oven Efficiency Levels**

| Level | Efficiency Level Source | Design Option | Proposed IAEC (kBtu) Freestanding | Built-in / Slide-in | Relative % Decrease in IAEC |
|---|---|---|---|---|---|
| Baseline | 2009 TSD | Baseline | 2118.2 | 2128.1 | - |
| 1 | NOPR Testing | Baseline + Optimized Burner/Cavity | 1649.3 | 1657.0 | -22.14% |
| 2 | NOPR Testing | 1 + SMPS | 1614.7 | 1622.2 | -2.10% |
| 3 | NOPR Testing | 2 + Electronic Spark Ignition | 1490.7 | 1497.7 | -7.68% |
| 4 | 2009 TSD | 3 + Improved Insulation | 1414.8 | 1421.5 | -5.09% |
| 5 | 2009 TSD | 4 + Improved Door Seals | 1400.6 | 1407.2 | -1.01% |
| 6 | NOPR Testing | 5 + Forced Convection | 1355.6 | 1362.0 | -3.21% |
| 7 | 2009 TSD | 6 + Reduced Conduction Losses | 1347.0 | 1353.3 | -0.64% |

**Table IV-18. Gas Self-Clean Oven Efficiency Levels**

| Level | Efficiency Level Source | Design Option | Proposed IAEC (kBtu) Freestanding | Built-in / Slide-in | Relative % Decrease in IAEC |
|---|---|---|---|---|---|
| Baseline | 2009 TSD | Baseline | 1883.8 | 1893.7 | - |
| 1 | NOPR Testing | Baseline + SMPS | 1848.2 | 1858.0 | -1.89% |
| 2 | NOPR Testing | 1 + Electronic Spark Ignition | 1668.7 | 1677.5 | -9.71% |
| 3 | NOPR Testing | 2 + Forced Convection | 1596.3 | 1604.7 | -4.34% |
| 4 | 2009 TSD | 3 + Reduced Conduction Losses | 1591.0 | 1599.4 | -0.33% |

c. Relationship between IAEC and Oven Cavity Volume

The conventional oven efficiency levels detailed above are predicated upon baseline ovens with a cavity volume of 4.3 $ft^3$. Based on DOE's testing of conventional gas and electric ovens and discussions with manufacturers, IAEC scales with oven cavity volume due to the fact that larger ovens have higher thermal masses and larger volumes of air (including larger vent rates) than smaller ovens. Because the DOE test procedure for measuring IAEC uses a fixed test load size, larger ovens with higher thermal mass will have a higher measured IAEC. As a result, DOE considered available data to characterize the relationship between IAEC and oven cavity volume.

DOE established the slopes by first evaluating the data from the 2009 TSD, which presented the relationship between measured energy factor (EF) and cavity volume, then translated from EF to IAEC considering the range of cavity volume for the majority of products available on the market. DOE believes these slopes continue to be relevant based on DOE's testing. For electric ovens, DOE considered the data for standard and self-clean ovens available in the Natural Resources Canada product databases.[27] DOE notes that this data is based on the same test procedure considered for the previous DOE standards rulemaking, and as a result, DOE believes the slopes based on these larger datasets are relevant for this analysis. The intercepts for each efficiency level were then chosen so that the equations pass through the desired IAEC corresponding to a particular volume. Values for the slopes and intercepts for each conventional oven product class are presented in Table IV-19 and Table IV-20. Additional details regarding the derivation of the slopes and intercepts for the oven IAEC versus cavity volume relationship are presented in chapter 5 of the NOPR TSD.

[27] Available at: http://oee.nrcan.gc.ca/pml-lmp/index.cfm?action=app.search-recherche&appliance=OVENS_E.

**Table IV-19. Slopes and Intercepts of Electric Oven IAEC versus Cavity Volume Relationship**

| Level | Standard Electric Ovens | | Self-Clean Electric Ovens | |
|---|---|---|---|---|
| | Slope = 31.8 | | Slope = 42.3 | |
| | Freestanding Intercepts | Built-in / Slide-in Intercepts | Freestanding Intercepts | Built-in / Slide-in Intercepts |
| Baseline | 157.74 | 164.78 | 173.12 | 179.18 |
| 1 | 147.82 | 154.62 | 163.24 | 169.13 |
| 2 | 134.98 | 141.47 | 145.28 | 150.86 |
| 3 | 122.45 | 128.64 | 97.05 | 101.81 |
| 4 | 118.20 | 124.29 | 96.24 | 100.98 |
| 5 | 107.91 | 113.75 | - | - |
| 6 | 71.10 | 76.07 | - | - |
| 7 | 70.54 | 75.49 | - | - |

**Table IV-20. Slopes and Intercepts of Gas Oven IAEC versus Cavity Volume Relationship**

| Level | Standard Gas Ovens | | Self-Clean Gas Ovens | |
|---|---|---|---|---|
| | Slope = 214.4 | | Slope = 214.4 | |
| | Freestanding Intercepts | Built-in / Slide-in Intercepts | Freestanding Intercepts | Built-in / Slide-in Intercepts |
| Baseline | 1196.3 | 1206.2 | 961.8 | 971.8 |
| 1 | 727.4 | 735.1 | 926.3 | 936.0 |
| 2 | 692.7 | 700.3 | 746.7 | 755.5 |
| 3 | 568.8 | 575.8 | 674.4 | 682.8 |
| 4 | 492.9 | 499.5 | 669.1 | 677.5 |
| 5 | 478.7 | 485.2 | - | - |
| 6 | 433.7 | 440.1 | - | - |
| 7 | 425.1 | 431.4 | - | - |

4. Incremental Manufacturing Production Cost Estimates

Based on the analyses discussed above, DOE developed the cost-efficiency results for each product class shown in Table IV-21. Where available, DOE developed incremental manufacturing production costs (MPCs) based on manufacturing cost modeling of test units in its sample featuring the proposed design options. For design options that were not observed in DOE's sample of test units for this NOPR, DOE used the incremental manufacturing costs developed as part of the 2009 TSD, then adjusted the values to reflect changes in the Bureau of Labor Statistics' Producer Price Index (PPI) for household cooking appliance manufacturing.[28] DOE notes that the estimated incremental MPCs would be equivalent for the freestanding and built-in/slide-in oven product classes.

**Table IV-21. Conventional Oven Incremental Manufacturing Product Cost (2014$)**

| | Electric Ovens | | Gas Ovens | |
|---|---|---|---|---|
| **Level** | **Standard** | **Self-Clean** | **Standard** | **Self-Clean** |
| Baseline | - | - | - | - |
| 1 | $0.82 | $0.82 | $0.00 | $0.82 |
| 2 | $2.76 | $25.00 | $0.82 | $7.31 |
| 3 | $7.89 | $56.74 | $7.31 | $27.96 |
| 4 | $10.22 | $61.93 | $12.44 | $33.15 |
| 5 | $34.40 | - | $14.77 | - |
| 6 | $66.14 | - | $35.43 | - |
| 7 | $70.36 | - | $39.74 | - |

5. Consumer Utility

In determining whether a standard is economically justified, EPCA requires DOE to consider "any lessening of the utility or the performance of the covered products likely to result from the imposition of the standard." (42 USC 6295(o)(2)(B)(i)(IV))

In a response to the December 2014 TP SNOPR, Sub Zero commented that heavier gauge materials provide customers with extended product life, quality, functionality, and durability. Sub Zero also commented that that full extension oven racks provided in these products provide consumer utility. (Sub Zero, TP No. 20 at p. 3)

[28] Available at: http://www.bls.gov/ppi/.

In response to the February 2014 RFI, AHAM and Whirlpool commented that new energy conservation standards could likely impact the utility of conventional ovens in the following ways:

- A standard could lower burner input rates, which will impact cooking times. Higher burner input rates allow for quicker cooking time, which is an important consumer utility;
- A standard could result in smaller oven windows. Consumers desire larger windows in order to view the food during cooking without opening the oven door. Smaller windows could result in more door openings, and thus increase energy use;
- A standard could also result in the removal of accent lighting and large displays which are preferred consumer features. There is reduced consumer utility from further reducing standby power from what products use today. According to Whirlpool, the market is still pushing manufacturers to add more advanced electronics that use more standby power. (AHAM, STD No. 9 at p. 7; Whirlpool, STD No. 13 at pp. 5, 8).

Accordingly, AHAM and Whirlpool opposed amendment of the existing standards for cooking products. AHAM and Whirlpool stated that not only would amended standards fail to be technologically feasible or economically justified, but they would also impact the utility of cooking products. (AHAM, STD No. 9 at p. 7; Whirlpool, STD No. 13 at p. 8).

DOE conducted the engineering analysis by considering design options that are consistent with products currently on the market, and as a result, DOE did not consider changes that would result in smaller oven windows or removal of accent lighting and display features. In addition, as discussed in section IV.A.2, DOE noted that gas ovens with higher burner input rates did not have significantly faster cooking times when tested according to the DOE test procedure in Appendix I. This is likely due in large part to the fact that gas-cooking products with higher burner input rates marketed as commercial-style often have significantly larger thermal masses, which absorb a significant amount of additional heat. DOE is also not aware of data justifying how added thermal mass improves durability, extends product life, or provides additional consumer utility as compared to standard residential-style ovens. As a result, DOE does not believe that any of the design options and efficiency levels considered in this NOPR would impact the consumer utility of conventional ovens, as suggested by AHAM and Whirlpool. However DOE welcomes continued feedback on this topic, including how the efficiency levels and technology options presented in Table IV-15 through Table IV-18 may affect consumer utility (see section VII.E).

## D. Markups Analysis

The markups analysis develops appropriate markups in the distribution chain to convert the MPC estimates derived in the engineering analysis to consumer prices. At each step in the distribution channel, companies mark up the price of the product to cover business costs and profit margin. For conventional cooking products, the main parties in the distribution chain are manufacturers and retailers.

Thus, DOE analyzed a manufacturer-to-consumer distribution channel consisting of three parties: (1) the manufacturers of the products; (2) the retailers purchasing the products from manufacturers and selling them to consumers; and (3) the consumers who purchase the products.

The manufacturer markup converts MPC to manufacturer selling price (MSP). 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 appliance manufacturing and whose combined product range includes conventional cooking products.

For retailers, DOE developed separate markups for baseline products (baseline markups) and for the incremental cost of more efficient products (incremental markups). Incremental markups are coefficients that relate the change in the MSP of higher-efficiency models to the change in the retailer sales price. DOE relied on economic data from the U.S. Census Bureau to estimate average baseline and incremental markups.[29]

In addition to developing manufacturer and retailer markups, DOE included sales taxes in the final appliance retail prices. DOE used an Internet source, the Sales Tax Clearinghouse, to calculate applicable sales taxes.

[29] U.S. Census, 2007 Annual Retail Trade Survey (ARTS), Electronics and Appliance Stores sectors

Chapter 6 of the NOPR TSD provides details on DOE's development of markups for conventional ovens.

## E. Energy Use Analysis

The energy use analysis provides estimates of the annual energy consumption of ovens at the considered efficiency levels. DOE uses these values in the LCC and PBP analyses and in the NIA to establish the savings in consumer operating costs at various product efficiency levels. DOE developed energy consumption estimates for all product classes analyzed in the engineering analysis.

For the April 2009 Final Rule, DOE utilized a 2004 California Residential Appliance Saturation Study (RASS) [30] and a Florida Solar Energy Center (FSEC) study [31] to establish representative annual energy use values for cooking products. For this NOPR, DOE used an update to the California RASS[32] and a recent FSEC study[33] to establish representative annual energy use values for conventional ovens. These studies confirmed that annual cooking energy use has been consistently declining since the late 1970s.

DOE's energy use analysis estimated the range of energy use of cooking products

[30] California Energy Commission, *California Statewide Residential Appliance Saturation Study* (June 2004).

[31] D.S. Parker. "Research Highlights from a Large Scale Residential Monitoring Study in a Hot Climate," Proceeding of International Symposium on Highly Efficient Use of Energy and Reduction of its Environmental Impact (January 2002).

[32] California Energy Commission, Residential Appliance Saturation Survey (RASS) (2009).

[33] Parker, D., Fairey, P., Hendron, R., "Updated Miscellaneous Electricity Loads and Appliance Energy Usage Profiles for Use in Home Energy Ratings, the Building America Benchmark Procedures and Related Calculations," Florida Solar Energy Center (FSEC) (2010).

in the field, i.e., as they are actually used by consumers. Because energy use by residential cooking products varies greatly based on consumer usage patterns, DOE established a range of energy use. The Energy Information Administration (EIA)'s 2009 Residential Energy Consumption Survey (RECS 2009) is one source for estimating the range of energy use for cooking products. [34] DOE used data from RECS 2009 for this NOPR to establish this range. [35] Although RECS 2009 does not provide the annual energy consumption of the cooking product, it does provide the frequency of cooking use. DOE was unable to use the frequency of use to calculate the annual energy consumption using a bottom-up approach, as data in RECS did not include information about the duration of a cooking event to allow for an annual energy use calculation. DOE therefore relied on California RASS and FSEC studies to establish the annual energy consumption of a cooking product.

From RECS 2009, DOE developed household samples for each product class. For each household using a conventional cooking product, RECS provides data on the frequency of use and number of meals cooked in the following bins: (1) less than once per week, (2) once per week, (3) a few times per week, (4) once per day, (5) two times per day, and (6) three or more times per day. Thus, DOE utilized the frequency of use to define the variability of the annual energy consumption. Conducting the analysis in this manner captures the observed variability in annual energy consumption while

[34] U.S. Department of Energy: Energy Information Administration, Residential Energy Consumption Survey: 2009 RECS Survey Data (2013) (Available at: http://www.eia.gov/consumption/residential/data/2009/).

[35] *RECS 2009* is based on a sample of 12,083 households statistically selected to represent 113.6 million housing units in the United States. *RECS 2009* data are available for 27 geographical areas (including 16 large States) (Available at: *www.eia.gov/consumption/residential/*).

maintaining the average annual energy consumption.  To determine the variability of cooking product energy consumption, DOE first equated the weighted-average cooking frequency from RECS with the average energy use values based on CA RASS and FSEC studies.  DOE then varied the annual energy consumption for each RECS household based on its reported cooking frequency.  Thus, DOE utilized the range in frequency of use to define the variability of the annual energy consumption.

Chapter 7 of the NOPR TSD describes the energy use analysis in detail.

AHAM expressed objections to DOE's reliance on RECS 2009 for analyses, stating that it is difficult, if not impossible, to compare the results to the energy use measured in a controlled test procedure situation. (AHAM, STD No. 9 at p. 7) DOE utilized RECS 2009 only to characterize variability of usage across various consumers. For representative energy use DOE relied on other studies and surveys to establish baseline energy consumption.

Whirlpool noted that cooking product energy use is unique from other major appliances in that there is a wide variation amongst consumers, with consumer behavior as a key determinant. (Whirlpool, STD No. 13 at p. 8) DOE acknowledges that consumer behavior is a key determinant of the eventual energy use by the product. To characterize the variability in usage across consumers, DOE utilized data from RECS 2009, as described above.

F. Life-Cycle Cost and Payback Period Analysis

The purpose of the LCC and PBP analysis is to evaluate the economic impacts of potential energy conservation standards for cooking products on individual consumers. The LCC is the total consumer expense over the life of the product, including purchase and installation expense and operating costs (energy expenditures, repair costs, and maintenance costs). The PBP is the number of years it would take for the consumer to recover the increased costs of purchasing a higher efficiency product through energy savings. To calculate LCC, DOE discounted future operating costs to the time of purchase and summed them over the lifetime of the product.

For any given efficiency level, DOE measures the change in LCC relative to an estimate of the base-case product efficiency distribution. The base-case estimate reflects the market in the absence of new or amended energy conservation standards, including the market for products that exceed the current energy conservation standards. In contrast, the PBP is measured relative to the baseline product.

DOE calculated the LCC and payback periods for conventional ovens for a nationally representative set of housing units selected from RECS 2009. By using a representative sample of households, the analysis captured the variability in energy consumption and energy prices associated with cooking product use.

For each sample household, DOE determined the energy consumption for the cooking product and the appropriate energy price. DOE first calculated the LCC associated with a baseline cooking product for each household. To calculate the LCC savings and PBP associated with products meeting higher efficiency standards, DOE substituted the baseline unit with more efficient designs.

As part of the LCC and PBP analyses, DOE developed data that it used to establish product prices, installation costs, annual household energy consumption, energy prices, maintenance and repair costs, product lifetime, and discount rates. Inputs to the LCC and PBP analysis are categorized as: (1) inputs for establishing the total installed cost and (2) inputs for calculating the operating costs. DOE models the uncertainty and the variability in the inputs to the LCC and PBP analysis using Monte Carlo simulations and probability distributions.[36]

The following sections contain comments on the inputs and key assumptions of DOE's LCC and PBP analysis and explain how DOE took these comments into consideration. Chapter 8 of the TSD accompanying this notice contains detailed discussion of the methodology and data utilized for the LCC and PBP analysis.

[36] The Monte Carlo process statistically captures input variability and distribution without testing all possible input combinations. Therefore, while some atypical situations may not be captured in the analysis, DOE believes the analysis captures an adequate range of situations in which the conventional cooking products operate.

1. Product Costs

To calculate the prices faced by cooking products purchasers, DOE multiplied the manufacturing costs developed from the engineering analysis by the supply chain markups it developed (along with sales taxes).

To project future product prices, DOE examined the electric and gas cooking products Producer Price Index (PPI) for the period 1982-2013. This index, adjusted for inflation, shows a declining trend. The decline for gas cooking products is a little more significant than that for electric cooking products (see appendix 10-D of the NOPR TSD). Based on an exponential fit of the adjusted PPIs, DOE utilized a declining price trend for both electric and gas cooking products as the default case to project future product price.

2. Installation Costs

Installation costs include labor, overhead, and any miscellaneous materials and parts. For this NOPR, DOE used data from the 2013 RS Means Mechanical Cost Data on labor requirements to estimate installation costs for conventional ovens. [37]

In general, DOE estimated that installation costs would be the same for different efficiency levels.

3. Unit Energy Consumption

Section IV.E describes the derivation of annual energy use for conventional

[37] RS Means Company Inc., RS Means Mechanical Cost Data (2013) (Available at http://rsmeans.reedconstructiondata.com/default.aspx).

ovens.

DOE did not find any evidence of a rebound effect, in which consumers use a more efficient appliance more intensively, for conventional ovens. Cooking practices are affected by people's eating habits, which are unlikely to change due to higher product efficiency. DOE requests comment on its decision to not use a rebound effect for cooking products (see issue 11 in section VII.E).

4. Energy Prices

DOE derived marginal residential electricity and natural gas prices for 27 geographic areas.[38]

DOE estimated residential electricity prices for each of the 27 areas based on 2013 data from EIA Form 861, Annual Electric Power Industry Report.[39] DOE first estimated a marginal residential price for each utility, and then calculated an marginal price for each area by weighting each utility with customers in an area by the number of residential customers served in that area.

DOE estimated marginal residential natural gas prices in each of the 27 geographic areas based on 2013 data from the EIA publication Natural Gas Monthly

[38] DOE characterized the geographic distribution into 27 geographic areas to be consistent with the 27 states and group of states reported in RECS 2009.
[39] Utility EIA form 861 submissions for 20132012 are available at http://www.eia.gov/electricity/data/eia861/

publication.[40] DOE calculated a marginal natural gas price for each area by first calculating the average prices for each State, and then calculating a regional price by weighting each State in a region by its population.

To estimate future trends in electricity and natural gas prices, DOE used price forecasts in AEO 2015. To arrive at prices in future years, DOE multiplied the marginal prices described above by the forecast of annual average changes in national-average residential electricity and natural gas prices. Because AEO 2015 forecasts prices only to 2040, DOE used the average rate of change during 2025–2040 to estimate the price trends beyond 2040.

Laclede and the American Gas Association (AGA) suggest that DOE use consumer marginal energy rates when evaluating the LCC for each standard efficiency level. They noted that this approach was recommended by DOE's Advisory Committee on Appliance Energy Efficiency Standards in April 1998. AGA notes that a marginal price analysis reflects incremental changes in natural gas costs most closely associated with changes in the amount of gas consumed. (Laclede, STD No. 8 at p. 4 and AGA, STD No. 7 at p. 2) DOE developed estimates of marginal electricity and natural gas prices for the NOPR analysis.

The spreadsheet tool used to conduct the LCC and PBP analysis allows users to select the AEO 2015 high-growth case or low-growth case price forecasts to estimate the

[40] The EIA Natural Gas Monthly publication is available at http://www.eia.gov/naturalgas/monthly/

sensitivity of the LCC and PBP to different energy price forecasts.

5. Repair and Maintenance Costs

Repair costs are associated with repairing or replacing components that have failed in the appliance. Maintenance costs are associated with maintaining the operation of the equipment.

Typically, small incremental changes in product efficiency incur no, or only very small, changes in repair and maintenance costs over baseline products. For all electric cooking products, DOE did not include any changes in repair and maintenance costs for products more efficient than baseline products.

For gas ovens, DOE determined the repair and maintenance costs associated with different types of ignition systems. Following the approach adopted in the April 2009 Final Rule for electric glo-bar/hot surface ignition systems, DOE estimated an average repair cost of $170 occurring every fifth year during the product's lifetime. For electronic spark ignition systems, DOE estimated an average repair cost of $206 occurring in the tenth year of the product's life. DOE seeks comments from the industry on repair cost estimation (see section VII.E).

See chapter 8 of the TSD accompanying this notice for further information regarding repair and maintenance costs.

6. Product Lifetime

Equipment lifetime is the age at which the equipment is retired from service. DOE used a variety of sources to establish low, average, and high estimates for product lifetime. Utilizing data from Appliance Magazine Market Insight, DOE established average product lifetimes of 15 years for conventional electric ovens and 17 years for conventional gas ovens.[41] DOE characterized the product lifetimes with Weibull probability distributions. See chapter 8 of the TSD accompanying this notice for further details on the sources used to develop product lifetimes, as well as the use of Weibull distributions.

7. Discount Rates

In the calculation of LCC, DOE applies discount rates appropriate to households to estimate the present value of future operating costs. DOE estimated a distribution of residential discount rates for conventional cooking products based on consumer financing costs and opportunity cost of funds related to appliance energy cost savings and maintenance costs.

To establish residential discount rates for the LCC analysis, DOE's approach involved identifying all relevant household debt or asset classes in order to approximate a consumer's opportunity cost of funds related to appliance energy cost savings and maintenance costs. DOE estimated the average percentage shares of the various types of

[41] Appliance Magazine, Market Insight. The U.S. Appliance Industry: Market Value, Life Expectancy & Replacement Picture 2012.

debt and equity by household income group using data from the Federal Reserve Board's Survey of Consumer Finances (SCF) for 1995, 1998, 2001, 2004, 2007, and 2010.[42] Using the SCF and other sources, DOE then developed a distribution of rates for each type of debt and asset by income group to represent the rates that may apply in the year in which amended standards would take effect. DOE assigned each sample household a specific discount rate drawn from one of the distributions. The average rate across all types of household debt and equity and income groups, weighted by the shares of each class, is 5.0 percent. See chapter 8 in the NOPR TSD for further details on the development of consumer discount rates.

8. Compliance Date

The compliance date is the date when a covered product is required to meet a new or amended standard. DOE calculated the LCC and PBP for all customers as if each were to purchase new equipment in the year that compliance with amended standards is required. EPCA, as amended, requires that not later than 6 years after issuance of any final rule establishing or amending a standard, DOE must publish either a notice of determination that standards for the product do not need to be amended, or a NOPR that includes new proposed energy conservation standards. (42 U.S.C. 6295(m)(1)) DOE's last final rule for conventional cooking products was issued on March 31, 2009. Thus, DOE must act by March 31, 2015. (42 U.S.C. 6295(m)(1)(b). Any amended standards

[42] Note that two older versions of the SCF are also available (1989 and 1992). These surveys were not used in this analysis because they do not provide all of the necessary types of data (e.g., credit card interest rates). DOE determines that the 15-year span covered by the six surveys included is sufficiently representative of recent debt and equity shares and interest rates.

would apply to conventional cooking products manufactured three years after the date on which the final amended standard is published. (42 U.S.C. 6295(m)(4)(A)(i)) Therefore, for purposes of its analysis, DOE assumed that a final rule would be published in 2016, which results in 2019 being the first year of compliance with amended standards.

9. Base Case Efficiency Distribution

To accurately estimate the percentage of consumers that would be affected by a particular standard level, DOE estimates the distribution of equipment efficiencies that consumers are expected to purchase under the base case (i.e., the case without amended energy efficiency standards). DOE refers to this distribution of equipment energy efficiencies as a base-case efficiency distribution. This approach reflects the fact that some consumers may already purchase equipment with efficiencies greater than the baseline equipment levels.

DOE did not have market data reflecting the efficiency distribution of cooking products being sold. DOE's Compliance Certification Database provides information on models of gas cooking products that comply with the requirement of not having a standing pilot. In the absence of data on the efficiency distribution of the products being sold in the market, DOE calculated the market share of available efficiency options based on consumer's sensitivity to first cost. DOE treated renters and owners as two separate entities to establish price sensitivities, and used a logit model to characterize historical shipments as a function of price. DOE used shipments data collected by the Market Research Magazine and the PPI for household cooking appliance manufacturers between the years 2002 – 2012, along with the manufacturer cost data from the engineering analysis to analyze factors that influence consumer purchasing decisions of cooking products. Because the data are not sufficient to capture any definite trend in efficiency, DOE used the 2013 distribution (described in Chapter 8 of the NOPR TSD) to represent the market in the compliance year (2019).

Table IV-22 and present market shares of the efficiency levels in the base case for conventional ovens. [43] See chapter 8 of the NOPR TSD for further details on the development of base-case market shares.

**Table IV-22. Conventional Electric Ovens: Base Case Efficiency Distribution**

| **Standard Ovens** | | | | **Self-Clean Ovens** | | | |
|---|---|---|---|---|---|---|---|
| **Standard Level** | **IAEC (kWh) Freestanding** | **IAEC (kWh) Built-in** | **Market Share** | **Standard Level** | **IAEC (kWh) Freestanding** | **IAEC (kWh) Built-in** | **Market Share** |
| Baseline | 294.5 | 301.5 | 40.4% | Baseline | 355.0 | 361.1 | 46.5% |
| 1 | 284.6 | 291.4 | 9.7% | 1 | 345.1 | 351.0 | 15.8% |
| 2 | 271.7 | 278.2 | 9.6% | 2 | 327.2 | 332.7 | 14.0% |
| 3 | 259.2 | 265.4 | 9.3% | 3 | 278.9 | 283.7 | 12.0% |
| 4 | 254.9 | 261.0 | 9.2% | 4 | 278.1 | 282.9 | 11.7% |
| 5 | 244.6 | 250.5 | 8.1% | | | | |
| 6 | 207.8 | 212.8 | 6.9% | | | | |
| 7 | 207.3 | 212.2 | 6.8% | | | | |

[43] For the conventional oven product classes, the efficiency levels are based on an oven with a cavity volume of 3.9 $ft^3$. As discussed in section IV.C.3, DOE developed slopes and intercepts to characterize the relationship between IEAC and cavity volume for each efficiency level.

**Table IV-23. Conventional Gas Ovens: Base Case Efficiency Distribution**

| Standard Ovens | | | | Self-Clean Ovens | | | |
|---|---|---|---|---|---|---|---|
| Standard Level | IAEC (kBtu) | | Market Share | Standard Level | IAEC (kBtu) | | Market Share |
| | Freestanding | Built-in | | | Freestanding | Built-in | |
| Baseline | 2,118.2 | 2,128.1 | 42.5% | Baseline | 1,883.8 | 1,893.7 | 47.5% |
| 1 | 1,649.3 | 1,657.0 | 8.6% | 1 | 1,848.2 | 1,858.0 | 13.6% |
| 2 | 1,614.7 | 1,622.2 | 8.6% | 2 | 1,668.7 | 1,677.5 | 13.4% |
| 3 | 1,490.7 | 1,497.7 | 8.4% | 3 | 1,596.3 | 1,604.7 | 12.8% |
| 4 | 1,414.8 | 1,421.5 | 8.3% | 4 | 1,591.0 | 1,599.4 | 12.6% |
| 5 | 1,400.6 | 1,407.2 | 8.2% | | | | |
| 6 | 1,355.6 | 1,362.0 | 7.8% | | | | |
| 7 | 1,347.0 | 1,353.3 | 7.7% | | | | |

10. Inputs to Payback Period Analysis

The PBP is the amount of time it takes the consumer to recover the additional installed cost of more efficient equipment, compared to baseline equipment, through energy cost savings. PBPs are expressed in years. PBPs 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 are the total installed cost of the product to the customer for each efficiency level and the annual first year operating expenditures for each efficiency level. The PBP calculation uses the same inputs as the LCC analysis, except that energy price trends and discount rates are not needed.

11. Rebuttable-Presumption Payback Period

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

## G. Shipments Analysis

DOE uses projections of product shipments to calculate the national impacts of standards on energy use, NPV, and future manufacturer cash flows. DOE develops shipment projections based on historical data and an analysis of key market drivers for each product. Historical shipments data are used to build up an equipment stock and also to calibrate the shipments model. DOE accounted for three market segments: (1) new construction, (2) existing homes (i.e., replacing failed products), and (3) retired but not replaced. DOE used the retired but not replaced market segment to calibrate the shipments model to historical shipments data.

DOE considered the impacts of prospective standards on product shipments. The combined market of conventional electric and gas cooking products is completely saturated. Thus, DOE concluded that any price increase due to a standard would not impact the overall decision to purchase. However, DOE did implement an impact due to a standard on the efficiency of the product that will likely be purchased. This impact is captured through a change in the efficiency distribution of the market.

Table IV-24 summarizes the approach and data DOE used to derive the inputs to the shipments analysis for the NOPR.

**Table IV-24. Approach and Data Used to Derive the Inputs to the Shipments Analysis**

| Inputs | Approach |
|---|---|
| New Construction Shipments | Determined by multiplying housing forecasts by forecasted saturation of cooking products for new housing. Housing forecasts based on AEO2014 projections. New housing product saturations based on RECS 2009. Forecasted saturations maintained at 2009 levels. |
| Replacements | Determined by tracking total product stock by vintage and establishing the failure of the stock using retirement functions from the LCC and PBP analysis. Retirement functions were based on Weibull lifetime distributions. |
| Retired but not replaced | Used to calibrate shipments model to historical shipments data to account for a decline in the replacement shipments. |
| Historical Shipments | Data sources include U.S. Statistical Review of Appliance Industry and Appliance Magazine. |
| Impacts Due to Efficiency Standards | Not considered due to a fully saturated market. |
| Fuel Switching | Not considered, as no significant movement was observed from historical data. |

To determine new construction shipments, DOE used a forecast of new housing coupled with product market saturation data for new housing. For new housing completions and mobile home placements, DOE adopted the projections from EIA's AEO 2015 through 2040.

DOE estimated replacements using product retirement functions developed from product lifetimes. For this NOPR, DOE used retirement functions based on Weibull distributions.

To reconcile the historical shipments with the model, DOE assumed that every retired unit is not replaced. DOE attributed the reason for this non-replacement to building demolition occurring at the rate of approximately three percent of the retiring units per annum over the period 2013–2048. The assumed not-replaced rate is distributed into 2.8 percent for electric cooking products and 4.1 percent for gas cooking products.

DOE allocated shipments to each of the eight product classes based on the current market share of each class. DOE developed the market shares based on historical data collected from Appliance Magazine Market Research report[44] and U.S. Appliance Industry Statistical Review.[45] The shares are kept constant over time.

AGA voiced concern that the establishment of energy conservation standards for natural gas cooking appliances may result in increased first-cost of these appliances, making them less attractive and leading to potential fuel switching. (AGA, STD No. 7 at p. 2) Because this NOPR considers standards for both electric and natural gas appliances, any increase in the price of the appliance would impact cooking products of both fuel types. As switching typically includes additional installation costs for accessing the new fuel source (e.g. installation of a gas line for gas appliances and installation of electrical lines for electrical appliances), which would outweigh the incremental change in equipment price, DOE determined that fuel-switching would not occur.

[44] Appliance Magazine Market Research. The U.S. Appliance Industry: Market Value, Life Expectancy & Replacement Picture 2012.
[45] Appliance 2011. U.S. Appliance Industry Statistical Review: 2000 to YTD 2011.

For further details on the shipments analysis, please refer to chapter 9 of the NOPR TSD.

H. National Impact Analysis

The NIA assesses the national energy savings and the national NPV of total consumer costs and savings that would be expected to result from amended standards at specific efficiency levels.

DOE used an MS Excel spreadsheet model to calculate the national energy savings and the consumer costs and savings from each TSL.[46] The NIA calculations are based on the annual energy consumption and total installed cost data from the energy use analysis and the LCC analysis. DOE projected the lifetime energy savings, energy cost savings, equipment costs, and NPV of customer benefits for each product class over the lifetime of equipment sold from 2019 through 2048.

DOE evaluated the impacts of proposed standards for conventional ovens by comparing base-case projections with standards-case projections. The base-case projections characterize energy use and customer costs for each product class in the absence of proposed energy conservation standards.

[46] DOE's use of MS Excel as the basis for the spreadsheet models provides interested parties with access to the models within a familiar context. In addition, the TSD and other documentation that DOE provides during the rulemaking help explain the models and how to use them. Interested parties can review DOE's analyses by changing various input quantities within the spreadsheet.

Table IV-25 summarizes the key inputs for the NIA. The sections following provide further details, as does chapter 10 of the NOPR TSD.

**Table IV-25. Inputs for the National Impact Analysis**

| Input | Description |
|---|---|
| Shipments | Annual shipments from shipments model. |
| Compliance date | January 1, 2019. |
| Base case efficiency | Based on the consumer choice model. |
| Standards case efficiency | Based on a "roll up" scenario to establish a 2019 shipment weighted efficiency. |
| Annual energy consumption per unit | Calculated for each efficiency level and product class based on inputs from the energy use analysis. |
| Total installed cost per unit | Calculated by efficiency level using manufacturer selling prices and weighted-average overall markup values. |
| Energy expense per unit | Annual energy use is multiplied by the corresponding average electricity and gas price. |
| Escalation of electricity and gas prices | AEO 2015 forecasts (to 2040) and extrapolation beyond 2040 for electricity and gas prices. |
| Electricity site-to-primary energy conversion | A time series conversion factor; includes electric generation, transmission, and distribution losses. |
| Discount rates | 3% and 7%. |
| Present year | 2014. |

1. Efficiency Trends

A key component of DOE's estimates of national energy savings and NPV is the energy efficiencies forecasted over time. For the base case, in the absence of any historical efficiency data, and absence of an ENERGY STAR program for conventional cooking products, DOE assumed that efficiency would follow the distribution based on consumer choice model. The model responds to changes in product prices, and therefore, is affected by the learning effect on the prices..

To estimate the impact that standards would have in the year compliance becomes required, DOE used a "roll-up" scenario, which assumes that equipment efficiencies in the base case that do not meet the standard level under consideration would "roll up" to meet the new standard level and equipment shipments at efficiencies above the standard level under consideration are not affected. In each standards case, the efficiency distributions remain constant at the 2019 levels for the remainder of the shipments forecast period.

2. National Energy Savings

For each year in the forecast period, DOE calculates the national energy savings for each standard level by multiplying the shipments of ovens by the per-unit annual energy savings. Cumulative energy savings are the sum of the annual energy savings over the lifetime of all equipment shipped during 2019–2048.

The annual energy consumption per unit depends directly on equipment efficiency. DOE used the shipment-weighted energy efficiencies associated with the base case and each standards case, in combination with the annual energy use data, to estimate the shipment-weighted average annual per-unit energy consumption under the base case and standards cases. The national energy consumption is the product of the annual energy consumption per unit and the number of units of each vintage, which depends on shipments. DOE calculates the total annual site energy savings for a given standards case by subtracting total energy use in the standards case from total energy use in the base case. Note that total shipments are the same in the standards cases as in the base case.

DOE converted the site electricity consumption and savings to primary energy (power sector energy consumption) using annual conversion factors derived from the AEO 2014 version of the National Energy Modeling System (NEMS).

The American Public Gas Association (APGA), National Propane Gas Association (NGPA), AGA, and Laclede recommend that DOE incorporate full fuel cycle analysis in the conservation standard. (APGA, STD No. 6 at p. 2, NPGA, STD No. 5 at pp. 1-3, AGA, STD No. 7 at p. 2, and Laclede, STD No. 8 at p. 3) 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 Science, DOE announced its intention to use FFC measures of energy use, GHG emissions and other emissions in the national impact analyses 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 the Federal Register in which DOE explained its determination that NEMS is the most appropriate tool for its FFC analysis and its intention to use NEMS for that purpose. 77 FR 49701 (August 17, 2012). The FFC factors incorporate losses in production and delivery in the case of natural gas (including fugitive emissions), and energy used to produce and deliver the fuels used by power plants. The approach used for this NOPR, and the FFC multipliers that were applied, are described in appendix 10A of the NOPR TSD. DOE continues to work with the Federal Trade Commission (FTC) to make available to the consumer information regarding FFC energy use through the Energy Guide label.  Table IV-26 through Table IV-29 below present the FFC equivalent of IAEC for the considered efficiency levels.

**Table IV-26. Conventional Electric Standard Ovens:  FFC equivalent of IAEC**

| Standard Level | IAEC - Site (*kWh*) | | IAEC - FFC (*kWh*) | |
|---|---|---|---|---|
| | **Freestanding** | **Built-in** | **Freestanding** | **Built-in** |
| Baseline | 294 | 302 | 962 | 985 |
| 1 | 285 | 291 | 930 | 952 |
| 2 | 272 | 278 | 888 | 909 |
| 3 | 259 | 265 | 847 | 867 |
| 4 | 255 | 261 | 833 | 853 |
| 5 | 245 | 250 | 799 | 819 |
| 6 | 208 | 213 | 679 | 695 |
| 7 | 207 | 212 | 677 | 694 |

**Table IV-27. Conventional Electric Self-Clean Ovens:  FFC equivalent of IAEC**

| Standard Level | IAEC - Site (*kWh*) | | IAEC - FFC (*kWh*) | |
|---|---|---|---|---|
| | **Freestanding** | **Built-in** | **Freestanding** | **Built-in** |
| Baseline | 355 | 361 | 1,160 | 1,180 |
| 1 | 345 | 351 | 1,128 | 1,147 |
| 2 | 327 | 333 | 1,069 | 1,087 |
| 3 | 279 | 284 | 912 | 927 |
| 4 | 278 | 283 | 909 | 924 |

**Table IV-28. Conventional Gas Standard Ovens: FFC equivalent of IAEC**

| Standard Level | IAEC – Site (*kBtu*) | | IAEC – FFC (*kBtu*) | |
|---|---|---|---|---|
| | **Freestanding** | **Built-in** | **Freestanding** | **Built-in** |
| Baseline | 2,118 | 2,128 | 2,347 | 2,358 |
| 1 | 1,649 | 1,657 | 1,828 | 1,836 |
| 2 | 1,615 | 1,622 | 1,789 | 1,798 |
| 3 | 1,491 | 1,498 | 1,652 | 1,660 |
| 4 | 1,415 | 1,421 | 1,568 | 1,575 |
| 5 | 1,401 | 1,407 | 1,552 | 1,559 |
| 6 | 1,356 | 1,362 | 1,502 | 1,509 |
| 7 | 1,347 | 1,353 | 1,493 | 1,500 |

**Table IV-29. Conventional Gas Self-Clean Ovens: FFC equivalent of IAEC**

| Standard Level | IAEC – Site (*kBtu*) | | IAEC - FFC (*kBtu*) | |
|---|---|---|---|---|
| | **Freestanding** | **Built-in** | **Freestanding** | **Built-in** |
| Baseline | 1,884 | 1,894 | 2,087 | 2,098 |
| 1 | 1,848 | 1,858 | 2,048 | 2,059 |
| 2 | 1,669 | 1,677 | 1,849 | 1,859 |
| 3 | 1,596 | 1,605 | 1,769 | 1,778 |
| 4 | 1,591 | 1,599 | 1,763 | 1,772 |

3. Net Present Value of Customer Benefit

The inputs for determining the NPV of the total costs and benefits experienced by consumers are: (1) total annual installed cost; (2) total annual savings in operating costs; and (3) a discount factor to calculate the present value of costs and savings. DOE calculates the lifetime net savings for equipment shipped each year as the difference between the base case and each standards case in total savings in lifetime operating costs and total increases in installed costs. DOE calculates lifetime operating cost savings over the life of each considered oven unit in conventional cooking products shipped during the forecast period.

a. Total Annual Installed Cost

The total installed cost includes both the equipment price and the installation cost. For each product class, DOE calculated equipment prices by efficiency level using manufacturer selling prices and weighted-average overall markup values. Because DOE calculated the total installed cost as a function of equipment efficiency, it was able to determine annual total installed costs based on the annual shipment-weighted efficiency levels determined in the shipments model. DOE accounted for the repair and maintenance costs associated with the ignition systems in gas cooking products.

As noted in section IV.F.1, DOE assumed a declining trend in the conventional cooking products prices over the analysis period. In addition, DOE conducted sensitivity analyses using alternative price trends: one in which the rate of decline in prices is greater after 2014, and one in which the rate of decline is lower. These price trends, and the NPV results from the associated sensitivity cases, are described in appendix 10B of the NOPR TSD.

b. Total Annual Operating Cost Savings

The per-unit energy savings were derived as described in section IV.H.2. To calculate future electricity and natural gas prices, DOE applied the projected trend in national-average commercial electricity and natural gas price from the AEO 2015

Reference case, which extends to 2040, to the prices derived in the LCC and PBP analysis. DOE used the trend from 2025 to 2040 to extrapolate beyond 2040. DOE requests comment on its approach (see issue 9 in section VII.E).

In addition, DOE analyzed scenarios that used the energy price projections in the AEO 2015 Low Economic Growth and High Economic Growth cases. These cases have higher and lower energy price trends compared to the Reference case. These price trends, and the NPV results from the associated cases, are described in appendix 10C of the NOPR TSD.

In calculating the NPV, DOE multiplies the net dollar savings in future years by a discount factor to determine their present value. DOE estimates the NPV using both a 3-percent and a 7-percent real discount rate in accordance with guidance provided by the OMB to Federal agencies on the development of regulatory analysis.[47] 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.

[47] U.S. Office of Management and Budget, "Circular A-4: Regulatory Analysis," Section E, (Sept. 17, 2003) (Available at: http://www.whitehouse.gov/omb/circulars_a004_a-4/).

## I. Consumer Subgroup Analysis

In analyzing the potential impact of new or amended standards on individual consumers, DOE evaluates the impact on identifiable subgroups of consumers that may be disproportionately affected by a national standard level. For this NOPR, DOE used RECS 2009 data to analyze the potential effect of standards for residential cooking products on two consumer subgroups: (1) households with low income levels, and (2) households comprised of seniors.

More details on the consumer subgroup analysis can be found in chapter 11 of the TSD accompanying this notice.

## J. Manufacturer Impact Analysis

### 1. Overview

DOE conducted an MIA for residential conventional ovens to estimate the financial impact of new and amended energy conservation standards on manufacturers of these products. The MIA has both quantitative and qualitative aspects. The quantitative part of the MIA relies on the GRIM, an industry cash-flow model customized for residential conventional ovens covered in this rulemaking. The key GRIM inputs are data on the industry cost structure, equipment costs, shipments, and assumptions about manufacturer markups and conversion costs. The key MIA output is INPV. DOE used the GRIM to calculate cash flows using standard accounting principles and to compare changes in INPV between a base case and various TSLs in the standards case. The difference in INPV between the base and standards cases represents the financial impact of new and amended energy conservation standards on residential conventional oven manufacturers. Different sets of assumptions (scenarios) produce different INPV results. The qualitative part of the MIA addresses factors such as manufacturing capacity; characteristics of, and impacts on, any particular subgroup of manufacturers; and impacts on competition.

DOE conducted the MIA for this rulemaking in three phases. In the first phase DOE prepared an industry characterization based on the market and technology assessment and publicly available information. In the second phase, DOE developed an interview guide based on the industry financial parameters derived in the first phase. In the third phase, DOE conducted interviews with a variety of residential conventional cooking product manufacturers that account for more than 85 percent of domestic residential conventional oven sales covered by this rulemaking. During these interviews, DOE discussed engineering, manufacturing, procurement, and financial topics specific to each company and obtained each manufacturer's view of the residential conventional oven industry as a whole. The interviews provided information that DOE used to evaluate the impacts of new and amended standards on manufacturers' cash flows, manufacturing capacities, and direct domestic manufacturing employment levels. Section V.B.2 of this NOPR contains a discussion on the estimated changes in the number of domestic employees involved in manufacturing residential conventional ovens covered by the proposed standards. Section IV.J.4 of this NOPR contains a description of the key issues manufacturers raised during the interviews.

During the third phase, DOE also used the results of the industry characterization analysis in the first phase and feedback from manufacturer interviews to group together manufacturers that exhibit similar production and cost structure characteristics. DOE identified one manufacturer subgroup for a separate impact analysis – small business manufacturers – using the small business employee threshold of 750 total employees published by the Small Business Administration (SBA). This threshold includes all employees in a business' parent company and any other subsidiaries. Based on this classification, DOE identified seven residential conventional oven manufacturers that qualify as small businesses. The manufacturer subgroup analysis is discussed in greater detail in chapter 12 of the NOPR TSD and in section VI.B of this notice.

2. GRIM Analysis and Key Inputs

DOE uses the GRIM to quantify the changes in cash flows over time due to new and amended energy conservation standards. These changes in cash flows result in either a higher or lower INPV for the standards case compared to the base case (the case where a standard is not set). The GRIM analysis uses a standard annual cash flow analysis that incorporates manufacturer costs, markups, shipments, and industry financial information as inputs. It then models changes in costs, investments, and manufacturer margins that result from new and amended standards. The GRIM uses these inputs to calculate a series of annual cash flows beginning with the base year of the analysis, 2015, and continuing to 2048. DOE computes INPV by summing the stream of annual discounted cash flows during the analysis period. DOE used a real discount rate of 9.1 percent for residential conventional cooking product manufacturers. The discount rate estimates were derived from industry corporate annual reports to the Securities and Exchange Commission (SEC 10-Ks). During manufacturer interviews residential conventional oven manufacturers were asked to provide feedback on this discount rate. Most manufacturers agreed that a discount rate of 9.1 was appropriate to use for residential conventional oven manufacturers. Many inputs into the GRIM came from the engineering analysis, the NIA, manufacturer interviews, and other research conducted during the MIA. The major GRIM inputs are described in detail in the following sections.

a. Capital and Product Conversion Costs

DOE expects new and amended energy conservation standards for residential conventional ovens to cause manufacturers to incur conversion costs to bring their production facilities and product designs into compliance with the new and amended standards. For the MIA, DOE classified these conversion costs into two major groups: (1) capital conversion costs, and (2) product conversion costs. Capital conversion costs are investments in property, plant, and equipment necessary to adapt or change existing production facilities such that new product designs can be fabricated and assembled. Product conversion costs are investments in research, development, testing, marketing, certification, and other non-capitalized costs necessary to make product designs comply with new and amended standards.

Using feedback from manufacturer interviews, DOE conducted a top-down analysis to calculate the capital and product conversion costs for residential conventional oven manufacturers. DOE asked manufacturers during interviews to estimate the total capital and product conversion costs they would need to incur to be able to produce each residential conventional oven at specific ELs. DOE then summed these values provided by manufacturers to arrive at total top-down industry conversion cost for residential conventional ovens.

See chapter 12 of this NOPR TSD for a complete description of DOE's assumptions for the capital and product conversion costs.

b. Manufacturer Production Costs

Manufacturing more efficient residential conventional ovens is typically more expensive than manufacturing baseline products due to the need for more costly materials and components. The higher MPCs for these more efficient products can affect the revenue, gross margin, and the cash flows of residential conventional oven manufacturers. DOE developed MPCs for each representative unit at each EL analyzed. DOE purchased a number of units for each product class, then tested and tore down those units to create a unique bill of materials for the purchased unit. Using the bill of materials for each residential conventional oven, DOE was able to create an aggregated MPC based on the material costs from the bill of materials, the labor costs based on an average labor rate and the labor hours necessary to manufacture the residential conventional oven, and the overhead costs, including depreciation, based on a markup applied to the material and labor costs based on the materials used. For more information about MPCs, see section IV.C of this NOPR.

c. Shipment Scenarios

INPV, the key GRIM output, depends on industry revenue, which depends on the quantity and prices of residential conventional ovens shipped in each year of the analysis period. Industry revenue calculations require forecasts of: (1) the total annual shipment volume of residential conventional ovens; (2) the distribution of shipments across product classes (because prices vary by product class); and (3) the distribution of shipments across efficiency levels (because prices vary with efficiency level).

In the base case shipment analysis, DOE develops shipment projections based on historical data and an analysis of key market drivers for each product. In the standards case, DOE modeled a roll-up scenario. The roll-up scenario represents the case in which all shipments in the base case do not meet the new and amended standards shift to now meet the new and amended standard level but do not exceed the new and amended standard. Also, no shipments that meet or exceed the new and amended standards have an increase in efficiency due to the new and amended standards.

For a complete description of the shipments used in the base and standards case see the shipments analysis discussion in section IV.G of this NOPR.

d. Markup Scenarios

As discussed in the previous manufacturer production costs section, the MPCs for each of the product classes of residential conventional ovens are the manufacturers' factory costs for those units. These costs include materials, direct labor, depreciation, and overhead, which are collectively referred to as the cost of goods sold (COGS). The MSP is the price received by residential conventional oven manufacturers from their customers, typically retail outlets, regardless of the downstream distribution channel through which the residential conventional ovens are ultimately sold. The MSP is not the cost the end-user pays for residential conventional ovens because there are typically multiple sales along the distribution chain and various markups applied to each sale. The MSP equals the MPC multiplied by the manufacturer markup. The manufacturer markup covers all the residential conventional oven manufacturer's non-production costs (i.e., selling, general and administrative expenses (SG&A), research and development (R&D), and interest, etc.) as well as profit. Total industry revenue for residential conventional oven manufacturers equals the MSPs at each EL for each product class multiplied by the number of shipments at each EL for each product class.

Modifying these manufacturer markups in the standards case yields a different set of impacts on residential conventional oven manufacturers than in the base case. For the MIA, DOE modeled two standards case markup scenarios for residential conventional ovens to represent the uncertainty regarding the potential impacts on prices and profitability for residential conventional oven manufacturers following the implementation of new energy conservation standards. The two scenarios are: (1) a preservation of gross margin markup scenario, and (2) a preservation of operating profit markup scenario. Each scenario leads to different manufacturer markup values, which, when applied to the inputted MPCs, result in varying revenue and cash flow impacts on residential conventional oven manufacturers.

The preservation of gross margin markup scenario assumes that the COGS for each residential conventional oven is marked up by a flat percentage to cover SG&A expenses, R&D expenses, interest expenses, and profit. This allows manufacturers to preserve the same gross margin percentage in the standards case as in the base case throughout the entire analysis period. This markup scenario represents the upper bound of the residential conventional oven industry profitability in the standards case because residential conventional oven manufacturers are able to fully pass through additional costs due to standards to their consumers.

To derive the preservation of gross margin markup percentages for residential conventional ovens, DOE examined the SEC 10-Ks of all publicly traded residential conventional oven manufacturers to estimate the industry average gross margin percentage. DOE estimated that the manufacturer markup for residential conventional ovens is 1.20 for all residential conventional ovens. Manufacturers were then asked about this industry gross margin percentage derived from SEC 10-Ks during interviews. Residential conventional oven manufacturers agreed that the 1.20 average industry gross margin calculated from SEC 10-Ks was an appropriate estimate to use in the MIA. DOE seeks comment on the use of 1.20 for all residential conventional ovens.

DOE included an alternative markup scenario, the preservation of operating profit markup scenario, because manufacturers stated they do not expect to be able to markup the full cost of production in the standards case, given the highly competitive residential conventional oven market. The preservation of operating profit markup scenario assumes that manufacturers are able to maintain only the base case total operating profit in absolute dollars in the standards case, despite higher production costs and investment. The base case total operating profit is derived from marking up the COGS for each product by the preservation of gross margin markup previously described. In the standards case for the preservation of operating profit markup scenario, DOE adjusted the residential conventional oven manufacturer markups in the GRIM at each TSL to yield approximately the same earnings before interest and taxes in the standards case in the year after the compliance date of the new and amended standards as in the base case. Under this scenario, while manufacturers are not able to earn additional operating profit on higher per unit production costs and the increase in capital and product investments that are required to comply with new and amended energy conservation standards, they are able to maintain the same operating profit in absolute dollars in the standards case that was earned in the base case.

The preservation of operating profit markup scenario represents the lower bound of industry profitability in the standards case. This is because manufacturers are not able to fully pass through the additional costs necessitated by new and amended energy conservation standards, as they are able to do in the preservation of gross margin markup scenario. Therefore, manufacturers earn less revenue in the preservation of operating profit markup scenario than they do in the preservation of gross margin markup scenario.

3. Discussion of Comments

The February 2014 RFI did not focus on the MIA or specifically address any issues relating to the MIA. Therefore, DOE did not receive any MIA specific comments from the February 2014 RFI.

4. Manufacturer Interviews

DOE conducted manufacturer interviews following publication of the February 2014 RFI in preparation for the NOPR analysis. In these interviews, DOE asked manufacturers to describe their major concerns with this residential conventional ovens rulemaking. The following section describes the key issues identified by residential conventional oven manufacturers during these interviews.

a. Premium Products Tend to be Less Efficient

Manufacturers stated that their premium products are usually less efficient than their baseline products. For example, premium ovens  typically have bigger cavities with hidden heat sources under the floor of the cavity. This makes the heat source less direct, therefore decreasing the efficiency. On the other hand, baseline ovens tend to use direct heating sources which are more efficient. Manufacturers warned DOE that focusing only on the efficiency of residential conventional ovens could cause some manufacturers to redesign their products in a way that reduces consumer satisfaction as consumers tend to value premium features.

b. Product Utility

Manufacturers stated that energy efficiency is not one of the most important aspects that consumers value when purchasing residential conventional ovens. Manufacturers state that there are several other factors, such as performance and durability, which consumers value more when purchasing residential conventional ovens. Forcing manufacturers to improve the efficiency of their products could lead to some manufacturers removing premium features that consumers desire from their products, reducing overall consumer utility.

c. Testing and Certification Burdens

Several manufacturers expressed concern about the testing and recertification costs associated with new and amended energy conservation standards for residential conventional ovens. Because testing and certification costs are incurred on a per model basis, if a large number of models are required to be redesigned to meet new and amended standards, manufacturers would be forced to spend a significant amount of money testing and certifying products that were redesigned due to new and amended standards. Manufacturers stated that these testing and certification costs associated with residential conventional ovens could significantly strain their limited resources if these costs were all incurred in the three year time frame from the publication of a final rule to the implementation of the standards.

## K. Emissions Analysis

In the emissions analysis, DOE estimated the reduction in power sector emissions of carbon dioxide ($CO_2$), nitrogen oxides ($NO_x$), sulfur dioxide ($SO_2$), and mercury (Hg) from potential energy conservation standards for conventional ovens. In addition, DOE estimated emissions impacts in production activities (extracting, processing, and transporting fuels) that provide the energy inputs to power plants. These are referred to as "upstream" emissions. Together, these emissions account for the FFC. In accordance with DOE's FFC Statement of Policy,[48] the FFC analysis includes impacts on emissions of methane ($CH_4$) and nitrous oxide ($N_2O$), both of which are recognized as GHGs.

The analysis of power sector emissions uses marginal emissions factors calculated using a methodology based on results published for the AEO 2014 reference case and a set of side cases that implement a variety of efficiency-related policies.[49] The methodology is described in chapter 15 of the NOPR TSD.

Combustion emissions of $CH_4$ and $N_2O$ were estimated using emissions intensity factors published by the U.S. Environmental Protection Agency (EPA), GHG Emissions Factors Hub.[50] Site emissions of $CO_2$ and $NO_X$ (from gas combustion) were estimated using emissions intensity factors from an EPA publication.[51] DOE developed separate

[48] 76 FR 51281 (Aug. 18, 2011). DOE's FFC was amended in 2012 for reasons unrelated to the inclusion of $CH_4$ and $N_2O$. 77 FR 49701 (Aug. 17, 2012).
[49] DOE did not use AEO 2015 for the emissions analysis because it does not provide the side cases that DOE uses to derive marginal emissions factors.
[50] See http://www.epa.gov/climateleadership/inventory/ghg-emissions.html
[51] U.S. Environmental Protection Agency, Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources (1998) (Available at: http://www.epa.gov/ttn/chief/ap42/index.html).

emissions factors for power sector emissions and upstream emissions. The method that DOE used to derive emissions factors is described in chapter 13 of the NOPR TSD.

For $CH_4$ and $N_2O$, DOE calculated emissions reduction in tons and also in terms of units of carbon dioxide equivalent ($CO_2eq$). Gases are converted to $CO_2eq$ by multiplying the physical units by the gas' global warming potential (GWP) over a 100-year time horizon. Based on the Fifth Assessment Report of the Intergovernmental Panel on Climate Change,[52] DOE used GWP values of 28 for $CH_4$ and 265 for $N_2O$.

Because the on-site operation of gas cooking products requires use of fossil fuels and results in emissions of $CO_2$ and $NO_x$ at the sites where these appliances are used, DOE also accounted for the reduction in these site emissions and the associated upstream emissions due to potential standards. Site emissions were estimated using emissions intensity factors from an EPA publication.[53]

EIA prepares the Annual Energy Outlook using NEMS. Each annual version of NEMS incorporates the projected impacts of existing air quality regulations on emissions. AEO 2014 generally represents current legislation and environmental regulations, including recent government actions, for which implementing regulations were available as of October 31, 2013.

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

[53] U.S. Environmental Protection Agency, Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources (1998) (Available at: http://www.epa.gov/ttn/chief/ap42/index.html).

$SO_2$ emissions from affected electric generating units (EGUs) are subject to nationwide and regional emissions cap-and-trade programs. Title IV of the Clean Air Act sets an annual emissions cap on $SO_2$ for affected EGUs in the 48 contiguous states and the District of Columbia (D.C.). $SO_2$ emissions from 28 eastern states and D.C. were also limited under the Clean Air Interstate Rule (CAIR), which created an allowance-based trading program that operates along with the Title IV program. 70 FR 25162 (May 12, 2005). CAIR was remanded to the EPA by the U.S. Court of Appeals for the District of Columbia Circuit but it remained in effect.[54] In 2011, EPA issued a replacement for CAIR, the Cross-State Air Pollution Rule (CSAPR). 76 FR 48208 (Aug. 8, 2011). On August 21, 2012, the D.C. Circuit issued a decision to vacate CSAPR.[55] The court ordered EPA to continue administering CAIR. On April 29, 2014, the U.S. Supreme Court reversed the judgment of the D.C. Circuit and remanded the case for further proceedings consistent with the Supreme Court's opinion.[56] On October 23, 2014, the D.C. Circuit lifted the stay of CSAPR. [57] Pursuant to this action, CSAPR went into effect (and CAIR ceased to be in effect) as of January 1, 2015.

[54] See North Carolina v. EPA, 550 F.3d 1176 (D.C. Cir. 2008); North Carolina v. EPA, 531 F.3d 896 (D.C. Cir. 2008).

[55] See EME Homer City Generation, LP v. EPA, 696 F.3d 7, 38 (D.C. Cir. 2012), cert. granted, 81 U.S.L.W. 3567, 81 U.S.L.W. 3696, 81 U.S.L.W. 3702 (U.S. June 24, 2013) (No. 12-1182).

[56] See EPA v. EME Homer City Generation, 134 S.Ct. 1584, 1610 (U.S. 2014). The Supreme Court held in part that EPA's methodology for quantifying emissions that must be eliminated in certain States due to their impacts in other downwind States was based on a permissible, workable, and equitable interpretation of the Clean Air Act provision that provides statutory authority for CSAPR.

[57] See Georgia v. EPA, Order (D. C. Cir. filed October 23, 2014) (No. 11-1302),

Because AEO 2014 was prepared prior to the Supreme Court's opinion, it assumed that CAIR remains a binding regulation through 2040.  Thus, DOE’s analysis used emissions factors that assume that CAIR, not CSAPR, is the regulation in force. However, the difference between CAIR and CSAPR is not relevant for the purpose of DOE's analysis of emissions impacts from energy conservation standards.

The attainment of emissions caps is typically flexible among EGUs and is enforced through the use of emissions allowances and tradable permits. Beginning in 2016, however, $SO_2$ emissions will decline significantly as a result of the Mercury and Air Toxics Standards (MATS) for power plants. 77 FR 9304 (Feb. 16, 2012). In the final MATS rule, EPA established a standard for hydrogen chloride as a surrogate for acid gas hazardous air pollutants (HAP), and also established a standard for $SO_2$ (a non-HAP acid gas) as an alternative equivalent surrogate standard for acid gas HAP. The same controls are used to reduce HAP and non-HAP acid gas; thus, $SO_2$ emissions will be reduced as a result of the control technologies installed on coal-fired power plants to comply with the MATS requirements for acid gas. AEO 2014 assumes that, in order to continue operating, coal plants must have either flue gas desulfurization or dry sorbent injection systems installed by 2016. Both technologies, which are used to reduce acid gas emissions, also reduce $SO_2$ emissions. Under the MATS, emissions will be far below the cap established by CAIR, so it is unlikely that excess $SO_2$ emissions allowances resulting from the lower electricity demand would be needed or used to permit offsetting increases in $SO_2$ emissions by any regulated EGU. Therefore, DOE believes that energy efficiency standards will reduce $SO_2$ emissions in 2016 and beyond.

CAIR established a cap on $NO_x$ emissions in 28 eastern states and the District of Columbia.[58] Energy conservation standards are expected to have little effect on $NO_x$ emissions in those states covered by CAIR because excess $NO_x$ emissions allowances resulting from the lower electricity demand could be used to permit offsetting increases in $NO_x$ emissions. However, standards would be expected to reduce $NO_x$ emissions in the states not affected by the caps, so DOE estimated $NO_x$ emissions reductions from the standards considered in this proposed rule for these states.

The MATS limit mercury emissions from power plants, but they do not include emissions caps. DOE estimated mercury emissions reduction using emissions factors based on AEO 2014, which incorporates the MATS.

## L. Monetizing Carbon Dioxide and Other Emissions Impacts

As part of the development of this rule, DOE considered the estimated monetary benefits from the reduced emissions of $CO_2$ and $NO_X$ that are expected to result from each of the TSLs considered. In order to make this calculation similar to the calculation of the NPV of consumer benefit, DOE considered the reduced emissions expected to result over the lifetime of equipment shipped in the forecast period for each TSL. This section summarizes the basis for the monetary values used for each of these emissions and presents the values considered in this rulemaking.

[58] CSAPR also applies to $NO_X$, and it would supersede the regulation of $NO_X$ under CAIR. As stated previously, the current analysis assumes that CAIR, not CSAPR, is the regulation in force. The difference between CAIR and CSAPR with regard to DOE's analysis of $NO_X$ is slight.

DOE is relying on a set of values for the SCC that was developed by an interagency process. A summary of the basis for these values is provided below, and a more detailed description of the methodologies used is provided as an appendix to chapter 14 of the NOPR TSD.

1. Social Cost of Carbon

The SCC is an estimate of the monetized damages associated with an incremental increase in carbon emissions in a given year. It is intended to include (but is not limited to) changes in net agricultural productivity, human health, property damages from increased flood risk, and the value of ecosystem services. Estimates of the SCC are provided in dollars per metric ton of carbon dioxide. A domestic SCC value is meant to reflect the value of damages in the United States resulting from a unit change in carbon dioxide emissions, while a global SCC value is meant to reflect the value of damages worldwide.

Under section 1(b)(6) of Executive Order 12866, "Regulatory Planning and Review," 58 FR 51735 (Oct. 4, 1993), agencies must, to the extent permitted by law, assess both the costs and the benefits of the intended regulation and, recognizing that some costs and benefits are difficult to quantify, propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs. The purpose of the SCC estimates presented here is to allow agencies to incorporate the monetized social benefits of reducing $CO_2$ emissions into cost-benefit analyses of regulatory actions. The estimates are presented with an acknowledgement of the many uncertainties involved and with a clear understanding that they should be updated over time to reflect increasing knowledge of the science and economics of climate impacts.

As part of the interagency process that developed the SCC estimates, technical experts from numerous agencies met on a regular basis to consider public comments, explore the technical literature in relevant fields, and discuss key model inputs and assumptions. The main objective of this process was to develop a range of SCC values using a defensible set of input assumptions grounded in the existing scientific and economic literatures. In this way, key uncertainties and model differences transparently and consistently inform the range of SCC estimates used in the rulemaking process.

a. Monetizing Carbon Dioxide Emissions

When attempting to assess the incremental economic impacts of carbon dioxide emissions, the analyst faces a number of challenges. A report from the National Research Council points out that any assessment will suffer from uncertainty, speculation, and lack of information about: (1) future emissions of greenhouse gases; (2) the effects of past and future emissions on the climate system; (3) the impact of changes in climate on the physical and biological environment; and (4) the translation of these environmental impacts into economic damages.[59] As a result, any effort to quantify and monetize the harms associated with climate change will raise serious questions of science, economics, and ethics and should be viewed as provisional.

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

Despite the limits of both quantification and monetization, SCC estimates can be useful in estimating the social benefits of reducing carbon dioxide emissions. The agency can estimate the benefits from reduced (or costs from increased) emissions in any future year by multiplying the change in emissions in that year by the SCC values appropriate for that year. The NPV of the benefits can then be calculated by multiplying each of these future benefits by an appropriate discount factor and summing across all affected years.

It is important to emphasize that the interagency process is committed to updating these estimates as the science and economic understanding of climate change and its impacts on society improves over time. In the meantime, the interagency group will continue to explore the issues raised by this analysis and consider public comments as part of the ongoing interagency process.

b. Development of Social Cost of Carbon Values

In 2009, an interagency process was initiated to offer a preliminary assessment of how best to quantify the benefits from reducing carbon dioxide emissions. To ensure consistency in how benefits are evaluated across Federal agencies, the Administration sought to develop a transparent and defensible method, specifically designed for the rulemaking process, to quantify avoided climate change damages from reduced $CO_2$ emissions. The interagency group did not undertake any original analysis. Instead, it combined SCC estimates from the existing literature to use as interim values until a more comprehensive analysis could be conducted. The outcome of the preliminary assessment by the interagency group was a set of five interim values: global SCC estimates for 2007 (in 2006$) of $55, $33, $19, $10, and $5 per metric ton of $CO_2$. These interim values represented the first sustained interagency effort within the U.S. government to develop an SCC for use in regulatory analysis. The results of this preliminary effort were presented in several proposed and final rules.

c. Current Approach and Key Assumptions

After the release of the interim values, the interagency group reconvened on a regular basis to generate improved SCC estimates. Specifically, the group considered public comments and further explored the technical literature in relevant fields. The interagency group relied on three integrated assessment models commonly used to estimate the SCC: the FUND, DICE, and PAGE models. These models are frequently cited in the peer-reviewed literature and were used in the last assessment of the Intergovernmental Panel on Climate Change (IPCC). Each model was given equal weight in the SCC values that were developed.

Each model takes a slightly different approach to model how changes in emissions result in changes in economic damages. A key objective of the interagency process was to enable a consistent exploration of the three models while respecting the different approaches to quantifying damages taken by the key modelers in the field. An extensive review of the literature was conducted to select three sets of input parameters for these models: climate sensitivity, socio-economic and emissions trajectories, and discount rates. A probability distribution for climate sensitivity was specified as an input into all three models. In addition, the interagency group used a range of scenarios for the socio-economic parameters and a range of values for the discount rate. All other model features were left unchanged, relying on the model developers' best estimates and judgments.

In 2010, the interagency group selected four sets of SCC values for use in regulatory analyses.[60] Three sets of values are based on the average SCC from three integrated assessment models, at discount rates of 2.5 percent, 3 percent, and 5 percent. The fourth set, which represents the 95th-percentile SCC estimate across all three models at a 3-percent discount rate, is included to represent higher-than-expected impacts from climate change further out in the tails of the SCC distribution. The values grow in real terms over time. Additionally, the interagency group determined that a range of values from 7 percent to 23 percent should be used to adjust the global SCC to calculate domestic effects,[61] although preference is given to consideration of the global benefits of reducing $CO_2$ emissions. Table IV-30 presents the values in the 2010 interagency group report, which is reproduced in appendix 14-A of the NOPR TSD.

[60] Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. Interagency Working Group on Social Cost of Carbon, United States Government (February 2010) (Available at: http://www.whitehouse.gov/sites/default/files/omb/inforeg/for-agencies/Social-Cost-of-Carbon-for-RIA.pdf).

[61] It is recognized that this calculation for domestic values is approximate, provisional, and highly speculative. There is no a priori reason why domestic benefits should be a constant fraction of net global damages over time.

**Table IV-30. Annual SCC Values from 2010 Interagency Report, 2010–2050 (in 2007 dollars per metric ton $CO_2$)**

| Year | Discount Rate % | | | |
|---|---|---|---|---|
| | **5** | **3** | **2.5** | **3** |
| | **Average** | **Average** | **Average** | **95th Percentile** |
| 2010 | 4.7 | 21.4 | 35.1 | 64.9 |
| 2015 | 5.7 | 23.8 | 38.4 | 72.8 |
| 2020 | 6.8 | 26.3 | 41.7 | 80.7 |
| 2025 | 8.2 | 29.6 | 45.9 | 90.4 |
| 2030 | 9.7 | 32.8 | 50.0 | 100.0 |
| 2035 | 11.2 | 36.0 | 54.2 | 109.7 |
| 2040 | 12.7 | 39.2 | 58.4 | 119.3 |
| 2045 | 14.2 | 42.1 | 61.7 | 127.8 |
| 2050 | 15.7 | 44.9 | 65.0 | 136.2 |

The SCC values used were generated using the most recent versions of the three integrated assessment models that have been published in the peer-reviewed literature.[62] **Table IV-31** shows the updated sets of SCC estimates from the 2013 interagency update in five-year increments from 2010 to 2050. Appendix 14-B of the NOPR TSD provides the full set of values. The central value that emerges is the average SCC across models at 3-percent discount rate. However, for purposes of capturing the uncertainties involved in regulatory impact analysis, the interagency group emphasizes the importance of including all four sets of SCC values.

[62] Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. Interagency Working Group on Social Cost of Carbon, United States Government (May 2013; revised November 2013) (Available at: http://www.whitehouse.gov/sites/default/files/omb/assets/inforeg/technical-update-social-cost-of-carbon-for-regulator-impact-analysis.pdf).

**Table IV-31. Annual SCC Values from 2013 Interagency Update, 2010–2050 (in 2007 dollars per metric ton $CO_2$)**

| Year | Discount Rate % | | | |
|---|---|---|---|---|
| | **5** | **3** | **2.5** | **3** |
| | **Average** | **Average** | **Average** | **95$^{th}$ Percentile** |
| 2010 | 11 | 32 | 51 | 89 |
| 2015 | 11 | 37 | 57 | 109 |
| 2020 | 12 | 43 | 64 | 128 |
| 2025 | 14 | 47 | 69 | 143 |
| 2030 | 16 | 52 | 75 | 159 |
| 2035 | 19 | 56 | 80 | 175 |
| 2040 | 21 | 61 | 86 | 191 |
| 2045 | 24 | 66 | 92 | 206 |
| 2050 | 26 | 71 | 97 | 220 |

AHAM suggested that DOE rely on the 2010 estimates for SCC until it has resolved all comments on the derivation of the SCC estimates from the 2013 report. (AHAM, STD No. 9, at p. 8) The 2013 report provides an update of the SCC estimates based solely on the latest peer-reviewed version of the models, replacing model versions that were developed up to ten years ago in a rapidly evolving field. It does not revisit other assumptions with regard to the discount rate, reference case socio-economic and emission scenarios, or equilibrium climate sensitivity. Improvements in the way damages are modeled are confined to those that have been incorporated into the latest versions of the models by the developers themselves in the peer-reviewed literature. Given the above, using the 2010 estimates would be inconsistent with DOE's objective of using the best available information in its analyses.

It is important to recognize that a number of key uncertainties remain, and that current SCC estimates should be treated as provisional and revisable since they will evolve with improved scientific and economic understanding. The interagency group also recognizes that the existing models are imperfect and incomplete. The National Research Council report mentioned above points out that there is tension between the goal of producing quantified estimates of the economic damages from an incremental ton of carbon and the limits of existing efforts to model these effects. There are a number of analytical challenges that are being addressed by the research community, including research programs housed in many of the Federal agencies participating in the interagency process to estimate the SCC. The interagency group intends to periodically review and revise those estimates to reflect increasing knowledge of the science and economics of climate impacts, as well as improvements in modeling.

In summary, in considering the potential global benefits resulting from reduced $CO_2$ emissions, DOE used the values from the 2013 interagency report, adjusted to 2014$ using the Gross Domestic Product price deflator. For each of the four SCC cases specified, the values used for emissions in 2015 were $12.2, $41.2, $63.4, and $121 per metric ton avoided (values expressed in 2014$). DOE derived values after 2050 using the relevant growth rates for the 2040-2050 period in the interagency update.

DOE multiplied the $CO_2$ emissions reduction estimated for each year by the SCC value for that year in each of the four cases. To calculate a present value of the stream of monetary values, DOE discounted the values in each of the four cases using the specific discount rate that had been used to obtain the SCC values in each case.

DOE acknowledges the limitations of the SCC estimates, which are discussed in detail in the 2010 interagency group report. Specifically, uncertainties in the assumptions regarding climate sensitivity, as well as other model inputs such as economic growth and emissions trajectories, are discussed and the reasons for the specific input assumptions chosen are explained. However, the three integrated assessment models used to estimate the SCC are frequently cited in the peer-reviewed literature and were used in the last assessment of the IPCC. In addition, new versions of the models that were used in 2013 to estimate revised SCC values were published in the peer-reviewed literature (see appendix 14B of the NOPR TSD for discussion). Although uncertainties remain, the revised estimates that were issued in November, 2013 are based on the best available scientific information on the impacts of climate change. The current estimates of the SCC have been developed over many years, using the best science available, and with input from the public. In November 2013, OMB announced a new opportunity for public comment on the interagency technical support document underlying the revised SCC estimates. 78 FR 70586 (Nov. 26, 2013). OMB is reviewing comments and considering whether further revisions to the SCC estimates are warranted. DOE stands ready to work with OMB and the other members of the interagency working group on further review and revision of the SCC estimates as appropriate.

In addition, it is important to note that the monetized benefits of carbon emission reductions are one factor that DOE considers in its evaluation of the economic justification of proposed standards. As shown in Table I.4, the benefits of these standards in terms of consumer operating cost savings exceed the incremental costs of the standards-compliant products. The benefits of $CO_2$ emission reductions were considered by DOE, but were not determinative in DOE's decision to adopt these standards.

2. Social Cost of Other Air Pollutants

As noted above, DOE has taken into account how amended energy conservation standards would reduce site $NO_X$ emissions nationwide and increase power sector $NO_X$ emissions in those 22 States not affected by the CAIR. DOE estimated the monetized value of net $NO_X$ emissions reductions resulting from each of the TSLs considered for this NOPR based on estimates developed by EPA for 2016, 2020, 2025, and 2030.[63] The values reflect estimated mortality and morbidity per ton of directly emitted $NO_X$ reduced by electricity generating units. EPA developed estimates using a 3-percent and a 7-percent discount rate to discount future emissions-related costs. The values in 2016 are $5,562/ton using a 3-percent discount rate and $4,920/ton using a 7-percent discount rate (2014$). DOE extrapolated values after 2030 using the average annual rate of growth in 2016-2030. DOE multiplied the emissions reduction (tons) in each year by the associated $/ton values, and then discounted each series using discount rates of 3 percent and 7 percent as appropriate.

DOE is evaluating appropriate monetization of avoided $SO_2$ and Hg emissions in energy conservation standards rulemakings. It has not included monetization of these emissions in the current analysis. DOE requests comment on its approach to monetizing emissions reductions for cooking products (see issue 12 in section VII.E)

[63] http://www2.epa.gov/benmap/sector-based-pm25-benefit-ton-estimates

M. Utility Impact Analysis

The utility impact analysis estimates several effects on the power generation industry that would result from the adoption of new or amended energy conservation standards. In the utility impact analysis, DOE analyzes the changes in installed electricity capacity and generation that would result for each TSL. The utility impact analysis is based on published output from the NEMS associated with AEO 2014. NEMS produces the AEO reference case as well as a number of side cases that estimate the economy-wide impacts of changes to energy supply and demand. DOE uses those published side cases that incorporate efficiency-related policies to estimate the marginal impacts of reduced energy demand on the utility sector.[64] The output of this analysis is a set of time-dependent coefficients that capture the change in electricity generation, primary fuel consumption, installed capacity and power sector emissions due to a unit reduction in demand for a given end use. These coefficients are multiplied by the stream of energy savings calculated in the NIA to provide estimates of selected utility impacts of new or amended energy conservation standards. Chapter 15 of the NOPR TSD describes the utility impact analysis in further detail.

N. Employment Impact Analysis

Employment impacts from new or amended energy conservation standards include direct and indirect impacts. Direct employment impacts are any changes in the number of employees of manufacturers of the equipment subject to standards; the MIA

[64] DOE did not use AEO 2015 for the analysis because it does not provide the side cases that DOE uses to derive marginal impact factors.

addresses those impacts. Indirect employment impacts are changes in national employment that occur due to the shift in expenditures and capital investment caused by the purchase and operation of more efficient equipment. Indirect employment impacts from standards consist of the jobs created or eliminated in the national economy, other than in the manufacturing sector being regulated, due to: (1) reduced spending by end users on energy; (2) reduced spending on new energy supply by the utility industry; (3) increased consumer spending on the purchase of new equipment; and (4) the effects of those three factors throughout the economy.

One method for assessing the possible effects on the demand for labor of such shifts in economic activity is to compare sector employment statistics developed by the Labor Department’s Bureau of Labor Statistics (BLS). BLS regularly publishes its estimates of the number of jobs per million dollars of economic activity in different sectors of the economy, as well as the jobs created elsewhere in the economy by this same economic activity. Data from BLS indicate that expenditures in the utility sector generally create fewer jobs (both directly and indirectly) than expenditures in other sectors of the economy. There are many reasons for these differences, including wage differences and the fact that the utility sector is more capital-intensive and less labor-intensive than other sectors. Energy conservation standards have the effect of reducing consumer utility bills. Because reduced consumer expenditures for energy likely lead to increased expenditures in other sectors of the economy, the general effect of efficiency standards is to shift economic activity from a less labor-intensive sector (i.e., the utility sector) to more labor-intensive sectors (e.g., the retail and service sectors). Thus, based on the BLS data alone, DOE believes net national employment may increase because of shifts in economic activity resulting from amended standards.

DOE estimated indirect national employment impacts for the standard levels considered in this NOPR using an input/output model of the U.S. economy called Impact of Sector Energy Technologies, Version 3.1.1 (ImSET).[65] ImSET is a special-purpose version of the "U.S. Benchmark National Input-Output" (I–O) model, which was designed to estimate the national employment and income effects of energy-saving technologies. The ImSET software includes a computer-based I–O model having structural coefficients that characterize economic flows among the 187 sectors most relevant to industrial, commercial, and residential building energy use.

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

[65] M.J. Scott, O.V. Livingston, P.J. Balducci, J.M. Roop, and R.W. Schultz, ImSET 3.1: Impact of Sector Energy Technologies, PNNL-18412, Pacific Northwest National Laboratory (2009) (Available at: www.pnl.gov/main/publications/external/technical_reports/PNNL-18412.pdf).

## V. Analytical Results

The following section addresses the results from DOE's analyses with respect to potential energy conservation standards for conventional ovens. It addresses the TSLs examined by DOE and the projected impacts of each of these levels if adopted as energy conservation standards for conventional ovens. Additional details regarding DOE's analyses are contained in the NOPR TSD supporting this notice.

### A. Trial Standard Levels

DOE analyzed the benefits and burdens of three TSLs for conventional ovens. These TSLs were developed using combinations of efficiency levels for the product classes analyzed by DOE. DOE presents the results for those TSLs in this proposed rule. The results for all efficiency levels that DOE analyzed are in the NOPR TSD.

Table V-1. and Table V-2. presents the TSLs and the corresponding efficiency levels for conventional ovens.[66] TSL 3 represents the maximum technologically feasible ("max-tech") improvements in energy efficiency for all product classes. TSL 2 comprises efficiency levels for all product classes providing the maximum NES with maximum NPV. TSL 1 was configured with standby levels with maximum NES.

[66] For the conventional oven product classes, the efficiency levels are based on an oven with a cavity volume of 3.9 ft. As discussed in section I.A.1.c, DOE developed slopes and intercepts to characterize the relationship between IEAC and cavity volume for each efficiency level.

**Table V-1. Summary of Trial Standard Levels for Ovens, Electric**

| TSL | Electric Standard Ovens, Free-Standing | | Electric Standard Ovens, Built-In/Slide-In | | Electric Self-Clean Ovens, Free-Standing | | Electric Self-Clean Ovens, Built-In/Slide-In | |
|---|---|---|---|---|---|---|---|---|
| | Efficiency Level | IAEC (*kWh/yr*) | Efficiency Level | IAEC (*kWh/yr*) | Efficiency Level | IAEC (*kWh/yr*) | Efficiency Level | IAEC (*kWh/yr*) |
| 1 | 1 | 284.6 | 1 | 291.4 | 1 | 345.1 | 1 | 351.0 |
| 2 | 3 | 259.2 | 3 | 265.4 | 1 | 345.1 | 1 | 351.0 |
| 3 | 7 | 207.3 | 7 | 212.2 | 4 | 278.1 | 4 | 282.9 |

**Table V-2. Summary of Trial Standard Levels for Ovens, Gas**

| TSL | Gas Standard Ovens, Free-Standing | | Gas Standard Ovens, Built-In/Slide-In | | Gas Self-Clean Ovens, Free-Standing | | Gas Self-Clean Ovens, Built-In/Slide-In | |
|---|---|---|---|---|---|---|---|---|
| | Efficiency Level | IAEC (*kBtu/yr*) | Efficiency Level | IAEC (*kBtu/yr*) | Efficiency Level | IAEC (*kBtu/yr*) | Efficiency Level | IAEC (*kBtu/yr*) |
| 1 | Baseline | 2,118.2 | Baseline | 2,128.1 | 1 | 1,848.2 | 1 | 1,858.0 |
| 2 | 4 | 1,414.8 | 4 | 1,421.5 | 2 | 1,668.7 | 2 | 1,677.5 |
| 3 | 7 | 1,347.0 | 7 | 1,353.3 | 4 | 1,591.0 | 4 | 1,599.4 |

Additionally, Table V-3 to Table V-6 illustrate the design and performance related changes that are assumed for each TSL for each product class.

**Table V-3. Summary of Trial Standard Levels and Design Options for Ovens, Electric Standard**

| TSL | Electric Standard Ovens, Free-Standing | | Electric Standard Ovens, Built-In/Slide-In | |
|---|---|---|---|---|
| | Efficiency Level | Design Option | Efficiency Level | Design Option |
| 1 | 1 | 1. SMPS | 1 | 1. SMPS |
| 2 | 3 | 1. SMPS<br>2. Reduced Vent Rate<br>3. Improved Insulation | 3 | 1. SMPS<br>2. Reduced Vent Rate<br>3. Improved Insulation |
| 3 | 7 | 1. SMPS<br>2. Reduced Vent Rate<br>3. Improved Insulation<br>4. Improved Door Seals<br>5. Forced Convection<br>6. Oven Separator<br>7. Reduced Conduction Losses | 7 | 1. SMPS<br>2. Reduced Vent Rate<br>3. Improved Insulation<br>4. Improved Door Seals<br>5. Forced Convection<br>6. Oven Separator<br>7. Reduced Conduction Losses |

**Table V-4. Summary of Trial Standard Levels and Design Options for Ovens, Electric Self-Clean**

| TSL | Electric Self-Clean Ovens, Free-Standing | | Electric Self-Clean Ovens, Built-In/Slide-In | |
|---|---|---|---|---|
| | Efficiency Level | Design Option | Efficiency Level | Design Option |
| 1 | 1 | 1. SMPS | 1 | 1. SMPS |
| 2 | 1 | 1. SMPS | 1 | 1. SMPS |
| 3 | 4 | 1. SMPS<br>2. Forced Convection<br>3. Oven Separator<br>4. Reduced Conduction Losses | 4 | 1. SMPS<br>2. Forced Convection<br>3. Oven Separator<br>4. Reduced Conduction Losses |

**Table V-5. Summary of Trial Standard Levels and Design Options for Ovens, Gas Standard**

| TSL | Gas Standard Ovens, Free-Standing | | Gas Standard Ovens, Built-In/Slide-In | |
|---|---|---|---|---|
| | Efficiency Level | Design Option | Efficiency Level | Design Option |
| 1 | Baseline | - | Baseline | - |
| 2 | 4 | 1. Optimized Burner/Cavity<br>2. SMPS<br>3. Electric Spark Ignition<br>4. Improved Insulation | 4 | 1. Optimized Burner/Cavity<br>2. SMPS<br>3. Electric Spark Ignition<br>4. Improved Insulation |
| 3 | 7 | 1. SMPS<br>2. Optimized Burner/Cavity<br>3. Electric Spark Ignition<br>4. Improved Insulation<br>5. Improved Door Seals<br>6. Forced Convection<br>7. Reduced Conduction Losses | 7 | 1. SMPS<br>2. Optimized Burner/Cavity<br>3. Electric Spark Ignition<br>4. Improved Insulation<br>5. Improved Door Seals<br>6. Forced Convection<br>7. Reduced Conduction Losses |

**Table V-6. Summary of Trial Standard Levels and Design Options for Ovens, Gas Self-Clean**

| TSL | Gas Self-Clean Ovens, Free-Standing | | Gas Self-Clean Ovens, Built-In/Slide-In | |
|---|---|---|---|---|
| | Efficiency Level | Design Option | Efficiency Level | Design Option |
| 1 | 1 | 1. SMPS | 1 | 1. SMPS |
| 2 | 2 | 1. SMPS<br>2. Electronic Spark Ignition | 2 | 1. SMPS<br>2. Electronic Spark Ignition |
| 3 | 4 | 1. SMPS<br>2. Electronic Spark Ignition<br>3. Forced Convection<br>4. Reduced Conduction Losses | 4 | 1. SMPS<br>2. Electronic Spark Ignition<br>3. Forced Convection<br>4. Reduced Conduction Losses |

## B. Economic Justification and Energy Savings

### 1. Economic Impacts on Individual Consumers

DOE analyzed the economic impacts on conventional oven consumers by looking at the effects potential amended standards would have on the LCC and PBP. DOE also examined the impacts of potential standards on consumer subgroups. These analyses are discussed below.

#### a. Life-Cycle Cost and Payback Period

In general, higher-efficiency products affect consumers in two ways: (1) purchase price increases, and (2) 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 savings, energy prices, energy price trends, repair costs, and maintenance costs). The LCC calculation also uses product lifetime and a discount rate. Chapter 8 of the NOPR TSD provides detailed information on the LCC and PBP analyses.

Table V-7 through Table V-22 show the LCC and PBP results for all efficiency levels considered for each conventional oven product class. In the first of each pair of tables, the simple payback is measured relative to the baseline product. In the second table, the LCC savings are measured relative to the base-case efficiency distribution in the compliance year (see section IV.F.8 of this notice).

**Table V-7. Average LCC and PBP Results by Efficiency Level for PC1 Electric Standard Ovens, Free-Standing**

| TSL | Efficiency Level | Average Costs 2014$ | | | | Simple Payback years |
|---|---|---|---|---|---|---|
| | | Installed Cost | First Year's Operating Cost | Lifetime Operating Cost | LCC | |
| 1 | 1 | $558 | $16 | $191 | $748 | 0.9 |
| 2 | 3 | $568 | $15 | $174 | $742 | 4.0 |
| 3 | 7 | $653 | $12 | $142 | $795 | 17.5 |

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

**Table V-8. Average LCC Savings Relative to the Base-Case Efficiency Distribution for PC1 Electric Standard Ovens, Free-Standing**

| TSL | Efficiency Level | Life-Cycle Cost Savings | |
|---|---|---|---|
| | | % of Consumers that Experience | Average Savings* |
| | | Net Cost | 2014$ |
| 1 | 1 | 0% | $13.96 |
| 2 | 3 | 12% | $15.18 |
| 3 | 7 | 82% | ($37.60) |

*The calculation does not include households with zero LCC savings (no impact).

**Table V-9. Average LCC and PBP Results by Efficiency Level for PC2 Electric Standard Ovens, Built-In/Slide-In**

| TSL | Efficiency Level | Average Costs 2014$ | | | | Simple Payback years |
|---|---|---|---|---|---|---|
| | | Installed Cost | First Year's Operating Cost | Lifetime Operating Cost | LCC | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | 1 | $584 | $16 | $190 | $775 | 0.9 |
| 2 | 3 | $594 | $15 | $174 | $768 | 4.0 |
| 3 | 7 | $680 | $12 | $142 | $821 | 17.5 |

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

**Table V-10. Average LCC Savings Relative to the Base-Case Efficiency Distribution for PC2 Electric Standard Ovens, Built-In/Slide-In**

| TSL | Efficiency Level | Life-Cycle Cost Savings | |
|---|---|---|---|
| | | % of Consumers that Experience | Average Savings* |
| | | Net Cost | 2014$ |
| 1 | 1 | 0% | $14.11 |
| 2 | 3 | 12% | $15.25 |
| 3 | 7 | 82% | ($37.64) |

*The calculation does not include households with zero LCC savings (no impact).

**Table V-11. Average LCC and PBP Results by Efficiency Level for PC3 Electric Self-Clean Ovens, Free-Standing**

| TSL | Efficiency Level | Average Costs 2014$ | | | | Simple Payback years |
|---|---|---|---|---|---|---|
| | | Installed Cost | First Year's Operating Cost | Lifetime Operating Cost | LCC | |
| 1,2 | 1 | $602 | $22 | $251 | $853 | 0.9 |
| 3 | 4 | $686 | $18 | $211 | $897 | 18.1 |

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

**Table V-12. Average LCC Savings Relative to the Base-Case Efficiency Distribution for PC3 Electric Self-Clean Ovens, Free-Standing**

| TSL | Efficiency Level | Life-Cycle Cost Savings | |
|---|---|---|---|
| | | % of Consumers that Experience | Average Savings* |
| | | Net Cost | 2014$ |
| 1,2 | 1 | 0% | $14.10 |
| 3 | 4 | 76% | ($27.79) |

*The calculation does not include households with zero LCC savings (no impact).

**Table V-13. Average LCC and PBP Results by Efficiency Level for PC4 Electric Self-Clean Ovens, Built-In/Slide-In**

| TSL | Efficiency Level | Average Costs 2014$ | | | | Simple Payback years |
|---|---|---|---|---|---|---|
| | | Installed Cost | First Year's Operating Cost | Lifetime Operating Cost | LCC | |
| 1,2 | 1 | $628 | $22 | $252 | $880 | 0.9 |
| 3 | 4 | $712 | $18 | $212 | $924 | 18.1 |

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

**Table V-14 Average LCC Savings Relative to the Base-Case Efficiency Distribution for PC4 Electric Self-Clean Ovens, Built-In/Slide-In**

| TSL | Efficiency Level | Life-Cycle Cost Savings | |
|---|---|---|---|
| | | % of Consumers that Experience | Average Savings* |
| | | Net Cost | 2014$ |
| 1,2 | 1 | 0% | $14.20 |
| 3 | 4 | 76% | ($27.80) |

*The calculation does not include households with zero LCC savings (no impact).

**Table V-15. Average LCC and PBP Results by Efficiency Level for PC5 Gas Standard Ovens, Free-Standing**

| TSL | Efficiency Level | Average Costs 2014$ | | | | Simple Payback years |
|---|---|---|---|---|---|---|
| | | Installed Cost | First Year's Operating Cost | Lifetime Operating Cost | LCC | |
| 1 | Baseline | $602 | $20 | $600 | $1,202 | -- |
| 2 | 4 | $619 | $9 | $277 | $896 | 1.7 |
| 3 | 7 | $656 | $9 | $277 | $933 | 5.3 |

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

**Table V-16 Average LCC Savings Relative to the Base-Case Efficiency Distribution for PC5 Gas Standard Ovens, Free-Standing**

| TSL | Efficiency Level | Life-Cycle Cost Savings | |
|---|---|---|---|
| | | % of Consumers that Experience | Average Savings* |
| | | Net Cost | 2014$ |
| 1 | Baseline | 0% | --- |
| 2 | 4 | 0% | $289.73 |
| 3 | 7 | 24% | $178.91 |

*The calculation does not include households with zero LCC savings (no impact).

**Table V-17. Average LCC and PBP Results by Efficiency Level for PC6 Gas Standard Ovens, Built-In/Slide-In**

| TSL | Efficiency Level | Average Costs 2014$ | | | | Simple Payback years |
|---|---|---|---|---|---|---|
| | | Installed Cost | First Year's Operating Cost | Lifetime Operating Cost | LCC | |
| 1 | Baseline | $628 | $20 | $600 | $1,228 | -- |
| 2 | 4 | $645 | $9 | $277 | $922 | 1.7 |
| 3 | 7 | $682 | $9 | $277 | $959 | 5.3 |

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

**Table V-18 Average LCC Savings Relative to the Base-Case Efficiency Distribution for PC6 Gas Standard Ovens, Built-In/Slide-In**

| TSL | Efficiency Level | Life-Cycle Cost Savings | |
|---|---|---|---|
| | | % of Consumers that Experience | Average Savings* |
| | | Net Cost | 2014$ |
| 1 | Baseline | 0% | --- |
| 2 | 4 | 0% | $289.77 |
| 3 | 7 | 24% | $178.92 |

*The calculation does not include households with zero LCC savings (no impact).

**Table V-19 Average LCC and PBP Results by Efficiency Level for PC7 Gas Self-Clean Ovens, Free-Standing**

| TSL | Efficiency Level | Average Costs 2014$ | | | | Simple Payback years |
|---|---|---|---|---|---|---|
| | | Installed Cost | First Year's Operating Cost | Lifetime Operating Cost | LCC | |
| 1 | 1 | $718 | $20 | $612 | $1,329 | 0.8 |
| 2 | 2 | $726 | $13 | $334 | $1,060 | 1.2 |
| 3 | 4 | $762 | $13 | $333 | $1,094 | 5.4 |

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

**Table V-20. Average LCC Savings Relative to the Base-Case Efficiency Distribution for PC7 Gas Self-Clean Ovens, Free-Standing**

| TSL | Efficiency Level | Life-Cycle Cost Savings | |
|---|---|---|---|
| | | % of Consumers that Experience | Average Savings* |
| | | Net Cost | 2014$ |
| 1 | 1 | 0% | $18.02 |
| 2 | 2 | 0% | $282.80 |
| 3 | 4 | 27% | $165.73 |

*The calculation does not include households with zero LCC savings (no impact).

**Table V-21 Average LCC and PBP Results by Efficiency Level for PC8 Gas Self-Clean Ovens, Built-In/Slide-In**

| TSL | Efficiency Level | Average Costs 2014$ | | | | Simple Payback years |
|---|---|---|---|---|---|---|
| | | Installed Cost | First Year's Operating Cost | Lifetime Operating Cost | LCC | |
| 1 | 1 | $744 | $20 | $612 | $1,355 | 0.8 |
| 2 | 2 | $752 | $13 | $334 | $1,086 | 1.2 |
| 3 | 4 | $788 | $13 | $333 | $1,120 | 5.4 |

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

**Table V-22. Average LCC Savings Relative to the Base-Case Efficiency Distribution for PC8 Gas Self-Clean Ovens, Built-In/Slide-In**

| TSL | Efficiency Level | Life-Cycle Cost Savings | |
|---|---|---|---|
| | | % of Consumers that Experience | Average Savings* |
| | | Net Cost | 2014$ |
| 1 | 1 | 0% | $18.03 |
| 2 | 2 | 0% | $282.85 |
| 3 | 4 | 27% | $165.75 |

*The calculation does not include households with zero LCC savings (no impact).

b. Consumer Subgroup Analysis

As described in section IV.I of this notice, DOE determined the impact of the considered TSLs on low-income households and senior-only households. Table V-23 through Table V-30 compare the average LCC savings and PBP at each efficiency level for the two consumer subgroups, along with the average LCC savings for the entire sample. In most cases, the average LCC savings and PBP for low-income households and senior-only households at the considered efficiency levels are not substantially different from the average for all households. Chapter 11 of the NOPR TSD presents the complete LCC and PBP results for the subgroups.

**Table V-23. Comparison of Average LCC Savings for Consumer Subgroups and All Households for PC1 Electric Standard Ovens, Free-Standing**

| TSL | Average Life-Cycle Cost Savings (2014$) | | | Simple Payback Period (years) | | |
|---|---|---|---|---|---|---|
| | Low-income households | Senior-only households | All Households | Low-income households | Senior-only households | All Households |
| 1 | $13.88 | $14.00 | $13.96 | 0.9 | 0.9 | 0.9 |
| 2 | $18.70 | $12.28 | $15.18 | 3.6 | 4.4 | 4.0 |
| 3 | ($28.75) | ($45.09) | ($37.60) | 14.9 | 20.6 | 17.5 |

**Table V-24. Comparison of Average LCC Savings for Consumer Subgroups and All Households for PC2 Electric Standard Ovens, Built-In/Slide-In**

| | Average Life-Cycle Cost Savings (2014$) | | | Simple Payback Period (years) | | |
|---|---|---|---|---|---|---|
| TSL | Low-income households | Senior-only households | All Households | Low-income households | Senior-only households | All Households |
| 1 | $14.06 | $14.11 | $14.11 | 0.9 | 0.9 | 0.9 |
| 2 | $18.79 | $12.34 | $15.25 | 3.6 | 4.4 | 4.0 |
| 3 | ($28.80) | ($45.13) | ($37.64) | 14.9 | 20.6 | 17.5 |

**Table V-25. Comparison of Average LCC Savings for Consumer Subgroups and All Households PC3 Electric Self-Clean Ovens, Free-Standing**

| | Average Life-Cycle Cost Savings (2014$) | | | Simple Payback Period (years) | | |
|---|---|---|---|---|---|---|
| TSL | Low-income households | Senior-only households | All Households | Low-income households | Senior-only households | All Households |
| 1,2 | $13.98 | $14.19 | $14.10 | 0.9 | 0.9 | 0.9 |
| 3 | ($18.98) | ($32.84) | ($27.79) | 15.2 | 20.3 | 18.1 |

**Table V-26. Comparison of Average LCC Savings for Consumer Subgroups and All Households PC4 Electric Self-Clean Ovens, Built-In/Slide-In**

| | Average Life-Cycle Cost Savings (2014$) | | | Simple Payback Period (years) | | |
|---|---|---|---|---|---|---|
| TSL | Low-income households | Senior-only households | All Households | Low-income households | Senior-only households | All Households |
| 1,2 | $14.11 | $14.27 | $14.20 | 0.9 | 0.9 | 0.9 |
| 3 | ($18.99) | ($32.84) | ($27.80) | 15.2 | 20.3 | 18.1 |

**Table V-27. Comparison of Average LCC Savings for Consumer Subgroups and All Households PC5 Gas Standard Ovens, Free-Standing**

| | Average Life-Cycle Cost Savings (2014$) | | | Simple Payback Period (years) | | |
|---|---|---|---|---|---|---|
| TSL | Low-income households | Senior-only households | All Households | Low-income households | Senior-only households | All Households |
| 1 | $0.00 | $0.00 | $0.00 | -- | -- | -- |
| 2 | $314.79 | $282.03 | $289.73 | 1.4 | 1.8 | 1.7 |
| 3 | $197.33 | $173.10 | $178.91 | 4.4 | 5.7 | 5.3 |

**Table V-28. Comparison of Average LCC Savings for Consumer Subgroups and All Households for PC6 Gas Standard Oven, Built-In/Slide-In**

| | Average Life-Cycle Cost Savings (2014$) | | | Simple Payback Period (years) | | |
|---|---|---|---|---|---|---|
| TSL | Low-income households | Senior-only households | All Households | Low-income households | Senior-only households | All Households |
| 1 | $0.00 | $0.00 | $0.00 | -- | -- | -- |
| 2 | $314.84 | $282.07 | $289.77 | 1.4 | 1.8 | 1.7 |
| 3 | $197.34 | $173.11 | $178.92 | 4.4 | 5.7 | 5.3 |

**Table V-29. Comparison of Average LCC Savings for Consumer Subgroups and All Households for PC7 Gas Self-Clean Ovens, Free-Standing**

| TSL | Average Life-Cycle Cost Savings (2014$) | | | Simple Payback Period (years) | | |
|---|---|---|---|---|---|---|
| | **Low-income households** | **Senior-only households** | **All Households** | **Low-income households** | **Senior-only households** | **All Households** |
| 1 | $17.28 | $18.39 | $18.02 | 0.8 | 0.7 | 0.8 |
| 2 | $298.61 | $278.34 | $282.80 | 1.0 | 1.3 | 1.2 |
| 3 | $176.87 | $162.47 | $165.73 | 4.7 | 5.7 | 5.4 |

**Table V-30. Comparison of Average LCC Savings for Consumer Subgroups and All Households for PC8 Gas Self-Clean Oven, Built-In/Slide-In**

| TSL | Average Life-Cycle Cost Savings (2014$) | | | Simple Payback Period (years) | | |
|---|---|---|---|---|---|---|
| | **Low-income households** | **Senior-only households** | **All Households** | **Low-income households** | **Senior-only households** | **All Households** |
| 1 | $17.30 | $18.40 | $18.03 | 0.8 | 0.7 | 0.8 |
| 2 | $298.68 | $278.39 | $282.85 | 1.0 | 1.3 | 1.2 |
| 3 | $176.89 | $162.48 | $165.75 | 4.7 | 5.7 | 5.4 |

c. Rebuttable Presumption Payback

As discussed above, EPCA provides a rebuttable presumption that an energy conservation standard is economically justified if the increased purchase cost for a product that meets the standard is less than three times the value of the first-year energy savings resulting from the standard. In calculating a rebuttable presumption payback period for the considered standard levels, DOE used discrete values rather than distributions for input values, and, as required by EPCA, based the energy use calculation on the DOE test procedures for conventional cooking products. As a result, DOE calculated a single rebuttable presumption payback value, and not a distribution of payback periods, for each efficiency level.

Table V-31 presents the rebuttable-presumption payback periods for the considered TSLs. While DOE examined the rebuttable-presumption criterion, it considered whether the standard levels considered for this rulemaking are economically justified through a more detailed analysis of the economic impacts of those levels pursuant to 42 U.S.C. 6295(o)(2)(B)(i). The results of that analysis serve as the basis for DOE to evaluate the economic justification for a potential standard level (thereby supporting or rebutting the results of any preliminary determination of economic justification).

**Table V-31. Conventional Ovens: Rebuttable PBPs (years)**

| Product Class | Trial Standard Level | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| PC1: Electric Standard Ovens, Free-Standing | 0.9 | 2.3 | 8.5 |
| PC2: Electric Standard Ovens, Built-In/Slide-In | 0.8 | 2.3 | 8.3 |
| PC3: Electric Self-Clean Ovens, Free-Standing | 0.9 | 0.9 | 8.4 |
| PC4: Electric Self-Clean Ovens, Built-In/Slide-In | 0.9 | 0.9 | 8.3 |
| PC5: Gas Standard Ovens, Free-Standing | -- | 2.4 | 7.0 |
| PC6: Gas Standard Ovens, Built-In/Slide-In | -- | 2.4 | 6.9 |
| PC7: Gas Self-Clean Ovens, Free-Standing | 3.1 | 4.6 | 15.3 |
| PC8: Gas Self-Clean Ovens, Built-In/Slide-In | 3.1 | 4.6 | 15.2 |

2. Economic Impacts on Manufacturers

DOE performed an MIA to estimate the impact of new and amended energy conservation standards on manufacturers of residential conventional ovens. The following sections describe the expected impacts on residential conventional oven manufacturers at each TSL. Chapter 12 of this NOPR TSD explains the MIA in further detail.

a. Industry Cash-Flow Analysis Results

Table V-32 through Table V-33 depict the financial impacts (represented by changes in INPV) of new and amended energy conservation standards on residential conventional oven manufacturers as well as the conversion costs that DOE estimates manufacturers would incur at each TSL. To evaluate the range of cash flow impacts on the residential conventional oven industry, DOE modeled two markup scenarios that correspond to the range of anticipated market responses to new and amended standards. Each markup scenario results in a unique set of cash flows and corresponding industry values at each TSL.

In the following discussion, the INPV results refer to the difference in industry value between the base case and the standards case that result from the sum of discounted cash flows from the base year (2015) through the end of the analysis period. The results also discuss the difference in cash flows between the base case and the standards case in the year before the compliance date for new and amended energy conservation standards. This figure represents the size of the required conversion costs relative to the cash flow generated by the residential conventional oven industry in the absence of new and amended energy conservation standards. In the engineering analysis, DOE enumerates common technology options that achieve the efficiencies for each of the product classes. For descriptions of these technology options and the required efficiencies at each TSL, see section IV.C and section V.A respectively of this NOPR.

To assess the upper (less severe) end of the range of potential impacts on residential conventional oven manufacturers, DOE modeled a preservation of gross margin markup scenario. This scenario assumes that in the standards case, manufacturers would be able to pass along all the higher production costs required for more efficient products to their consumers. Specifically, the industry would be able to maintain its average base case gross margin (as a percentage of revenue) despite the higher product costs in the standards case. In general, the larger the product price increases, the less likely manufacturers are to achieve the cash flow from operations calculated in this scenario because it is less likely that manufacturers would be able to fully mark up these larger cost increases.

To assess the lower (more severe) end of the range of potential impacts on the residential conventional oven manufacturers, DOE modeled the preservation of operating profit markup scenario. This scenario represents the lower end of the range of potential impacts on manufacturers because no additional operating profit is earned on the higher product costs, eroding profit margins as a percentage of total revenue.

Table V-32 and Table V-33 present the projected results for residential conventional ovens under the preservation of gross margin and preservation of operating profit markup scenarios. DOE examined results for all product classes together since most manufacturers produce both gas and electric ovens.

**Table V-32. Manufacturer Impact Analysis for Residential Conventional Ovens – Preservation of Gross Margin Markup Scenario**

| | Units | Base Case | Trial Standard Level | | |
|---|---|---|---|---|---|
| | | | 1 | 2 | 3 |
| **INPV** | (2014$ millions) | 783.5 | 762.8 | 702.6 | 140.6 |
| **Change in INPV** | (2014$ millions) | - | (20.7) | (80.9) | (642.9) |
| | (%) | - | (2.6) | (10.3) | (82.0) |
| **Product Conversion Costs** | (2014$ millions) | - | 4.3 | 67.9 | 401.5 |
| **Capital Conversion Costs** | (2014$ millions) | - | 9.0 | 42.0 | 528.0 |
| **Total Conversion Costs** | (2014$ millions) | - | 13.3 | 109.9 | 929.5 |

*DOE presents a range of potential employment impacts. Numbers in parentheses indicate negative numbers

**Table V-33. Manufacturer Impact Analysis for Residential Conventional Ovens – Preservation of Operating Profit Markup Scenario**

| | Units | Base Case | Trial Standard Level | | |
|---|---|---|---|---|---|
| | | | 1 | 2 | 3 |
| **INPV** | (2014$ millions) | 783.5 | 762.1 | 697.1 | 56.0 |
| **Change in INPV** | (2014$ millions) | - | (21.4) | (86.4) | (727.5) |
| | (%) | - | (2.7) | (11.0) | (92.9) |
| **Product Conversion Costs** | (2014$ millions) | - | 4.3 | 67.9 | 401.5 |
| **Capital Conversion Costs** | (2014$ millions) | - | 9.0 | 42.0 | 528.0 |
| **Total Conversion Costs** | (2014$ millions) | - | 13.3 | 109.9 | 929.5 |

TSL 1 sets the efficiency level at baseline for two product classes (gas standard ovens, free-standing; and gas standard ovens, built-in/slide-in), and EL 1 for six product classes (electric standard ovens, free-standing; electric standard ovens, built-in/slide-in; electric self-clean ovens, free-standing; electric self-clean ovens, built-in/slide-in; gas self-clean ovens, free-standing; and gas self-clean ovens, built-in/slide-in). At TSL 1, DOE estimates impacts on INPV range from -$21.4 million to -$20.7 million, or a change in INPV of -2.7 percent to -2.6 percent. At TSL 1, industry free cash flow (operating cash flow minus capital expenditures) is estimated to decrease to $52.1 million, or a drop of

14.3 percent, compared to the base-case value of $60.8 million in 2018, the year leading up to new and amended energy conservation standards.

Percentage impacts on INPV are slightly negative at TSL 1. DOE does not anticipate that manufacturers would lose a significant portion of their INPV at this TSL. DOE projects that in the expected year of compliance (2019), 100 percent of gas standard oven, free-standing shipments; and gas standard oven, built-in/slide-in shipments would meet or exceed the efficiency levels required at TSL 1. Meanwhile in 2019, 60 percent of electric standard oven, free-standing shipments; 60 percent of electric standard oven, built-in/slide-in shipments; 53 percent of electric self-clean oven, free-standing shipments; 53 electric self-clean oven, built-in/slide-in shipments; 52 percent of gas self-clean oven, free-standing shipments; and 52 percent of gas self-clean oven, built-in/slide-in shipments would meet the efficiency levels at TSL 1.

DOE expects conversion costs to be small at TSL 1 because the design changes prescribed at this TSL only affect standby mode power consumption and do not apply to active mode power consumption. DOE expects residential conventional oven manufacturers to incur $4.3 million in product conversion costs for product redesigns that will convert residential conventional ovens from using linear power supply to switch mode power supply to reduce standby power consumption. DOE expects $9.0 million in capital conversion costs for manufacturers to upgrade production lines and retool equipment associated with achieving this reduction in standby power.

At TSL 1, under the preservation of gross margin markup scenario, the shipment-weighted average MPC increases very slightly by approximately 0.1 percent relative to the base-case MPC. This extremely slight price increase is outweighed by the $13.3 million in conversion costs estimated at TSL 1, resulting in slightly negative INPV impacts at TSL 1 under the preservation of gross margin markup scenario.

Under the preservation of operating profit markup scenario, manufacturers earn the same nominal operating profit as would be earned in the base case, but manufacturers do not earn additional profit from their investments. The very slight increase in the shipment weighted-average MPC is again outweighed by a slightly lower average manufacturer markup (slightly smaller than the 1.20 manufacturer markup used in the base case) and $13.3 million in conversion costs, resulting in slightly negative impacts at TSL 1.

TSL 2 sets the efficiency level at EL 1 for two product classes (electric self-clean ovens, free-standing; and electric self-clean ovens, built-in/slide-in), EL 2 for two product classes (gas self-clean ovens, free-standing; and gas self-clean ovens, built-in/slide-in), EL 3 for two product classes (electric standard ovens, free-standing and electric standard ovens, built-in/slide-in); and EL 4 for two product classes (gas standard ovens, free-standing and gas standard ovens, built-in/slide-in). At TSL 2, DOE estimates impacts on INPV to range from -$86.4 million to -$80.9 million, or a change in INPV of -11.0 percent to -10.3 percent. At this standard level, industry free cash flow is estimated to decrease to $17.6, or a drop of 71.0 percent, compared to the base-case value of $60.8 million in 2018.

Percentage impacts on INPV are moderately negative at TSL 2. While the $109.9 million in industry conversion costs represent a significant investment for manufacturers, DOE does not anticipate that manufacturers would lose a significant portion of their INPV at this TSL since the base case INPV for manufacturers is slightly less than $800 million. DOE projects that in 2019, 40 percent of electric standard oven, free-standing shipments; 40 percent of electric standard oven, built-in/slide-in shipments; 53 percent of electric self-clean oven, free-standing shipments; 53 percent of electric self-clean oven, built-in/slide-in shipments; 32 percent of gas standard oven, free-standing shipments; 32 percent of gas standard oven, built-in/slide-in shipments; 39 percent of gas self-clean oven, free-standing shipments; and 39 percent of gas self-clean oven, built-in/slide-in shipments would meet or exceed the efficiency levels at TSL 2.

While DOE expects conversion costs to be a large investment at TSL 2, the much larger base case INPV reduces the overall INPV impact on a percentage basis at TSL 2. DOE expects that product conversion costs will significantly rise from $4.3 million at TSL 1 to $67.9 million at TSL 2 for extensive product redesigns and testing. Capital conversion costs will also significantly increase from $9.0 million at TSL 1 to $42.0 million at TSL 2 to upgrade production equipment to accommodate for added or redesigned features in each product class. The large conversion costs at TSL 2 are driven by reduce vent rate and improve insulation in the electric oven product classes, and conversion from glo-bar to electronic spark ignition systems in the gas oven product classes.

At TSL 2, under the preservation of gross margin markup scenario, the shipment weighted-average MPC only slightly increases by 0.9 percent, relative to the base-case MPC. In this scenario, INPV impacts are moderately negative because manufacturers incur sizable conversion costs ($109.9 million) and are not able to recover much of those conversion costs through the slight increase in the shipment weighted-average MPC at TSL 2.

Under the preservation of operating profit markup scenario, the 0.9 percent shipment weighted-average MPC increase is outweighed by a slightly lower average manufacturer markup (slightly smaller than the 1.20 manufacturer markup used in the base case) and $109.9 million in conversion costs, resulting in moderately negative INPV impacts at TSL 2.

TSL 3 sets the efficiency level at max tech for all product classes. At TSL 3, DOE estimates impacts on INPV to range from -$727.5 million to -$642.9 million, or a change in INPV of -92.9 percent to -82.0 percent. At this standard level, industry free cash flow is estimated to decrease by approximately 635.3 percent to -$325.5 million, compared to the base-case value of $60.8 million in 2018.

At TSL 3 conversion costs significantly increase causing free cash flow to become significantly negative in the year leading up to energy conservation standards and cause manufacturers to loss a substantial amount of INPV. Also, the percent change in INPV at TSL 3 is significantly negative due to the extremely large conversion costs. Manufacturers at this TSL would have a very difficult time in the short term to make the necessary investments to comply with new and amended energy conservation standards prior to when standards went into effect. Also, the long-term profitability of residential conventional oven manufacturers could be seriously jeopardized as some manufacturers would struggle to comply with standards at this TSL.

A high percentage of total shipments will need to be redesigned to meet efficiency levels prescribed at TSL 3. DOE projects that in 2019, only 7 percent of electric standard oven, free-standing shipments; 7 percent of electric standard oven, built-in/slide-in shipments; 12 percent of electric self-clean oven, free-standing shipments; 12 percent of electric self-clean oven, built-in/slide-in shipments; 8 percent of gas standard oven, free-standing shipments; 8 percent of gas standard oven, built-in/slide-in shipments; 13 percent of gas self-clean oven, free-standing shipments; and 13 percent of gas self-clean oven, built-in/slide-in shipments would meet the efficiency levels prescribed at TSL 3.

DOE expects significant conversion costs at TSL 3, which represents max tech. DOE expects product conversion costs to significantly increase from $67.9 million at TSL 2 to $401.5 million at TSL 3. Large increases in product conversion are due to the vast majority of shipments needing extensive redesign as well as a significant increase in testing and recertification for redesigned products. DOE estimates that capital conversion costs will also significantly increase from $42.0 million at TSL 2 to $528.0 million at TSL 3. Capital conversion costs are driven by investments in production equipment to accommodate for forced convection and reduced conduction losses in the electric and gas oven product classes.

At TSL 3, under the preservation of gross margin markup scenario, the shipment weighted-average MPC increases by 12.7 percent relative to the base-case MPC. In this scenario, INPV impacts are significantly negative because the $929.5 million in conversion costs significantly outweighs the modest increase in shipment weighted-average MPC.

Under the preservation of operating profit markup scenario, the 12.7 percent MPC increase is again significantly outweighed by a lower average manufacturer markup of 1.19 (compared to 1.20 used in the base case) and $929.5 million in conversion costs, resulting in significantly negative impacts at TSL 3.

b. Impacts on Employment

DOE quantitatively assessed the impacts of new and amended energy conservation standards on direct employment. DOE used the GRIM to estimate the domestic labor expenditures and number of domestic production workers in the base case and at each TSL from 2019 to 2048. DOE used statistical data from the U.S. Census Bureau's 2011 Annual Survey of Manufacturers (ASM), the results of the engineering analysis, and interviews with manufacturers to determine the inputs necessary to calculate industry-wide labor expenditures and domestic employment levels. Labor expenditures involved with the manufacturing of the products are a function of the labor intensity of the products, the sales volume, and an assumption that wages remain fixed in real terms over time.

In the GRIM, DOE used the labor content of the MPCs to estimate the annual labor expenditures in the industry. DOE used census data and interviews with manufacturers to estimate the portion of the total labor expenditures that is attributable to domestic labor.

The production worker estimates in this section cover only workers up to the line-supervisor level directly involved in fabricating and assembling a product within a manufacturing facility. Workers performing services that are closely associated with production operations, such as material handing with a forklift, are also included as production labor. DOE's estimates account for production workers who manufacture only the specific products covered in this rulemaking.

The employment impacts shown in Table V-34 represent the potential production employment that could result following new and amended energy conservation standards. The upper bound of the results estimates the maximum change in the number of production workers that could occur after compliance with new and amended energy conservation standards when assuming that manufacturers continue to produce the same scope of covered products in the same production facilities. It also assumes that domestic production does not shift to lower labor-cost countries. Because there is a real risk of manufacturers evaluating sourcing decisions in response to new and amended energy conservation standards, the lower bound of the employment results includes the estimated total number of U.S. production workers in the industry who could lose their jobs if some or all existing production were moved outside of the United States. While the results present a range of employment impacts following 2019, the following sections also include qualitative discussions of the likelihood of negative employment impacts at the various TSLs. Finally, the employment impacts shown are independent of the employment impacts from the broader U.S. economy, documented in chapter 17 of the NOPR TSD.

Using 2011 ASM data and interviews with manufacturers, DOE estimates that approximately 60 percent of the residential conventional ovens sold in the United States are manufactured domestically. With this assumption, DOE estimates that in the absence of new and amended energy conservation standards, there would be approximately 6,564 domestic production workers involved in manufacturing residential conventional ovens in 2019. Table V-34 shows the range of the impacts of new and amended energy conservation standards on U.S. production workers in the residential conventional oven industry.

**Table V-34. Potential Changes in the Total Number of Domestic Residential Conventional Ovens Production Workers in 2019**

| | Base Case | Trial Standard Level | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| Total Number of Domestic Production Workers in 2019 (without changes in production locations) | 6,564 | 6,571 | 6,622 | 7,397 |
| Potential Changes in Domestic Production Workers in 2019* | - | 0 - 7 | (1,641) - 58 | (3,282) – 833 |

*DOE presents a range of potential employment impacts. Numbers in parentheses indicate negative numbers

At the upper end of the range, all examined TSLs show a slight increase in the number of domestic employment for residential conventional ovens. DOE believes that manufacturers would increase production hiring due to the increase in the labor associated with adding the required components to make residential conventional ovens more efficient. However, as previously stated, this assumes that in addition to hiring more production employees, all existing domestic production would remain in the United States and not shift to lower labor-cost countries.

DOE does not expect any significant changes in domestic employment at TSL 1 because standards would only affect standby mode power consumption at this TSL. Most manufacturers stated that this TSL would not require significant design changes and therefore would not have a significant impact on domestic employment decisions.

At TSLs 2 and 3, all product classes would require higher efficiency standards and therefore most manufacturers would be required to make modifications to their existing production lines. However, manufacturers stated that due to the larger size of most residential conventional ovens very few units are shipped from far distances such as

Asia or Europe. The vast majority of residential conventional ovens are currently made in North America. Some manufacturers stated that even significant changes to production line would not cause them to shift their production to lower labor-cost countries, as several manufacturers either only produce residential conventional ovens domestically or have recently made significant investments to continue to produce a portion of their residential conventional ovens domestically. DOE estimates that at most 25 percent of the domestic labor for residential conventional ovens could move to other countries in response to the standards proposed at TSL 2. However, DOE believes this to be a high upper bound estimate as most manufacturers would not significantly alter their production locations at the efficiency levels prescribed at TSL 2.

At TSL 3, manufacturers could alter production locations in response to standards since all product classes would be required to meet max tech. DOE estimated that at most 50 percent of the domestic labor for residential conventional ovens could move to other countries in response to the standards prescribed at TSL 3.

DOE seeks comment on the potential domestic employment impacts to residential conventional oven manufacturers at the proposed efficiency levels.

c. Impacts on Manufacturer Capacity

Residential conventional oven manufacturers stated that they did not anticipate any capacity constraints for the efficiency levels analyzed for either electric or gas residential conventional ovens.

DOE requests comment on any potential manufacturer capacity constraints caused by the proposed standards in this NOPR, TSL 2.

d. Impacts on Sub-Groups of Manufacturers

Using average cost assumptions to develop an industry cash-flow estimate may not be adequate for assessing differential impacts among manufacturer subgroups. Small manufacturers, niche product manufacturers, and manufacturers exhibiting cost structures substantially different from the industry average could be affected disproportionately. DOE analyzed the impacts to small businesses in section VI.B and did not identify any other adversely impacted subgroups for residential conventional ovens for this rulemaking based on the results of the industry characterization.

DOE requests comment on manufacturer subgroups that DOE should analyze and/or types of residential conventional oven manufacturers for the subgroup analysis.

e. Cumulative Regulatory Burden

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

DOE acknowledges that most residential conventional oven manufacturers also make appliances that are or could be subject to future energy conservation standards implemented by DOE. DOE is aware of several other energy conservations that could also affect residential conventional oven manufacturers. These energy conservation standards include residential refrigerators and freezers that have a compliance date in 2014,[67] residential clothes dryers that have a compliance date in 2015,[68] residential clothes washers that have a compliance date in 2015 and in 2018,[69] and microwave ovens that have a compliance date in 2016.[70]

The compliance years and expected industry conversion costs of relevant amended energy conservation standards are indicated in Table V-35..

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[67] Energy conservation standards for residential refrigerators, refrigerators-freezers, and freezers became effective on September 14, 2014. 76 FR 57516 [Docket Number EE–2008–BT–STD–0012]

[68] Energy conservation standards for residential clothes dryers became effective on January 1, 2015. 76 FR 52854 [Docket Number EERE–2007–BT–STD–0010]

[69] The first round of prescribed energy conservation standards for residential clothes washers became effective on March 7, 2015. The second round of standards will go into effect on January 1, 2018. 77 FR 59719 [Docket Number EERE–2008–BT–STD–0019]

[70] Energy conservation standards for microwave oven operating in standby mode and off mode will go into effect on June 17, 2016. 78 FR 36316 [Docket Number EERE–2011–BT–STD–0048]

**Table V-35. Compliance Dates and Expected Conversion Expenses of Federal Energy Conservation Standards Affecting Residential Conventional Oven Manufacturers**

| Federal Energy Conservation Standards | Compliance Date | Estimated Total Industry Conversion Expense |
|---|---|---|
| Residential Refrigerators and Freezers 76 FR 57516 (September 15, 2011) | 2014 | $1,243M (2009$) |
| Residential Clothes Dryers 76 FR 52854 (April 21, 2011) | 2015 | $95M (2009$) |
| Residential Clothes Washers 77 FR 59719 (May 31, 2012) | 2015 – First Round<br>2018 – Second Round | $418.5M (2010$) |
| Microwave Ovens 78 FR 36316 (June 17, 2013) | 2016 | $43.1M (2011$) |
| Residential Cooking Tops | 2020* | N/A** |

* The date listed is an approximation. The exact date is pending final DOE action

** For energy conservation standards awaiting DOE final action. DOE does not have finalized estimated total industry conversion expenses.

DOE discusses these and other requirements and includes the full details of the cumulative regulatory burden analysis in chapter 12 of the NOPR TSD. DOE seeks comment on the compliance costs of any other regulations residential conventional oven manufacturers must make, especially if compliance with those regulations is required three years before or after the estimated compliance date of this proposed standard (2019).

3. National Impact Analysis

a. Significance of Energy Savings

To estimate the energy savings attributable to potential standards for conventional ovens, DOE compared the energy consumption of those products under the base case to their anticipated energy consumption under each TSL. Table V-36 and Table V-37 present DOE’s projections of the national energy savings for each TSL considered for conventional ovens. The savings were calculated using the approach described in section IV.H.1 of this notice.

**Table V-36. Conventional Ovens: Cumulative Primary National Energy Savings for Products Shipped in 2019–2048 (quads)**

| Product Class | Trial Standard Level | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| PC1: Electric Standard Ovens, Free-Standing | 0.023 | 0.057 | 0.161 |
| PC2: Electric Standard Ovens, Built-In/Slide-In | 0.000 | 0.001 | 0.003 |
| PC3: Electric Self-Clean Ovens, Free-Standing | 0.071 | 0.071 | 0.372 |
| PC4: Electric Self-Clean Ovens, Built-In/Slide-In | 0.021 | 0.021 | 0.108 |
| PC5: Gas Standard Ovens, Free-Standing | 0.000 | 0.204 | 0.209 |
| PC6: Gas Standard Ovens, Built-In/Slide-In | 0.000 | 0.038 | 0.039 |
| PC7: Gas Self-Clean Ovens, Free-Standing | 0.038 | 0.268 | 0.282 |
| PC8: Gas Self-Clean Ovens, Built-In/Slide-In | 0.002 | 0.014 | 0.014 |
| TOTAL (All Products) | 0.156 | 0.673 | 1.188 |

**Table V-37. Conventional Ovens: Cumulative FFC National Energy Savings for Products Shipped in 2019–2048**

| Product Class | Trial Standard Level | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| PC1: Electric Standard Ovens, Free-Standing | 0.024 | 0.060 | 0.168 |
| PC2: Electric Standard Ovens, Built-In/Slide-In | 0.000 | 0.001 | 0.003 |
| PC3: Electric Self-Clean Ovens, Free-Standing | 0.074 | 0.074 | 0.389 |
| PC4: Electric Self-Clean Ovens, Built-In/Slide-In | 0.022 | 0.022 | 0.113 |
| PC5: Gas Standard Ovens, Free-Standing | 0.000 | 0.216 | 0.223 |
| PC6: Gas Standard Ovens, Built-In/Slide-In | 0.000 | 0.041 | 0.042 |
| PC7: Gas Self-Clean Ovens, Free-Standing | 0.040 | 0.281 | 0.297 |
| PC8: Gas Self-Clean Ovens, Built-In/Slide-In | 0.002 | 0.014 | 0.015 |
| TOTAL (All Products) | 0.163 | 0.709 | 1.251 |

OMB Circular A-4[71] requires agencies to present analytical results, including separate schedules of the monetized benefits and costs that show the type and timing of benefits and costs. Circular A-4 also directs agencies to consider the variability of key elements underlying the estimates of benefits and costs. For this rulemaking, DOE undertook a sensitivity analysis using nine, 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.[72] The review timeframe established in EPCA is generally not

[71] U.S. Office of Management and Budget, "Circular A-4: Regulatory Analysis" (Sept. 17, 2003) (Available at: http://www.whitehouse.gov/omb/circulars_a004_a-4/)
[72] Section 325(m) of EPCA requires DOE to review its standards at least once every 6 years, and requires, for certain products, a 3-year period after any new standard is promulgated before compliance is required, except that in no case may any new standards be required within 6 years of the compliance date of the

synchronized with the product lifetime, product manufacturing cycles, or other factors specific to conventional ovens. 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-38. The impacts are counted over the lifetime of conventional ovens purchased in 2019–2027.

**Table V-38. Conventional Ovens: Cumulative FFC National Energy Savings for Products Shipped in 2019–2027**

| Product Class | Trial Standard Level | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| PC1: Electric Standard Ovens, Free-Standing | 0.007 | 0.016 | 0.046 |
| PC2: Electric Standard Ovens, Built-In/Slide-In | 0.000 | 0.001 | 0.002 |
| PC3: Electric Self-Clean Ovens, Free-Standing | 0.018 | 0.018 | 0.102 |
| PC4: Electric Self-Clean Ovens, Built-In/Slide-In | 0.006 | 0.006 | 0.033 |
| PC5: Gas Standard Ovens, Free-Standing | 0.000 | 0.070 | 0.072 |
| PC6: Gas Standard Ovens, Built-In/Slide-In | 0.000 | 0.013 | 0.013 |
| PC7: Gas Self-Clean Ovens, Free-Standing | 0.012 | 0.081 | 0.085 |
| PC8: Gas Self-Clean Ovens, Built-In/Slide-In | 0.001 | 0.004 | 0.004 |
| TOTAL (All Products) | 0.044 | 0.210 | 0.358 |

previous standards. While adding a 6-year review to the 3-year compliance period adds up to 9 years, DOE notes that it may undertake reviews at any time within the 6 year period and that the 3-year compliance date may yield to the 6-year backstop. A 9-year analysis period may not be appropriate given the variability that occurs in the timing of standards reviews and the fact that for some consumer products, the compliance period is 5 years rather than 3 years.

b. Net Present Value of Consumer Costs and Benefits

DOE estimated the cumulative NPV to the nation of the total costs and savings for consumers that would result from particular standard levels for conventional ovens. In accordance with the OMB's guidelines on regulatory analysis (OMB Circular A-4, section E, September 17, 2003),[73] DOE calculated NPV using both a 7-percent and a 3-percent real discount rate.

Table V-39. shows the consumer NPV results for each TSL DOE considered for conventional ovens. The impacts are counted over the lifetime of products purchased in 2019–2048.

**Table V-39. Conventional Ovens: Cumulative Net Present Value of Consumer Benefits for Products Shipped in 2019–2048**

| Equipment Type | Discount Rate | Trial Standard Level | | |
|---|---|---|---|---|
| | | 1 | 2 | 3* |
| PC1: Electric Standard Ovens, Free-Standing | 3% | 0.17 | 0.31 | (0.57) |
| | 7% | 0.07 | 0.11 | (0.49) |
| PC2: Electric Standard Ovens, Built-In/Slide-In | 3% | 0.00 | 0.01 | (0.02) |
| | 7% | 0.00 | 0.00 | (0.01) |
| PC3: Electric Self-Clean Ovens, Free-Standing | 3% | 0.52 | 0.52 | (1.02) |
| | 7% | 0.21 | 0.21 | (0.96) |
| PC4: Electric Self-Clean Ovens, Built-In/Slide-In | 3% | 0.16 | 0.16 | (0.32) |
| | 7% | 0.07 | 0.07 | (0.30) |

[73] Available at: www.whitehouse.gov/omb/circulars_a004_a-4. Available at: www.whitehouse.gov/omb/circulars_a004_a-4.

| | | | | |
|---|---|---|---|---|
| PC5: Gas Standard Ovens, Free-Standing | 3% | 0.00 | 3.59 | 3.06 |
| | 7% | 0.00 | 1.55 | 1.24 |
| PC6: Gas Standard Ovens, Built-In/Slide-In | 3% | 0.00 | 0.67 | 0.57 |
| | 7% | 0.00 | 0.29 | 0.23 |
| PC7: Gas Self-Clean Ovens, Free-Standing | 3% | 0.28 | 5.48 | 4.72 |
| | 7% | 0.12 | 2.31 | 1.87 |
| PC8: Gas Self-Clean Ovens, Built-In/Slide-In | 3% | 0.01 | 0.28 | 0.24 |
| | 7% | 0.01 | 0.12 | 0.10 |
| TOTAL (All Products) | 3% | 1.15 | 11.02 | 6.67 |
| | 7% | 0.48 | 4.66 | 1.67 |

*Parentheses indicate negative (-) values.

The NPV results based on the aforementioned 9-year analytical period are presented in Table V-40.. The impacts are counted over the lifetime of products purchased in 2019–2027. As mentioned previously, such results are presented for informational purposes only and is not indicative of any change in DOE’s analytical methodology or decision criteria.

**Table V-40. Conventional Ovens: Cumulative Net Present Value of Consumer Benefits for Products Shipped in 2019–2027**

| Equipment Type | Discount Rate | Trial Standard Level | | |
|---|---|---|---|---|
| | | 1 | 2 | 3* |
| | | Billion 2014$ | | |
| PC1: Electric Standard Ovens, Free-Standing | 3% | 0.06 | 0.10 | (0.28) |
| | 7% | 0.03 | 0.05 | (0.28) |
| PC2: Electric Standard Ovens, Built-In/Slide-In | 3% | 0.00 | 0.00 | (0.01) |
| | 7% | 0.00 | 0.00 | (0.01) |
| PC3: Electric Self-Clean Ovens, Free-Standing | 3% | 0.16 | 0.16 | (0.53) |
| | 7% | 0.09 | 0.09 | (0.55) |
| PC4: Electric Self-Clean Ovens, Built-In/Slide-In | 3% | 0.05 | 0.05 | (0.17) |
| | 7% | 0.03 | 0.03 | (0.18) |
| PC5: Gas Standard Ovens, Free-Standing | 3% | 0.00 | 1.47 | 1.22 |
| | 7% | 0.00 | 0.83 | 0.65 |
| PC6: Gas Standard Ovens, Built-In/Slide-In | 3% | 0.00 | 0.27 | 0.22 |
| | 7% | 0.00 | 0.15 | 0.12 |
| PC7: Gas Self-Clean Ovens, Free-Standing | 3% | 0.10 | 2.02 | 1.71 |
| | 7% | 0.06 | 1.16 | 0.92 |
| PC8: Gas Self-Clean Ovens, Built-In/Slide-In | 3% | 0.01 | 0.11 | 0.09 |
| | 7% | 0.00 | 0.06 | 0.05 |
| TOTAL (All Products) | 3% | 0.38 | 4.18 | 2.26 |
| | 7% | 0.22 | 2.38 | 0.72 |

*Parentheses indicate negative (-) values.

The above results reflect the use of a default trend to estimate the change in price for conventional ovens over the analysis period (see section IV.F.1of this notice). DOE also conducted a sensitivity analysis that considered one scenario with a lower rate of price decline than the reference case and one scenario with a higher rate of price decline than the reference case. The results of these alternative cases are presented in appendix 10C of the NOPR TSD. In the high price decline case, the NPV is higher than in the default case. In the low price decline case, the NPV is lower than in the default case.

c. Impacts on Employment

DOE expects energy conservation standards for conventional ovens to reduce energy bills for consumers of those products, and the resulting net savings to be redirected to other forms of economic activity. These expected shifts in spending and economic activity could affect the demand for labor. As described in section IV.N of this notice, DOE used an input/output model of the U.S. economy to estimate indirect employment impacts of the TSLs that DOE considered in this rulemaking. DOE understands that there are uncertainties involved in projecting employment impacts, especially changes in the later years of the analysis. Therefore, DOE generated results for near-term timeframes, where these uncertainties are reduced.

The results suggest that the proposed standards are likely to have negligible impact on the net demand for labor in the economy. The net change in jobs is so small that it would be imperceptible in national labor statistics and might be offset by other, unanticipated effects on employment. Chapter 16 of the NOPR TSD presents detailed results.

4. Impact on Utility or Performance of Products

Based on testing conducted in support of this proposed rule, discussed in section IV.C.2 of this notice, DOE concluded that the standards proposed in this NOPR would not reduce the utility or performance of the conventional ovens under consideration in this rulemaking. Manufacturers of these products currently offer units that meet or exceed the proposed standards.

5. Impact of Any Lessening of Competition

DOE has also considered any lessening of competition that is likely to result from the proposed standards. The Attorney General determines the impact, if any, of any lessening of competition likely to result from a proposed standard, and transmits such determination to DOE, together with an analysis of the nature and extent of such impact. (42 U.S.C. 6295(o)(2)(B)(i)(V) and (B)(ii))

DOE will transmit a copy of this NOPR and the accompanying TSD to the Attorney General, requesting that the DOJ provide its determination on this issue. DOE will consider DOJ's comments on the proposed rule in determining whether to proceed with the proposed energy conservation standards. DOE will also publish and respond to DOJ's comments in the Federal Register.

6. Need of the Nation to Conserve Energy

Enhanced energy efficiency, where economically justified, improves the nation's energy security, strengthens the economy, and reduces the environmental impacts of energy production. Reduced electricity demand due to energy conservation standards is also likely to reduce the cost of maintaining the reliability of the electricity system, particularly during peak-load periods. As a measure of this reduced demand, chapter 15 in the NOPR TSD presents the estimated reduction in generating capacity for the TSLs that DOE considered in this rulemaking.

Energy savings from proposed standards for conventional ovens are expected to yield environmental benefits in the form of reduced emissions of air pollutants and greenhouse gases. Table V-41. provides DOE's estimate of cumulative emissions reductions to result from the TSLs considered in this rulemaking. DOE reports annual emissions reductions for each TSL in chapter 13 of the NOPR TSD.

**Table V-41. Conventional Ovens: Cumulative Emissions Reduction for Products Shipped in 2019–2048**

| | Trial Standard Level | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| **Power Sector Emissions** | | | |
| $CO_2$ (million metric tons) | 9.0 | 38.6 | 68.2 |
| $SO_2$ (thousand tons) | 7.4 | 29.1 | 51.8 |
| $NO_X$ (thousand tons) | 6.9 | 32.2 | 56.7 |
| Hg (tons) | 0.02 | 0.09 | 0.16 |
| $CH_4$ (thousand tons) | 0.88 | 3.51 | 6.22 |
| $N_2O$ (thousand tons) | 0.13 | 0.50 | 0.89 |
| **Upstream Emissions** | | | |
| $CO_2$ (million metric tons) | 0.52 | 2.52 | 4.42 |
| $SO_2$ (thousand tons) | 0.09 | 0.36 | 0.63 |
| $NO_X$ (thousand tons) | 7.5 | 36.6 | 64.2 |
| Hg (tons) | 0.00 | 0.00 | 0.00 |
| $CH_4$ (thousand tons) | 43.6 | 218 | 381 |
| $N_2O$ (thousand tons) | 0.00 | 0.02 | 0.03 |
| **Total FFC Emissions** | | | |
| $CO_2$ (million metric tons) | 9.5 | 41.1 | 72.6 |
| $SO_2$ (thousand tons) | 7.5 | 29.5 | 52.4 |
| $NO_X$ (thousand tons) | 14.4 | 68.8 | 120.9 |
| Hg (tons) | 0.02 | 0.09 | 0.16 |
| $CH_4$ (thousand tons) | 44.4 | 221.2 | 387.5 |
| $CH_4$ (thousand tons $CO_2$eq)* | 1,244 | 6,195 | 10,849 |
| $N_2O$ (thousand tons) | 0.13 | 0.52 | 0.92 |
| $N_2O$ (thousand tons $CO_2$eq)* | 34.6 | 137.0 | 243.2 |

* $CO_2$eq is the quantity of $CO_2$ that would have the same GWP.

As part of the analysis for this proposed rule, DOE estimated monetary benefits likely to result from the reduced emissions of $CO_2$ and $NO_X$ that DOE estimated for each of the considered TSLs. As discussed in section IV.L of this notice, for $CO_2$, DOE used the most recent values for the SCC developed by an interagency process. The four sets of SCC values for $CO_2$ emissions reductions in 2015 resulting from that process (expressed in 2014$) are represented by $12.2/metric ton (the average value from a distribution that uses a 5-percent discount rate), $41.2/metric ton (the average value from a distribution that uses a 3-percent discount rate), $63.4/metric ton (the average value from a distribution that uses a 2.5-percent discount rate), and $121/metric ton (the 95$^{th}$-percentile value from a distribution that uses a 3-percent discount rate). The values for later years are higher due to increasing damages (emissions-related costs) as the projected magnitude of climate change increases.

Table V-42. presents the global value of $CO_2$ emissions reductions at each TSL. For each of the four cases, DOE calculated a present value of the stream of annual values using the same discount rate as was used in the studies upon which the dollar-per-ton values are based. DOE calculated domestic values as a range from 7 percent to 23 percent of the global values; these results are presented in chapter 14 of the NOPR TSD.

**Table V-42. Conventional Ovens: Estimates of Global Present Value of $CO_2$ Emissions Reduction for Products Shipped in 2019–2048**

| TSL | SCC Case* | | | |
|---|---|---|---|---|
| | 5% discount rate, average | 3% discount rate, average | 2.5% discount rate, average | 3% discount rate, 95th percentile |
| | Million 2014$ | | | |
| **Power Sector Emissions** | | | | |
| 1 | 62.0 | 288.2 | 458.0 | 892.8 |
| 2 | 266.7 | 1,238.9 | 1,968.8 | 3,836.7 |
| 3 | 473.1 | 2,194.1 | 3,485.5 | 6,794.3 |
| **Upstream Emissions** | | | | |
| 1 | 3.5 | 16.6 | 26.5 | 51.5 |
| 2 | 17.1 | 80.0 | 127.4 | 248.0 |
| 3 | 30.0 | 140.6 | 223.8 | 435.8 |
| **Total FFC Emissions** | | | | |
| 1 | 65.5 | 304.8 | 484.5 | 944.3 |
| 2 | 283.8 | 1,319.0 | 2,096.1 | 4,084.7 |
| 3 | 503.1 | 2,334.7 | 3,709.3 | 7,230.1 |

DOE is well aware that scientific and economic knowledge about the contribution of $CO_2$ and other GHG emissions to changes in the future global climate and the potential resulting damages to the world economy continues to evolve rapidly. Thus, any value placed on reducing $CO_2$ emissions in this rulemaking is subject to change. DOE, together with other Federal agencies, will continue to review various methodologies for estimating the monetary value of reductions in $CO_2$ and other GHG emissions. This ongoing review will consider the comments on this subject that are part of the public record for this and other rulemakings, as well as other methodological assumptions and issues. However, consistent with DOE's legal obligations, and taking into account the uncertainty involved with this particular issue, DOE has included in this proposed rule the most recent values and analyses resulting from the interagency process.

DOE also estimated the cumulative monetary value of the economic benefits associated with $NO_X$ emissions reductions anticipated to result from the considered TSLs for conventional ovens. The dollar-per-ton value that DOE used is discussed in section IV.L of this notice. Table V-43. presents the cumulative present values for each TSL calculated using 7-percent and 3-percent discount rates.

**Table V-43. Conventional Ovens: Estimates of Present Value of $NO_X$ Emissions Reduction for Products Shipped in 2019–2048**

| TSL | 3% discount rate | 7% discount rate |
|---|---|---|
| | **Million 2014$** | |
| **Power Sector Emissions** | | |
| 1 | 24.6 | 9.7 |
| 2 | 113.8 | 45.2 |
| 3 | 200.9 | 80.1 |
| **Upstream Emissions** | | |
| 1 | 25.9 | 9.7 |
| 2 | 127.1 | 48.4 |
| 3 | 223.2 | 85.1 |
| **Total FFC Emissions** | | |
| 1 | 50.4 | 19.4 |
| 2 | 240.9 | 93.5 |
| 3 | 424.1 | 165.2 |

7. Summary of National Economic Impacts

The NPV of the monetized benefits associated with emissions reductions can be viewed as a complement to the NPV of the consumer savings calculated for each TSL considered in this rulemaking.

Table V-44. presents the NPV values that result from adding the estimates of the potential economic benefits resulting from reduced $CO_2$ and $NO_X$ emissions in each of four valuation scenarios to the NPV of consumer savings calculated for each TSL considered in this rulemaking, at both a 7-percent and 3-percent discount rate. The $CO_2$ values used in the columns of each table correspond to the four sets of SCC values discussed above.

**Table V-44. Conventional Ovens: Net Present Value of Consumer Savings Combined with Present Value of Monetized Benefits from $CO_2$ and $NO_X$ Emissions Reductions**

| TSL | Consumer NPV at 3% Discount Rate added with: | | | |
|---|---|---|---|---|
| | SCC Case $12.2/t and Medium $NO_X$ Value | SCC Case $41.2/t and Medium $NO_X$ Value | SCC Case $63.4/t and Medium $NO_X$ Value | SCC Case $121/t and Medium $NO_X$ Value |
| | Billion 2014$ | | | |
| 1 | 1.3 | 1.5 | 1.7 | 2.1 |
| 2 | 11.5 | 12.6 | 13.4 | 15.3 |
| 3 | 7.6 | 9.4 | 10.8 | 14.3 |
| TSL | Consumer NPV at 7% Discount Rate added with: | | | |
| | SCC Case $12.2/t and Medium $NO_X$ Value | SCC Case $41.2/t and Medium $NO_X$ Value | SCC Case $63.4/t and Medium $NO_X$ Value | SCC Case $121/t and Medium $NO_X$ Value |
| | Billion 2014$ | | | |
| 1 | 0.6 | 0.8 | 1.0 | 1.4 |
| 2 | 5.0 | 6.1 | 6.9 | 8.8 |
| 3 | 2.3 | 4.2 | 5.5 | 9.1 |

Although adding the value of consumer savings to the values of emission reductions provides a valuable perspective, two issues should be considered. First, the national operating cost savings are domestic U.S. monetary savings that occur as a result of market transactions, while the value of $CO_2$ reductions is based on a global value. Second, the assessments of operating cost savings and the SCC are performed with different methods that use different time frames for analysis. The national operating cost savings is measured for the lifetime of equipment shipped in 2019 to 2048. Because $CO_2$ emissions have a very long residence time in the atmosphere,[74] the SCC values in future years reflect future climate-related impacts resulting from the emission of $CO_2$ that continue well beyond 2100.

8. Other Factors

The Secretary of Energy, in determining whether a standard is economically justified, may consider any other factors that the Secretary deems to be relevant. (42 U.S.C. 6295(o)(2)(B)(i)(VII)) DOE did not consider any other factors for this NOPR.

## C. Conclusion

When considering proposed standards, the new or amended energy conservation standard that DOE adopts for any type (or class) of covered product must be designed to achieve the maximum improvement in energy efficiency that the Secretary determines is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A)) In determining whether a standard is economically justified, the Secretary must determine whether the benefits of the standard exceed its burdens, considering to the greatest extent practicable the seven statutory factors discussed previously. (42 U.S.C. 6295(o)(2)(B)(i))

[74] The atmospheric lifetime of $CO_2$ is estimated of the order of 30–95 years. Jacobson, MZ (2005). "Correction to "Control of fossil-fuel particulate black carbon and organic matter, possibly the most effective method of slowing global warming."" J. Geophys. Res. 110. pp. D14105.

The new or amended standard must also result in a significant conservation of energy. (42 U.S.C. 6295(o)(3)(B))

The Department considered the impacts of standards at each TSL, beginning with a maximum technologically feasible level, to determine whether that level was economically justified. Where the max-tech level was not justified, DOE then considered the next most efficient level and undertook the same evaluation until it reached the highest efficiency level that is both technologically feasible and economically justified and saves a significant amount of energy.

To aid the reader as DOE discusses the benefits and/or burdens of each trial standard level, tables present a summary of the results of DOE's quantitative analysis for each TSL. In addition to the quantitative results presented in the tables, DOE also considers other burdens and benefits that affect economic justification. Those include the impacts on identifiable subgroups of consumers who may be disproportionately affected by a national standard. Section V.B.1 of this notice presents the estimated impacts of each TSL for these subgroups.

DOE also notes that the economics literature provides a wide-ranging discussion of how consumers trade off upfront costs and energy savings in the absence of government intervention. Much of this literature attempts to explain why consumers appear to undervalue energy efficiency improvements. This undervaluation suggests that regulation that promotes energy efficiency can produce significant net private gains (as well as producing social gains by, for example, reducing pollution). There is evidence that consumers undervalue future energy savings as a result of (1) a lack of information; (2) a lack of sufficient salience of the long-term or aggregate benefits; (3) a lack of sufficient savings to warrant delaying or altering purchases; (4) excessive focus on the short term, in the form of inconsistent weighting of future energy cost savings relative to available returns on other investments; (5) computational or other difficulties associated with the evaluation of relevant tradeoffs; and (6) a divergence in incentives (between renters and owners, or builders and purchasers). Having less than perfect foresight and a high degree of uncertainty about the future, consumers may trade off these types of investments at a higher than expected rate between current consumption and uncertain future energy cost savings.

In DOE's current regulatory analysis, potential changes in the benefits and costs of a regulation due to changes in consumer purchase decisions are included in two ways: First, if consumers forego a purchase of a product in the standards case, this decreases sales for product manufacturers, and the impact on manufacturers attributed to lost revenue is included in the MIA. Second, DOE accounts for energy savings attributable only to products actually used by consumers in the standards case; if a regulatory option decreases the number of products used by consumers, this decreases the potential energy savings from an energy conservation standard. DOE provides estimates of shipments and changes in the volume of product purchases in chapter 9 of the NOPR TSD. However, DOE's current analysis does not explicitly control for heterogeneity in consumer preferences, preferences across subcategories of products or specific features, or consumer price sensitivity variation according to household income.[75]

While DOE is not prepared at present to provide a fuller quantifiable framework for estimating the benefits and costs of changes in consumer purchase decisions due to an energy conservation standard, DOE is committed to developing a framework that can support empirical quantitative tools for improved assessment of the consumer welfare impacts of appliance standards. DOE has posted a paper that discusses the issue of consumer welfare impacts of appliance energy efficiency standards, and potential enhancements to the methodology by which these impacts are defined and estimated in the regulatory process.[76] DOE welcomes comments on how to more fully assess the potential impact of energy conservation standards on consumer choice and how to quantify this impact in its regulatory analysis in future rulemakings.

1. Benefits and Burdens of TSLs Considered for Conventional Ovens

Table V-45. and Table V-46. summarize the quantitative impacts estimated for each TSL for conventional ovens. The efficiency levels contained in each TSL are described in section V.A of this notice.

[75] P.C. Reiss and M.W. White. Household Electricity Demand, Revisited. Review of Economic Studies (2005) 72, 853–883.
[76] Alan Sanstad, Notes on the Economics of Household Energy Consumption and Technology Choice. Lawrence Berkeley National Laboratory. 2010. Available online at: www1.eere.energy.gov/buildings/appliance_standards/pdfs/consumer_ee_theory.pdf

**Table V-45. Conventional Ovens: Summary of National Impacts**

| Category | TSL 1 | TSL 2 | TSL 3 |
|---|---|---|---|
| **Cumulative FFC Energy Savings** quads | | | |
| | 0.163 | 0.709 | 1.251 |
| **NPV of Consumer Costs and Benefits** 2014$ billion | | | |
| 3% discount rate | 1.2 | 11.0 | 6.7 |
| 7% discount rate | 0.5 | 4.7 | 1.7 |
| **Cumulative FFC Emissions Reduction** | | | |
| $CO_2$ million metric tons | 9.5 | 41.1 | 72.6 |
| $SO_2$ thousand tons | 7.5 | 29.5 | 52.4 |
| $NO_X$ thousand tons | 14.4 | 68.8 | 120.9 |
| Hg tons | 0.02 | 0.09 | 0.16 |
| $CH_4$ thousand tons | 44.4 | 221.2 | 387.5 |
| $CH_4$ thousand tons $CO_2$eq* | 1,244 | 6,195 | 10,849 |
| $N_2O$ thousand tons | 0.13 | 0.52 | 0.92 |
| $N_2O$ thousand tons $CO_2$eq* | 34.6 | 137.0 | 243.2 |
| **Value of Emissions Reduction** | | | |
| $CO_2$ 2014$ million** | 66 to 944 | 284 to 4,085 | 503 to 7,230 |
| $NO_X$ – 3% discount rate 2014$ million | 50.4 | 240.9 | 424.1 |
| $NO_X$ – 7% discount rate 2014$ million | 19.4 | 93.5 | 165.2 |

Parentheses indicate negative (-) values.
* $CO_2$eq is the quantity of $CO_2$ that would have the same GWP.
** Range of the economic value of $CO_2$ reductions is based on estimates of the global benefit of reduced $CO_2$ emissions.

**Table V-46. Conventional Ovens: Summary of Manufacturer and Consumer Impacts**

| Category | TSL 1 | TSL 2 | TSL 3* |
|---|---|---|---|
| **Manufacturer Impacts** | | | |
| Industry NPV (2014$ million) (Base Case INPV = $783.5) | 762.1 - 762.8 | 697.1 - 702.6 | 56.0 - 140.6 |
| Industry NPV (% change) | (2.7) - (2.6) | (11.0) - (10.3) | (92.9) - (82.0) |
| **Consumer Average LCC Savings** (2014$) | | | |
| PC1: Electric Standard Ovens, Free-Standing | $13.96 | $15.18 | ($37.60) |
| PC2: Electric Standard Ovens, Built-in/Slide-in | $14.11 | $15.25 | ($37.64) |
| PC3: Electric Self-Clean Ovens, Free-Standing | $14.10 | $14.10 | ($27.79) |
| PC4: Electric Self-Clean Ovens, Built-in/Slide-in | $14.20 | $14.20 | ($27.80) |
| PC5: Gas Standard Ovens, Free-Standing | $0.00 | $289.73 | $178.91 |
| PC6: Gas Standard Ovens, Built-In/Slide-In | $0.00 | $289.77 | $178.92 |
| PC7: Gas Self-Clean Ovens, Free-Standing | $18.02 | $282.80 | $165.73 |
| PC8: Gas Self-Clean Ovens, Built-In/Slide-In | $18.03 | $282.85 | $165.75 |
| **Consumer Simple PBP (years)** | | | |
| PC1: Electric Standard Ovens, Free-Standing | 0.9 | 4.0 | 17.5 |
| PC2: Electric Standard Ovens, Built-in/Slide-in | 0.9 | 4.0 | 17.5 |
| PC3: Electric Self-Clean Ovens, Free-Standing | 0.9 | 0.9 | 18.1 |
| PC4: Electric Self-Clean Ovens, Built-in/Slide-in | 0.9 | 0.9 | 18.1 |
| PC5: Gas Standard Ovens, Free-Standing | -- | 1.7 | 5.3 |
| PC6: Gas Standard Ovens, Built-In/Slide-In | -- | 1.7 | 5.3 |
| PC7: Gas Self-Clean Ovens, Free-Standing | 0.8 | 1.2 | 5.4 |
| PC8: Gas Self-Clean Ovens, Built-In/Slide-In | 0.8 | 1.2 | 5.4 |
| **% of Consumers that Experience Net Cost** | | | |
| PC1: Electric Standard Ovens, Free-Standing | 0 | 12 | 82 |

| Category | TSL 1 | TSL 2 | TSL 3* |
|---|---|---|---|
| PC2: Electric Standard Ovens, Built-in/Slide-in | 0 | 12 | 82 |
| PC3: Electric Self-Clean Ovens, Free-Standing | 0 | 0 | 76 |
| PC4: Electric Self-Clean Ovens, Built-in/Slide-in | 0 | 0 | 76 |
| PC5: Gas Standard Ovens, Free-Standing | 0 | 0 | 24 |
| PC6: Gas Standard Ovens, Built-In/Slide-In | 0 | 0 | 24 |
| PC7: Gas Self-Clean Ovens, Free-Standing | 0 | 0 | 27 |
| PC8: Gas Self-Clean Ovens, Built-In/Slide-In | 0 | 0 | 27 |

* Parentheses indicate negative (-) values.

DOE first considered TSL 3, which represents the max-tech efficiency levels. TSL 3 would save 1.25 quads of energy, an amount DOE considers significant. TSL 3 has an estimated NPV of consumer benefit of 1.7 billion using a discount rate of 7 percent, and 6.7 billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 3 are 72.6 Mt of $CO_2$, 120.9 thousand tons of $NO_X$, 52.4 thousand tons of $SO_2$, 0.2 ton of Hg, 387.5 thousand tons of $CH_4$, and 0.92 thousand tons of $N_2O$. The estimated monetary value of the $CO_2$ emissions reduction at TSL 3 ranges from $503 million to $7,230 million.

At TSL 3, the average LCC impact is a savings ranging from -$37.64 for PC2 (Electric Standard Ovens, Built-In/Slide-In) to $178.92 for product class 6 (Gas Standard Ovens, Built-in/Slide-in). The simple payback period ranges from 5 years for PC5, PC6, PC7, and PC8 (Gas Standard Ovens, Free-Standing and Built-In/Slide-In, and Gas Self-

Clean Ovens, Free-Standing and Built-In/Slide-In) to 18 years for PC1, PC2, PC3, and PC4 (Electric Standard Ovens, Built-In/Slide-In and Free-Standing and Electric Self-Clean Ovens, Built-In/Slide-In and Free-Standing). The fraction of consumers experiencing an LCC net cost ranges from 24 percent for PC5 and PC6 (Gas Standard Ovens, Free-Standing and Built-In/Slide-In) to 82 percent for PC1 and PC2 (Electric Standard Oven, Free-Standing and Built-In/Slide-In).

At TSL 3, the projected change in INPV ranges from a decrease of $727.5 million to a decrease of $642.9 million, equivalent to a loss of 92.9 percent and a loss of 82.0 percent, respectively.

Products that meet the efficiency standards specified by this TSL are forecast to represent 11 percent of shipments in the year leading up to new and amended standards. As such, manufacturers would have to redesign the vast majority of their products by the 2019 compliance date to meet demand. Redesigning all these units to meet the current max-tech efficiency levels would require considerable capital and equipment conversion expenditures. At TSL 3, the capital conversion costs total $528.0 million, 4.3 times the industry annual capital expenditure in the year leading up to new and amended standards. DOE estimates that complete platform redesigns would cost the industry $401.5 million in product conversion costs. These conversion costs largely relate to the research programs required to develop new products that meet the efficiency standards set forth by TSL 3. These costs are equivalent to 4.5 times the industry annual budget for research and development. Total capital and product conversion costs associated with the changes in products and manufacturing facilities required at TSL 3 would require significant use of manufacturers' financial reserves , impacting other areas of business that compete for these resources, and significantly reducing INPV. In addition, manufacturers could face a substantial impact on profitability at TSL 3. Because manufacturers are more likely to reduce their margins to maintain a price-competitive product at higher TSLs, DOE expects that TSL 3 would yield impacts closer to the high end of the range of INPV impacts. If the high end of the range of impacts is reached, as DOE expects, TSL 3 could result in a net loss of 92.9 percent in INPV to residential conventional oven manufacturers. As a result, at TSL 3, DOE expects that some companies could be forced to exit the residential conventional oven market or shift production abroad, both of which would negatively impact domestic manufacturing capacity and employment.

In view of the foregoing, DOE concludes that, at TSL 3 for conventional ovens, the benefits of energy savings, positive NPV of total customer benefits, customer LCC savings for four of the eight product classes, emission reductions and the estimated monetary value of the emissions reductions would be outweighed by the negative customer impacts for product classes 1, 2, 3, and 4 (Electric Standard Ovens, Free-Standing and Built-In/Slide-In and Electric Self-Clean Ovens, Free-Standing and Built-In/Slide-In), the significant reduction in industry value at TSL 3, as well as the potential for loss of domestic manufacturing. Consequently, DOE has concluded that TSL 3 is not economically justified.

DOE then considered TSL 2. TSL 2 would save 0.71 quads of energy, an amount DOE considers significant. Under TSL 2, the estimated NPV of consumer benefit is $4.7 billion using a discount rate of 7 percent, and $11.0 billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 2 are 41.1 Mt of $CO_2$, 68.8 thousand tons of $NO_X$, 29.5 thousand tons of $SO_2$, 0.09 tons of Hg, 221.2 thousand tons of $CH_4$, and 0.52 thousand tons of $N_2O$. The estimated monetary value of the $CO_2$ emissions reduction at TSL 2 ranges from $284 million to $4,085 million.

At TSL 2, the average LCC impact is a savings ranging from $14.10 for PC3 (Electric Self-Clean Ovens, Free-Standing) to $289.77 for PC6 (Gas Standard Ovens, Built-In/Slide-in). The simple payback period ranges from 1 year for PC3, PC4, PC7, and PC8 (Electric Self-Clean Ovens, Free-Standing and Built-In/Slide-In and Gas Self-Clean Ovens, Free-Standing and Built-In/Slide-In) to 4 years for PC1 and PC2 (Electric Standard Ovens Free-Standing and Built-In/Slide-In). The fraction of consumers experiencing an LCC net cost ranges from zero percent for PC3 through PC8 (Electric Self-Clean Ovens, Free-Standing and Built-In/Slide-In, Gas Standard Ovens, Free-Standing and Built-In/Slide-In, and Gas Self-Clean Ovens, Free-Standing and Built-In/Slide-In) to 12 percent for PC1 and PC2 (Electric Standard Ovens, Free-Standing and Built-In/Slide-In).

At TSL 2, the projected change in INPV ranges from a decrease of $86.4 million to a decrease of $80.9 million, equivalent to a loss of 11.0 percent and a loss of 10.3 percent, respectively. Products that meet the efficiency standards specified by this TSL are forecast to represent 46 percent of shipments in the year leading up to new and amended standards. DOE estimates that compliance with TSL 2 would require manufacturers to make an estimated $42.0 million in capital conversion costs. This represents a 0.3 times increase in the annual capital expenditure budget in the year leading up to new and amended standards. TSL 2 will also require manufacturers to make an estimated $67.9 million in product conversion costs primarily relating to the research and development programs needed to improve upon existing platforms to meet the specified efficiency levels. This represents 0.8 times the industry budget for research and development in the year leading up to new and amended standards. The substantial reduction in conversion costs corresponding to compliance with TSL 2 greatly mitigates the operational risk and impact on INPV.

The Secretary tentatively concludes that at TSL 2 for residential conventional ovens, the benefits of energy savings, positive NPV of consumer benefits, emission reductions, and the estimated monetary value of the $CO_2$ emissions reductions, and positive average LCC savings would outweigh the negative impacts on some consumers and on manufacturers, including the conversion costs that would result in a reduction in INPV for manufacturers.

After considering the analysis and the benefits and burdens of TSL 2, DOE has tentatively concluded that this TSL will offer the maximum improvement in efficiency that is technologically feasible and economically justified, and will result in significant conservation of energy. Therefore, DOE proposes TSL 2 for conventional ovens. The proposed energy conservation standards for conventional ovens are shown in Table V-47..

**Table V-47. Proposed Amended Energy Conservation Standards for Conventional Ovens**

| Compliance Date: January 1, 2019 | | |
|---|---|---|
| **Product Class** | **Integrated Annual Energy Consumption (IAEC)** | |
| | Electricity Consumption kWh/year | Gas Consumption kBtu/year |
| Electric Standard Ovens, Free-Standing | 122.5 + (31.8 × Rated Cavity Volume) | -- |
| Electric Standard Ovens, Built-in/Slide-in | 128.6 + (31.8 × Rated Cavity Volume) | -- |
| Electric Self-Clean Ovens, Free-Standing | 163.2 + (42.3 × Rated Cavity Volume) | -- |
| Electric Self-Clean Ovens, Built-in/Slide-in | 169.1 + (42.3 × Rated Cavity Volume) | -- |
| Gas Standard Ovens, Free-Standing | -- | 492.9 + (214.4 × Rated Cavity Volume) |
| Gas Standard Ovens, Built-in/Slide-in | -- | 499.5 + (214.4 × Rated Cavity Volume) |
| Gas Self-Clean Ovens, Free-Standing | -- | 746.7 + (214.4 × Rated Cavity Volume) |
| Gas Self-Clean Ovens, Built-In/Slide-in | -- | 755.5 + (214.4 × Rated Cavity Volume) |

**Note**: The Rated Cavity Volume is the volume of the oven cavity in cubic feet as measured using the final DOE test procedure at 10 CFR part 430, subpart B, appendix I.

2. Annualized Benefits and Costs of the Proposed Standards

The benefits and costs of the proposed standards can also be expressed in terms of annualized values. The annualized monetary values are the sum of (1) the annualized national economic value of the benefits from operating products that meet the proposed standards (consisting of operating cost savings from using less energy, minus increases in product purchase costs, which is another way of representing consumer NPV), and (2) the monetary value of the benefits of $CO_2$ and $NO_X$ emission reductions.[77]

Table V-48 shows the annualized values for conventional ovens under TSL 2, expressed in 2014$. The results under the primary estimate are as follows. Using a 7-percent discount rate for benefits and costs other than $CO_2$ reductions, for which DOE used a 3-percent discount rate along with the SCC series corresponding to a value of $41.2/ton in 2015 (in 2014$), the cost of the standards for conventional ovens in today's rule is $33.5 million per year in increased equipment costs, while the annualized benefits are $494 million per year in reduced equipment operating costs, $74 million in $CO_2$ reductions, and $9 million in reduced $NO_X$ emissions. In this case, the net benefit amounts to $543 million per year. Using a 3-percent discount rate for all benefits and costs and the SCC series corresponding to a value of $41.2/ton in 2015 (in 2014$), the cost of the standards for conventional ovens in today's rule is $33.1 million per year in

[77] To convert the time-series of costs and benefits into annualized values, DOE calculated a present value in 2014, the year used for discounting the NPV of total consumer costs and savings. For the benefits, DOE calculated a present value associated with each year's shipments in the year in which the shipments occur (2020, 2030, etc.), and then discounted the present value from each year to 2014. The calculation uses discount rates of 3 and 7 percent for all costs and benefits except for the value of $CO_2$ reductions, for which DOE used case-specific discount rates. Using the present value, DOE then calculated the fixed annual payment over a 30-year period, starting in the compliance year that yields the same present value.

increased equipment costs, while the benefits are $648 million per year in reduced operating costs, $74 million in $CO_2$ reductions, and $13 million in reduced $NO_X$ emissions. In this case, the net benefit amounts to $701 million per year.

**Table V-48. Annualized Benefits and Costs of Proposed Amended Standards (TSL 2) for Conventional Ovens Sold in 2019–2048**

| | Discount Rate | Primary Estimate* | Low Net Benefits Estimate* | High Net Benefits Estimate* |
|---|---|---|---|---|
| | | Million 2014$/year | | |
| **Benefits** | | | | |
| Consumer Operating Cost Savings | 7% | 494 | 457 | 542 |
| | 3% | 648 | 593 | 719 |
| $CO_2$ Reduction at $12.2/t** | 5% | 21 | 20 | 24 |
| $CO_2$ Reduction at $41.2/t** | 3% | 74 | 68 | 81 |
| $CO_2$ Reduction at $63.4/t** | 2.5% | 108 | 100 | 119 |
| $CO_2$ Reduction at $121/t** | 3% | 228 | 211 | 252 |
| $NO_X$ Reduction† | 7% | 9.24 | 8.66 | 10.11 |
| | 3% | 13.43 | 12.46 | 14.80 |
| Total†† | 7% plus $CO_2$ range | 524 to 731 | 485 to 677 | 576 to 804 |
| | 7% | 577 | 534 | 634 |
| | 3% plus $CO_2$ range | 682 to 889 | 625 to 817 | 758 to 986 |
| | 3% | 734 | 674 | 815 |
| **Costs** | | | | |
| Consumer Incremental Product Costs | 7% | 34 | 34 | 33 |
| | 3% | 33 | 34 | 33 |
| | | | | |
| Total†† | 7% plus $CO_2$ range | 491 to 697 | 451 to 642 | 543 to 771 |
| | 7% | 543 | 499 | 601 |
| | 3% plus $CO_2$ range | 649 to 856 | 592 to 783 | 725 to 953 |
| | 3% | 701 | 640 | 783 |

* The results include benefits to consumers which accrue after 2048 from products purchased from 2019 through 2048. Costs incurred by manufacturers, some of which may be incurred prior to 2019 in preparation for the rule, are not directly included, but are indirectly included as part of incremental equipment costs. The Primary, Low Benefits, and High Benefits Estimates utilize forecasts of energy prices and housing starts from the AEO 2015 Reference case, Low Estimate, and High Estimate, respectively. In addition, incremental product costs reflect a medium decline rate for projected product price trends in the Primary Estimate, a low decline rate in the Low Benefits Estimate, and a high decline rate in the High Benefits Estimate. The methods used to derive projected price trends are explained in section IV.F.1 of this notice.

** The $CO_2$ values represent global values (in 2014$) of the social cost of $CO_2$ emissions in 2015 under several scenarios. The values of $12.2, $41.2, and $63.4 per ton are the averages of SCC distributions calculated using 5%, 3%, and 2.5% discount rates, respectively. The value of $121 per ton represents the 95th percentile of the SCC distribution calculated using a 3% discount rate.

† The $/ton values used for $NO_X$ are described in section IV.L.2.

†† Total Benefits for both the 3% and 7% cases are derived using the SCC value calculated at a 3% discount rate, which is $41.2/ton in 2015 (2014$). In the rows labeled as "7% plus $CO_2$ range" and "3% plus $CO_2$ range," the operating cost and $NO_X$ benefits are calculated using the labeled discount rate, and those values are added to the full range of $CO_2$ values.

## VI. Procedural Issues and Regulatory Review

### A. Review Under Executive Orders 12866 and 13563

Section 1(b)(1) of Executive Order 12866, "Regulatory Planning and Review," 58 FR 51735 (Oct. 4, 1993), requires each agency to identify the problem that it intends to address, including, where applicable, the failures of private markets or public institutions that warrant new agency action, as well as to assess the significance of that problem. The problems that the proposed standards address are as follows:

(1) Insufficient information and the high costs of gathering and analyzing relevant information leads some consumers to miss opportunities to make cost-effective investments in energy efficiency.

(2) In some cases the benefits of more efficient products are not realized due to misaligned incentives between purchasers and users. An example of such a case is when the products purchase decision is made by a building contractor or building owner who does not pay the energy costs.

(3) There are external benefits resulting from improved energy efficiency of appliances that are not captured by the users of such equipment. These benefits include externalities related to public health, environmental protection, and

national security that are not reflected in energy prices, such as reduced emissions of air pollutants and greenhouse gases that impact human health and global warming.

In addition, DOE has determined that this regulatory action is an "economically significant regulatory action" under Executive Order 12866. DOE presented to the Office of Information and Regulatory Affairs (OIRA) in the OMB for review the draft rule and other documents prepared for this rulemaking, including a regulatory impact analysis (RIA), and has included these documents in the rulemaking record. The assessments prepared pursuant to Executive Order 12866 can be found in the technical support document for this rulemaking.

DOE has also reviewed this regulation pursuant to Executive Order 13563. 76 FR 3281 (Jan. 21, 2011). Executive Order 13563 is supplemental to and explicitly reaffirms the principles, structures, and definitions governing regulatory review established in Executive Order 12866. To the extent permitted by law, agencies are required by Executive Order 13563 to: (1) propose or adopt a regulation only upon a reasoned determination that its benefits justify its costs (recognizing that some benefits and costs are difficult to quantify); (2) tailor regulations to impose the least burden on society, consistent with obtaining regulatory objectives, taking into account, among other things, and to the extent practicable, the costs of cumulative regulations; (3) select, in choosing among alternative regulatory approaches, those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity); (4) to the extent feasible, specify performance objectives, rather than specifying the behavior or manner of compliance that regulated entities must adopt; and (5) identify and assess available alternatives to direct regulation, including providing economic incentives to encourage the desired behavior, such as user fees or marketable permits, or providing information upon which choices can be made by the public.

DOE emphasizes as well that Executive Order 13563 requires agencies to use the best available techniques to quantify anticipated present and future benefits and costs as accurately as possible. In its guidance, the Office of Information and Regulatory Affairs has emphasized that such techniques may include identifying changing future compliance costs that might result from technological innovation or anticipated behavioral changes. For the reasons stated in the preamble, DOE believes that the NOPR is consistent with these principles, including the requirement that, to the extent permitted by law, benefits justify costs and that net benefits are maximized.

## B. Review Under the Regulatory Flexibility Act

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

1. Description and Estimated Number of Small Entities Regulated

a. Methodology for Estimating the Number of Small Entities

For manufacturers of residential conventional ovens, the Small Business Administration (SBA) has set a size threshold, which defines those entities classified as "small businesses" for the purposes of the statute. DOE used the SBA's small business size standards to determine whether any small entities would be subject to the requirements of the rule. 65 FR 30836, 30848 (May 15, 2000), as amended at 65 FR 53533, 53544 (September 5, 2000) and codified at 13 CFR part 121. The size standards are listed by North American Industry Classification System (NAICS) code and industry description and are available at http://www.sba.gov/sites/default/files/files/Size_Standards_Table.pdf. Residential conventional oven manufacturing is classified under NAICS 335221, "Household Cooking Appliance Manufacturing." The SBA sets a threshold of 750 employees or fewer for an entity to be considered a small business for this category.

DOE reviewed the potential standard levels considered in this NOPR under the provisions of the Regulatory Flexibility Act and the procedures and policies published on

February 19, 2003. To better assess the potential impacts of this rulemaking on small entities, DOE conducted a more focused inquiry of the companies that could be small business manufacturers of products covered by this rulemaking. During its market survey, DOE used available public information to identify potential small manufacturers. DOE's research involved industry trade association membership directories (e.g., AHAM), information from previous rulemakings, individual company websites, and market research tools (e.g., Hoover's reports) to create a list of companies that manufacture or sell residential conventional ovens covered by this rulemaking.

**Table VI-1. Sources Used to Identify Residential Conventional Oven Manufacturers**

| Source | Number of Large Manufacturers Identified | Number of Small Manufacturers Identified |
|---|---|---|
| AHAM Trade Association Directory | 10 | 1 |
| Previous Rulemaking | 2 | 3 |
| Market Research | 0 | 3 |
| **Total** | **12** | **7** |

DOE also asked stakeholders and industry representatives if they were aware of any additional small manufacturers during manufacturer interviews and at DOE public meetings. DOE reviewed publicly available data and contacted various companies on its complete list of manufacturers, as necessary, to determine whether they met the SBA's definition of a small business manufacturer. DOE screened out companies that do not offer products impacted by this rulemaking, do not meet the definition of a "small business," or are foreign owned and operated.

DOE identified 19 companies that either manufacture or sell residential conventional ovens that would be affected by this proposal. Of these 19 companies, DOE identified seven that met the SBA's definition of a small business.

b. Manufacturer Participation

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

c. Residential Conventional Oven Industry Structure and Nature of Competition

Three major manufacturers supply approximately 85 percent of the market for residential conventional ovens. DOE estimates that the remaining 15 percent of the market is served by a combination of small businesses and large businesses. None of the three major manufacturers of residential conventional ovens affected by this rulemaking is a small business.

d. Comparison between Large and Small Manufacturers

In general, small manufacturers differ from large manufacturers in several ways that affect the extent to which a manufacturer may be impacted by proposed standards. Characteristics of small manufacturers typically include: lower production volumes, fewer engineering resources, and less access to capital. Lower production volumes in particular may place small manufacturers at a competitive disadvantage relative to large manufacturers as they convert products and facilities to comply with new and amended standards. When producing at lower volumes, a small manufacturer's conversion costs must be spread over fewer units than a larger competitor's. Therefore, unless a small manufacturer can differentiate its products in order to earn a price premium, the small manufacturer may experience a disproportionate cost penalty as it spreads one-time conversion costs over fewer unit sales. Additionally, when producing at lower volumes, small manufacturers may lack the purchasing power of their larger competitors and may therefore face higher costs when sourcing components for more efficient products. Disadvantages tied to lower production volumes may be further exacerbated by the fact that small manufacturers often have more limited engineering resources than their larger competitors, thereby complicating the redesign effort required to comply with new and amended standards. Finally, small manufacturers often have less access to capital, which may be needed to cover the conversion costs associated with new and amended standards. Combined, these factors may entail a disproportionate burden on small manufacturers.

2. Description and Estimate of Compliance Requirements

At TSL 1 DOE estimates capital conversion costs of $0.3 million and product conversion costs of $0.1 million for an average small manufacturer. For an average large manufacturer, DOE estimates capital conversion costs of $0.6 million and product conversion costs of $0.3 million.

At TSL 2, the level proposed here, DOE estimates capital conversion costs of $1.3 million and product conversion costs of $4.1 million for an average small manufacturer. For an average large manufacturer, DOE estimates capital conversion costs of $2.7 million and product conversion costs of $3.3 million. Table VI-2 presents the estimated conversion costs as a percentage of annual revenue for an average small manufacturer relative to an average large manufacturer.

**Table VI-2. Conversion Costs Facing an Average Small Manufacturer versus an Average Large Manufacturer of Residential Conventional Ovens**

| | Capital Conversion Costs as a Percentage of Annual Revenue | Product Conversion Costs as a Percentage of Annual Revenue | Total Conversion Costs as a Percentage of Annual Revenue |
|---|---|---|---|
| Average Small Manufacturer | 2% | 6% | 8% |
| Average Large Manufacturer | 1% | 1% | 1% |

At TSL 3, DOE estimates capital conversion costs of $16.5 million and product conversion costs of $19.2 million for an average small manufacturer. For an average large manufacturer, DOE estimates capital conversion costs of $34.4 million and product conversion costs of $22.2 million.

As the results for TSL 2 indicate, new and amended energy conservation standards could potentially impact small businesses disproportionately. Although estimated conversion costs at TSL 2 are higher for an average large manufacturer than an average small manufacturer, the relative impacts of conversion costs on large manufacturers will likely be offset by higher annual revenues. This is consistent with the dynamic previously described, whereby large manufacturers tend to have larger production and sales volumes over which to spread costs and may also enjoy a competitive advantage due to their size and ability to access capital that may not be available to small manufacturers. Since the proposed standards could cause competitive concerns for small manufacturers, DOE cannot certify that the proposed standards would not have a significant impact on a substantial number of small businesses.

DOE requests comments on the number of small businesses identified and on the impacts of new and amended energy conservation standards on small businesses.

3. Duplication, Overlap, and Conflict with Other Rules and Regulations

DOE is not aware of any rules or regulations that duplicate, overlap, or conflict with the rule being proposed.

4. Significant Alternatives to the Rule

The discussion in the previous section analyzes impacts on small businesses that would result from DOE's new and amended standards. In reviewing alternatives to the proposed rule, DOE examined energy conservation standards set at higher and lower efficiency levels, TSL 3 and TSL1, respectively. As discussed in section VI.B.2, compared to TSL 3, DOE estimates that the capital conversion costs and product conversion costs for an average small manufacturer at TSL 2 would be 92 and 79 percent lower, respectively. The substantial reduction in small manufacturer capital and product conversion costs corresponding to TSL 2 compared to TSL 3 greatly mitigates the operational risk and the impact of the standard on INPV.

While TSL 1 would reduce the impacts on small business manufacturers, it would come at the expense of a significant reduction in energy savings and NPV benefits to consumers, achieving 75 percent lower energy savings and 84 percent less NPV benefits to consumers compared to the energy savings and NPV benefits at TSL 2.

DOE believes that establishing standards at TSL 2 balances the benefits of the energy savings and the NPV benefits to consumers created at TSL 2 with the potential burdens placed on residential conventional oven manufacturers, including small business manufacturers. Accordingly, DOE is declining to adopt one of the other TSLs considered above, or the other policy alternatives detailed as part of the regulatory impacts analysis included in Chapter 17 of this NOPR TSD.

Additional compliance flexibilities may be available through other means. For example, individual manufacturers may petition for a waiver of the applicable test procedure. (See 10 CFR 431.401.) Further, EPCA provides that a manufacturer whose annual gross revenue from all of its operations does not exceed $8,000,000 may apply for an exemption from all or part of an energy conservation standard for a period not longer than 24 months after the effective date of a final rule establishing the standard. (42 U.S.C. 6295 (t)). DOE estimates that two of the seven small manufacturers could potentially petition for a waiver based on their annual gross revenue not exceeding $8 million. Additionally, Section 504 of the Department of Energy Organization Act, 42 U.S.C. 7194, provides authority for the Secretary to adjust a rule issued under EPCA in order to prevent “special hardship, inequity, or unfair distribution of burdens” that may be imposed on that manufacturer as a result of such rule. Manufacturers should refer to 10 CFR part 430, subpart E, and part 1003 for additional details

DOE continues to seek input from businesses that would be affected by this rulemaking and will consider comments received in the development of any final rule (See section VII.E. that solicits specific data as well as input on the results of the analyses contained in this section VI.B.4).

## C. Review Under the Paperwork Reduction Act

Manufacturers of covered products must certify to DOE that their products comply with any applicable energy conservation standards. In certifying compliance, manufacturers must test their products according to the applicable DOE test procedure, including any amendments adopted for that test procedure. DOE has established regulations for the certification and recordkeeping requirements for all covered consumer products and commercial equipment, including conventional cooking products. 76 FR 12422 (March 7, 2011). The collection-of-information requirement for the certification and recordkeeping is subject to review and approval by OMB under the Paperwork Reduction Act (PRA). This requirement has been approved by OMB under OMB control number 1910-1400. Public reporting burden for the certification is estimated to average 30 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

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

## D. Review Under the National Environmental Policy Act of 1969

Pursuant to the National Environmental Policy Act (NEPA) of 1969, DOE has determined that the proposed rule fits within the category of actions included in Categorical Exclusion (CX) B5.1 and otherwise meets the requirements for application of a CX. See 10 CFR Part 1021, App. B, B5.1(b); 1021.410(b) and Appendix B, B(1)-(5). The proposed rule fits within the category of actions because it is a rulemaking that establishes energy conservation standards for consumer products or industrial equipment, and for which none of the exceptions identified in CX B5.1(b) apply. Therefore, DOE has made a CX determination for this rulemaking, and DOE does not need to prepare an Environmental Assessment or Environmental Impact Statement for this proposed rule. DOE's CX determination for this proposed rule is available at http://cxnepa.energy.gov/

## E. Review Under Executive Order 13132

Executive Order 13132, "Federalism." 64 FR 43255 (Aug. 10, 1999) imposes certain requirements on Federal agencies formulating and implementing policies or regulations that preempt State law or that have Federalism implications. The Executive Order requires agencies to examine the constitutional and statutory authority supporting any action that would limit the policymaking discretion of the States and to carefully assess the necessity for such actions. The Executive Order also requires agencies to have an accountable process to ensure meaningful and timely input by State and local officials in the development of regulatory policies that have Federalism implications. On March 14, 2000, DOE published a statement of policy describing the intergovernmental consultation process it will follow in the development of such regulations. 65 FR 13735. EPCA governs and prescribes Federal preemption of State regulations as to energy conservation for the products that are the subject of this proposed rule. States can petition DOE for exemption from such preemption to the extent, and based on criteria, set forth in EPCA. (42 U.S.C. 6297) No further action is required by Executive Order 13132.

F. Review Under Executive Order 12988

With respect to the review of existing regulations and the promulgation of new regulations, section 3(a) of Executive Order 12988, "Civil Justice Reform," imposes on Federal agencies the general duty to adhere to the following requirements: (1) eliminate drafting errors and ambiguity; (2) write regulations to minimize litigation; and (3) provide a clear legal standard for affected conduct rather than a general standard and promote simplification and burden reduction. 61 FR 4729 (Feb. 7, 1996). Section 3(b) of Executive Order 12988 specifically requires that Executive agencies make every reasonable effort to ensure that the regulation: (1) clearly specifies the preemptive effect, if any; (2) clearly specifies any effect on existing Federal law or regulation; (3) provides a clear legal standard for affected conduct while promoting simplification and burden reduction; (4) specifies the retroactive effect, if any; (5) adequately defines key terms;

and (6) addresses other important issues affecting clarity and general draftsmanship under any guidelines issued by the Attorney General. Section 3(c) of Executive Order 12988 requires Executive agencies to review regulations in light of applicable standards in section 3(a) and section 3(b) to determine whether they are met or it is unreasonable to meet one or more of them. DOE has completed the required review and determined that, to the extent permitted by law, this proposed rule meets the relevant standards of Executive Order 12988.

G. Review Under the Unfunded Mandates Reform Act of 1995

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

Although the proposed rule does not contain a Federal intergovernmental mandate, it may require expenditures of $100 million or more on the private sector. Specifically, the proposed rule will likely result in a final rule that could require expenditures of $100 million or more. Such expenditures may include: (1) investment in research and development and in capital expenditures by conventional cooking product manufacturers in the years between the final rule and the compliance date for the new standards, and (2) incremental additional expenditures by consumers to purchase higher-efficiency conventional cooking products, starting at the compliance date for the applicable standard.

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

Under section 205 of UMRA, the Department is obligated to identify and consider a reasonable number of regulatory alternatives before promulgating a rule for which a written statement under section 202 is required. 2 U.S.C. 1535(a). DOE is required to select from those alternatives the most cost-effective and least burdensome alternative that achieves the objectives of the proposed rule unless DOE publishes an explanation for doing otherwise, or the selection of such an alternative is inconsistent with law. This proposed rule would establish energy conservation standards for conventional cooking products that are designed to achieve the maximum improvement in energy efficiency that DOE has determined to be both technologically feasible and economically justified. A full discussion of the alternatives considered by DOE is presented in the "Regulatory Impact Analysis" section of the TSD for the proposed rule.

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

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

## I. Review Under Executive Order 12630

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

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

Section 515 of the Treasury and General Government Appropriations Act, 2001 (44 U.S.C. 3516, note) provides for Federal agencies to review most disseminations of information to the public under guidelines established by each agency pursuant to general guidelines issued by OMB. OMB's guidelines were published at 67 FR 8452 (Feb. 22, 2002), and DOE's guidelines were published at 67 FR 62446 (Oct. 7, 2002). DOE has reviewed the NOPR under the OMB and DOE guidelines and has concluded that it is consistent with applicable policies in those guidelines.

## K. Review Under Executive Order 13211

Executive Order 13211, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use" 66 FR 28355 (May 22, 2001), requires Federal agencies to prepare and submit to OIRA at OMB, a Statement of Energy Effects for any proposed significant energy action. A "significant energy action" is defined as any action by an agency that promulgates or is expected to lead to promulgation of a final rule, and that: (1) is a significant regulatory action under Executive Order 12866, or any successor order; and (2) is likely to have a significant adverse effect on the supply, distribution, or use of energy, or (3) is designated by the Administrator of OIRA as a significant energy action. For any proposed significant energy action, the agency must give a detailed statement of any adverse effects on energy supply, distribution, or use should the proposal be implemented, and of reasonable alternatives to the action and their expected benefits on energy supply, distribution, and use.

DOE has tentatively concluded that this regulatory action, which sets forth energy conservation standards for conventional cooking products, is not a significant energy action because the proposed standards are not likely to have a significant adverse effect on the supply, distribution, or use of energy, nor has it been designated as such by the Administrator at OIRA. Accordingly, DOE has not prepared a Statement of Energy Effects on the proposed rule.

## L. Review Under the Information Quality Bulletin for Peer Review

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

In response to OMB's Bulletin, DOE conducted formal in-progress peer reviews of the energy conservation standards development process and analyses and has prepared a Peer Review Report pertaining to the energy conservation standards rulemaking analyses. Generation of this report involved a rigorous, formal, and documented evaluation using objective criteria and qualified and independent reviewers to make a judgment as to the technical/scientific/business merit, the actual or anticipated results, and the productivity and management effectiveness of programs and/or projects. The "Energy Conservation Standards Rulemaking Peer Review Report" dated February 2007 has been disseminated and is available at the following Web site: www1.eere.energy.gov/buildings/appliance_standards/peer_review.html.

## VII. Public Participation

### A. Attendance at the Public Meeting

The time, date, and location of the public meeting are listed in the DATES and ADDRESSES sections at the beginning of this notice. If you plan to attend the public meeting, please notify Ms. Brenda Edwards at (202) 586-2945 or Brenda.Edwards@ee.doe.gov. Please note that foreign nationals participating in the public meeting are subject to advance security screening procedures which require advance notice prior to attendance at the public meeting. If a foreign national wishes to participate in the public meeting, please inform DOE of this fact as soon as possible by contacting Ms. Regina Washington at (202) 586-1214 or by e-mail: Regina.Washington@ee.doe.gov so that the necessary procedures can be completed.

Please also note that those wishing to bring laptops into the Forrestal Building will be required to obtain a property pass. Visitors should avoid bringing laptops, or allow an extra 45 minutes.

Due to the REAL ID Act implemented by the Department of Homeland Security (DHS), there have been recent changes regarding ID requirements for individuals wishing to enter Federal buildings from specific states and U.S. territories. Driver's licenses from the following states or territory will not be accepted for building entry and one of the alternate forms of ID listed below will be required. DHS has determined that regular driver's licenses (and ID cards) from the following jurisdictions are not acceptable for entry into DOE facilities: Alaska, American Samoa, Arizona, Louisiana, Maine, Massachusetts, Minnesota, New York, Oklahoma, and Washington. Acceptable alternate forms of Photo-ID include: U.S. Passport or Passport Card; an Enhanced Driver's License or Enhanced ID-Card issued by the states of Minnesota, New York or Washington (Enhanced licenses issued by these states are clearly marked Enhanced or Enhanced Driver's License); a military ID or other Federal government issued Photo-ID card.

In addition, you can attend the public meeting via webinar. Webinar registration information, participant instructions, and information about the capabilities available to webinar participants will be published on DOE's website at: http://www1.eere.energy.gov/buildings/appliance_standards/rulemaking.aspx?ruleid=85. Participants are responsible for ensuring their systems are compatible with the webinar software.

B. Procedure for Submitting Prepared General Statements For Distribution

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

C. Conduct of the Public Meeting

DOE will designate a DOE official to preside at the public meeting and may also use a professional facilitator to aid discussion. The meeting will not be a judicial or evidentiary-type public hearing, but DOE will conduct it in accordance with section 336 of EPCA (42 U.S.C. 6306). A court reporter will be present to record the proceedings and prepare a transcript. DOE reserves the right to schedule the order of presentations and to establish the procedures governing the conduct of the public meeting. After the public meeting, interested parties may submit further comments on the proceedings as well as on any aspect of the rulemaking until the end of the comment period.

The public meeting will be conducted in an informal, conference style. DOE will present summaries of comments received before the public meeting, allow time for prepared general statements by participants, and encourage all interested parties to share their views on issues affecting this rulemaking. Each participant will be allowed to make a general statement (within time limits determined by DOE), before the discussion of specific topics. DOE will allow, as time permits, other participants to comment briefly on any general statements.

At the end of all prepared statements on a topic, DOE will permit participants to clarify their statements briefly and comment on statements made by others. Participants should be prepared to answer questions by DOE and by other participants concerning these issues. DOE representatives may also ask questions of participants concerning other matters relevant to this rulemaking. The official conducting the public meeting will accept additional comments or questions from those attending, as time permits. The presiding official will announce any further procedural rules or modification of the above procedures that may be needed for the proper conduct of the public meeting.

A transcript of the public meeting will be included in the docket, which can be viewed as described in the Docket section at the beginning of this notice. In addition, any person may buy a copy of the transcript from the transcribing reporter.

D. Submission of Comments

DOE will accept comments, data, and information regarding this proposed rule before or after the public meeting, but no later than the date provided in the DATES section at the beginning of this proposed rule. Interested parties may submit comments, data, and other information using any of the methods described in the ADDRESSES section at the beginning of this notice.

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

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

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

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

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

Include contact information each time you submit comments, data, documents, and other information to DOE. If you submit via mail or hand delivery/courier, please provide all items on a CD, if feasible. It is not necessary to submit printed copies. No facsimiles (faxes) will be accepted.

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

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

Confidential Business Information. According to 10 CFR 1004.11, any person submitting information that he or she believes to be confidential and exempt by law from public disclosure should submit via email, postal mail, or hand delivery/courier two well-marked copies: one copy of the document marked confidential including all the information believed to be confidential, and one copy of the document marked non-confidential with the information believed to be confidential deleted. Submit these documents via email or on a CD, if feasible. DOE will make its own determination about the confidential status of the information and treat it according to its determination.

Factors of interest to DOE when evaluating requests to treat submitted information as confidential include: (1) A description of the items; (2) whether and why such items are customarily treated as confidential within the industry; (3) whether the information is generally known by or available from other sources; (4) whether the information has previously been made available to others without obligation concerning its confidentiality; (5) an explanation of the competitive injury to the submitting person which would result from public disclosure; (6) when such information might lose its confidential character due to the passage of time; and (7) why disclosure of the information would be contrary to the public interest.

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

## E. Issues on Which DOE Seeks Comment

Although DOE welcomes comments on any aspect of this proposal, DOE is particularly interested in receiving comments and views of interested parties concerning the following issues:

1. DOE seeks comment on its proposal to develop two distinct component standards under separate timetables, and whether issues of product design and development, consumer utility and more broadly, cumulative regulatory burden concerns would arise as a result of its proposal (see section III.A of this notice).

2. DOE requests comment on its decision to defer the consideration of adopting energy conservation standards for conventional cooking tops until a representative, repeatable and reproducible test method for cooking tops is finalized. DOE invites data and information that will allow it to further conduct the analysis of cooking tops, particularly when using a water-heating method to evaluate energy consumption. (see section III.B of this notice).

3. DOE requests comment on the proposed product classes for residential conventional cooking products. DOE requests comment on establishing separate product classes for freestanding and built-in/slide-in ovens. DOE also welcomes comment and data on the determination that conventional gas cooking products with higher input rates do not warrant establishing a separate product class. (see section IV.A.2 of this notice).

4. DOE seeks data that characterize the energy consumption of residential steam ovens currently available on the market and requests comment regarding whether a test procedure that accurately measures the energy of a steam cooking mode exists. DOE also seeks comment on the use of optimized burner and cavity design (and other options listed in Table IV-5) to meet the proposed efficiency levels discussed in section I.A.1.b (see section IV.A.3 of this notice).

5. DOE requests comment and data regarding additional design options or variants of the considered design options that can increase the range of considered

efficiency improvements for conventional cooking products, including design options that may not yet be found in the market (see section IV.B.2 of this notice).

6. DOE requests comment on the proposed baseline and incremental efficiency levels. DOE specifically requests inputs and test data on the efficiency improvements associated with the design options identified at each incremental efficiency level that were determined based on either the analysis from the 2009 TSD or updated based on testing and reverse engineering analyses for this NOPR. DOE also seeks comment and data on the proposed slopes and intercepts used to characterize the relationship between IAEC and oven cavity volume for each conventional oven product class (see section IV.C.3 of this notice).

7. DOE requests input and data on the proposed incremental manufacturing production costs for each efficiency level analyzed that were determined based on either the analysis from the 2009 TSD adjusted to reflect changes in the PPI or costs determined based on testing and reverse engineering analyses conducted for this NOPR (see section IV.C.4 of this notice).

8. DOE seeks comment on the tentative determination that the proposed efficiency levels and design options would not impact the consumer utility of conventional ovens (see section IV.C.5 of this notice).

9. DOE requests comments on repair costs and frequency of repair incurred by gas standard and self-clean ovens with Glo-bar ignition and electronic spark

ignition technologies. In this NOPR, DOE used data from 2008 provided by the industry (see section IV.E.5 of this notice for details).

10. DOE requests data that would allow for use of different price trend projections for electric and gas cooking products. (see section IV.H.3.b of this notice)

11. To estimate the impact on shipments of the price increase for the considered efficiency levels, DOE determined that the overall market will be inelastic to price changes and will not impact shipments. DOE welcomes stakeholder input on the effect of amended standards on impacts across products within the same fuel class and equipment. (see section IV.G of this notice).

12. DOE requests comment on the reasonableness of the approach DOE has used to consider the rebound effect with higher-efficiency cooking products. (see section IV.F.3 of this notice)

13. DOE requests comment on DOE's approach for estimating monetary benefits associated with emissions reductions. (see section IV.L of this notice).

14. DOE seeks comment on the proposed manufacturer markup of 1.20 for all residential conventional ovens (see section IV.J.2).

15. DOE seeks comment on the potential domestic employment impacts to residential conventional oven manufacturers at the proposed efficiency levels (see section V.B.2).

16. DOE requests comment on any potential manufacturer capacity constraints caused by the proposed standards in the NOPR, TSL 2 (see section V.B.2).

17.  DOE requests comment on manufacturer subgroups that DOE should analyze and/or types of residential conventional oven manufacturers for the subgroup analysis (see section V.B.2).

18. DOE seeks comment on the compliance costs of any other regulations residential conventional oven manufacturers must make, especially if compliance with those regulations is required three years before or after the estimated compliance date of this proposed standard (2019) (see section V.B.2).

19. DOE requests comments on the number of small businesses identified and on the impacts of new and amended energy conservation standards on small businesses (see section VI.B).

## VIII. Approval of the Office of the Secretary

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

List of Subjects in 10 CFR Part 430

Administrative practice and procedure, Confidential business information, Energy conservation, Household appliances, Imports, Intergovernmental relations, Reporting and recordkeeping requirements, and Small businesses.

Issued in Washington, DC, on May 29, 2015.

David T. Danielson
Assistant Secretary
Energy Efficiency and Renewable Energy

For the reasons set forth in the preamble, DOE proposes to amend part 430 of chapter II, subchapter D, of title 10 of the Code of Federal Regulations, as set forth below:

**PART 430 - ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS**

1. The authority citation for Part 430 continues to read as follows:

Authority: 42 U.S.C. 6291-6309; 28 U.S.C. 2461 note.

2. In §430.2 revising the definitions of "conventional cooking top" and "conventional oven" to read as follows:

**§430.2 Definitions.**

*     *     *     *     *

Conventional cooking top means a class of kitchen ranges and ovens which is a household cooking appliance consisting of a horizontal surface containing one or more surface units which include either a gas flame or electric resistance heating. This includes the conventional cooking top portion of a conventional range.

Conventional oven means a class of kitchen ranges and ovens which is a household cooking appliance consisting of one or more compartments intended for the cooking or heating of food by means of either a gas flame or electric resistance heating. It does not include portable or countertop ovens which use electric resistance heating for the cooking or heating of food and are designed for an electrical supply of approximately 120 volts. This includes the conventional oven(s) portion of a conventional range.

*  *  *  *  *

3. In §430.32 revise paragraph (j) to read as follows:

**§430.32 Energy and water conservation standards and their compliance dates.**

*  *  *  *  *

(j) Cooking Products.

(1) Gas cooking products with an electrical supply cord manufactured on or after January 1, 1990, shall not be equipped with a constant burning pilot light.

(2) Gas cooking products without an electrical supply cord manufactured on or after April 9, 2012, shall not be equipped with a constant burning pilot light.

(3) Conventional ovens manufactured on or after [INSERT DATE 3 YEARS AFTER FINAL RULE FEDERAL REGISTER PUBLICATION] shall have an integrated annual energy consumption no greater than:

| Product Class | Integrated Annual Energy Consumption |
|---|---|
| Electric Standard Oven, Free-standing | 122.5 + (31.8 × Rated Cavity Volume in cubic feet) kWh/yr |
| Electric Standard Oven, Built-In/Slide-In | 128.6 + (31.8 × Rated Cavity Volume in cubic feet) kWh/yr |
| Electric Self-Clean Oven, Free-Standing | 163.2 + (42.3 × Rated Cavity Volume in cubic feet) kWh/yr |
| Electric Self-Clean Oven, Built-In/Slide-In | 169.1 + (42.3 × Rated Cavity Volume in cubic feet) kWh/yr |
| Gas Standard Oven, Free-Standing | 492.9 + (214.4 × Rated Cavity Volume in cubic feet) kWh/yr |
| Gas Standard Oven, Built-In/Slide-In | 499.5 + (214.4 × Rated Cavity Volume in cubic feet) kWh/yr |
| Gas Self-Clean Oven, Free-Standing | 746.7 + (214.4 × Rated Cavity Volume in cubic feet) kWh/yr |
| Gas Self-Clean Oven, Built-In/Slide-In | 755.5 + (214.4 × Rated Cavity Volume in cubic feet) kWh/yr |

**Note:** The Rated Cavity Volume is the volume of the oven cavity in cubic feet as measured using the final DOE test procedure at 10 CFR part 430, subpart B, appendix I.

(4) Microwave-only ovens and countertop convection microwave ovens manufactured on or after June 17, 2016 shall have an average standby power not more than 1.0 watt. Built-in and over-the-range convection microwave ovens manufactured on or after June 17, 2016 shall have an average standby power not more than 2.2 watts.

*     *     *     *     *