DEPARTMENT OF ENERGY

10 CFR Parts 429 and 430

[Docket Number EERE–2014–BT–STD–0005]

RIN 1904–AD15

Energy Conservation Program: Energy Conservation Standards for Residential Conventional Cooking Products

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

ACTION: Supplemental notice of proposed rulemaking (SNOPR).

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 cooking products. 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 SNOPR, DOE proposes new and amended energy conservation standards for residential conventional cooking products, specifically conventional cooking tops and conventional ovens.

DATES: *Comments:* DOE will accept comments, data, and information regarding this supplemental notice of proposed rulemaking (SNOPR) no later than October 3, 2016. See section VII, ''Public Participation'' for details.

Comments regarding the likely competitive impact of the proposed standard should be sent to the Department of Justice contact listed in the **ADDRESSES** section before October 3, 2016.

ADDRESSES:

Instructions: Any comments submitted must identify the SNOPR for Energy Conservation Standards for residential conventional cooking products, and provide docket number EERE–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. *Email: ConventionalCookingProducts2014STD0005@ee.doe.gov.* Include the docket number and/or RIN in the subject line of the message.

3. *Mail:* Mr. John Cymbalsky, U.S. Department of Energy, Building Technologies Program, Mailstop EE–5B, 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:* Mr. John Cymbalsky, U.S. Department of Energy, Building Technologies Program, 950 L'Enfant Plaza SW., Room 6094, Washington, DC 20024. Telephone: (202) 586–6636. If possible, please submit all items on a CD, in which case it is not necessary to include printed copies.

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

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 email to *Chad_S_Whiteman@omb.eop.gov.*

EPCA requires the Attorney General to provide DOE a written determination of whether the proposed standard is likely to lessen competition. The U.S. Department of Justice Antitrust Division invites input from market participants and other interested persons with views on the likely competitive impact of the proposed standard. Interested persons may contact the Division at *energy.standards@usdoj.gov* before October 3, 2016. Please indicate in the ''Subject'' line of your email the title and Docket Number of this SNOPR.

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

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 document on the *www.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, ''Public Participation,'' for further information on how to submit comments through *www.regulations.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. Email: *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. Email: *Celia.Sher@hq.doe.gov.*

SUPPLEMENTARY INFORMATION:

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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), Public Law 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 cooking products, and specifically conventional cooking tops [3] and conventional ovens,[4] the subject of this document.

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)) EPCA also provides that not later than 6 years after issuance of any final rule establishing or amending a standard, DOE must publish either a notice of determination that standards for the product do not need to be amended, or a notice of proposed rulemaking including new proposed energy conservation standards. (42 U.S.C. 6295(m)(1))

In accordance with these and other statutory provisions discussed in this document, DOE proposes new and amended energy conservation standards for residential conventional cooking products. Per its authority in 42 U.S.C. 6295(h)(2), DOE proposes to remove the existing prescriptive standard for gas cooking tops prohibiting a constant burning pilot light. Instead, for conventional cooking tops, DOE proposes performance standards only, shown in Table I.1, which are the maximum allowable integrated annual energy consumption (IAEC). The IAEC includes active mode, standby mode, and off mode energy use. These proposed standards for conventional cooking tops, if adopted, would apply to all product classes listed in Table I.1 and manufactured in, or imported into, the United States starting on the date 3 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 notes that constant burning pilot lights, which are currently prohibited under the existing prescriptive standard for gas cooking tops (10 CFR 430.32(j)), consume approximately 2,000 kilo British thermal units (kBtu) per year. While DOE's proposal would remove this prescriptive requirement from its regulations, DOE notes that, based on its review of the existing prescriptive standard prohibiting constant burning pilots for gas cooking tops and the proposed efficiency levels presented in section IV.C.3.b, the proposed performance standards of 924.4 kBtu per year for gas cooking tops would not be achievable by products if they were to incorporate a constant burning pilot.

TABLE I.1—PROPOSED ENERGY CONSERVATION PERFORMANCE STANDARDS FOR CONVENTIONAL COOKING TOPS

Product class	Maximum integrated annual energy consumption (IAEC)
Electric Open (Coil) Element Cooking Tops	113.2 *kWh/yr.*
Electric Smooth Element Cooking Tops	121.2 *kWh/yr.*
Gas Cooking Tops	924.4 *kBtu/yr.*

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

[2] All references to EPCA in this document refer to the statute as amended through the Energy Efficiency Improvement Act of 2015, Public Law 114–11 (Apr. 30, 2015).

[3] 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. (10 CFR 430.2) This includes any conventional cooking top component of a combined cooking product.

[4] 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. (10 CFR 430.2) This includes any conventional oven(s) component of a combined cooking product.

For conventional ovens, the proposed standard is a prescriptive design requirement for the control system of the oven. Conventional electric ovens shall not be equipped with a control system that uses a linear power supply. Conventional gas ovens shall be equipped with a control system that uses an intermittent/interrupted ignition or intermittent pilot ignition and does not use a linear power supply (See Table I.2). These proposed standards for conventional ovens, if adopted, would apply to all conventional ovens manufactured in, or imported into, the United States starting on the date 3 years after the publication of any final rule for this rulemaking. DOE considered a combination of factors in developing its proposal to prescribe a control system design requirement for conventional ovens, rather than proposing to regulate IAEC with a performance standard. The rationale for this tentative decision is further explained in sections IV.C.5 and V.B.8 of this SNOPR. DOE also notes that the current prescriptive standards for conventional gas ovens prohibiting constant burning pilot lights would continue to be applicable. (10 CFR 430.32(j)). Table I.2 provides a summary of the proposed standards for conventional ovens.

TABLE I.2—PROPOSED PRESCRIPTIVE ENERGY CONSERVATION STANDARDS FOR CONVENTIONAL OVENS

Oven product class	Current standard	Current SNOPR proposed standards
Electric Standard, Freestanding Electric Standard, Built-In/Slide-In Electric Self-Clean, Freestanding. Electric Self-Clean, Built-In/Slide-In.	None	Shall not be equipped with a control system that uses linear power supply.*
Gas Standard, Freestanding Gas Standard, Built-In/Slide-In Gas Self-Clean, Freestanding Gas Self-Clean, Built-In/Slide-In	No constant burning pilot light	The control system for gas ovens shall: (1) Not be equipped with a constant burning pilot light; (2) Be equipped with an intermittent/interrupted ignition or intermittent pilot ignition; and (3) Not be equipped with a linear power supply.

* A linear power supply produces unregulated as well as regulated power. The unregulated portion of a linear power supply typically consists of a transformer that steps alternating current (AC) line voltage down, a voltage rectifier circuit for AC to direct current (DC) conversion, and a capacitor to produce unregulated, direct current output. Linear power supplies are described in section IV.A.3 of this SNOPR.

A. Benefits and Costs to Consumers

Table I.3 presents DOE's evaluation of the economic impacts of the proposed standards on consumers of residential conventional cooking products, as measured by the average life-cycle cost (LCC) savings and the simple payback period (PBP).[5] 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 16 years for electric cooking tops and 13 years for gas cooking products (see section IV.F.6 for additional detail).

TABLE I.3—IMPACTS OF PROPOSED ENERGY CONSERVATION STANDARDS (TSL2) ON CONSUMERS OF RESIDENTIAL CONVENTIONAL COOKING PRODUCTS

Product class	Average LCC savings (2015$)	Simple payback period (years)	Average lifetime (years)
Electric Open (Coil) Element Cooking Tops	3	0.5	16
Electric Smooth Element Cooking Tops	24	1.0	16
Gas Cooking Tops	1	9.1	13
Electric Standard Oven, Free-standing	6	0.9	16
Electric Standard Oven, Built-in/Slide-in	6	0.9	16
Electric Self-Clean Oven, Free-Standing	7	0.9	16
Electric Self-Clean Oven, Built-in/Slide-in	7	0.9	16
Gas Standard Oven, Free-Standing	44	1.1	13
Gas Standard Oven, Built-in/Slide-in	44	1.1	13
Gas Self-Clean Oven, Free-Standing	48	1.1	13
Gas Self-Clean Oven, Built-In/Slide-in	48	1.1	13

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

B. Impact on Manufacturers

The industry net present value (INPV) is the sum of the discounted cash flows to the industry from the reference year through the end of the analysis period (2016 to 2048). Using a real discount rate of 9.1 percent, DOE estimates that the INPV for manufacturers of residential conventional cooking products is $1,238.1 million in 2015$. Under the proposed standards, DOE expects that manufacturers may lose up to 7.2 percent of their INPV, which is approximately $89.6 million in 2015$. Additionally, based on DOE's interviews with the manufacturers of residential conventional cooking

[5] The average LCC savings are measured relative to the no-new-standards-case efficiency distribution, which depicts the market in the compliance year (see section IV.F.9 of this notice) and is the savings achieved over the average lifetime of the product. The simple PBP, which is designed to compare specific efficiency levels, is measured relative to the baseline model.

products, DOE does not expect any plant closings or significant loss of employment.

Table I.4 and Table I.5 show the financial impacts (represented by changes in INPV) of new and amended energy conservation standards on residential conventional cooking product manufacturers as well as the conversion costs that DOE estimates manufacturers would incur under the preservation of gross margin and preservation of operating profit markup scenarios (described in section IV.J.2). As noted above, the proposed standards correspond to TSL 2.

TABLE I.4—MANUFACTURER IMPACT ANALYSIS FOR RESIDENTIAL CONVENTIONAL COOKING PRODUCTS—PRESERVATION OF GROSS MARGIN MARKUP SCENARIO

	Units	No-new-standards case	Trial standard level			
			1	2	3	4
INPV	(2015$ millions)	1,238.1	1,200.1	1,156.7	868.0	511.1
Change in INPV	(2015$ millions)		(38.0)	(81.4)	(370.1)	(727.1)
	(%)		(3.1)	(6.6)	(29.9)	(58.7)
Product Conversion Costs	(2015$ millions)		19.9	71.3	261.8	525.4
Capital Conversion Costs	(2015$ millions)		29.9	47.9	248.2	580.2
Total Conversion Costs	(2015$ millions)		49.8	119.2	510.0	1,105.7

* Numbers in parentheses indicate negative numbers.

TABLE I.5—MANUFACTURER IMPACT ANALYSIS FOR RESIDENTIAL CONVENTIONAL COOKING PRODUCTS—PRESERVATION OF OPERATING PROFIT MARKUP SCENARIO

	Units	No-new-standards case	Trial standard level			
			1	2	3	4
INPV	(2015$ millions)	1,238.1	1,198.3	1,148.5	844.7	314.6
Change in INPV	(2015$ millions)		(39.8)	(89.6)	(393.5)	(923.6)
	(%)		(3.2)	(7.2)	(31.8)	(74.6)
Product Conversion Costs	(2015$ millions)		19.9	71.3	261.8	525.4
Capital Conversion Costs	(2015$ millions)		29.9	47.9	248.2	580.2
Total Conversion Costs	(2015$ millions)		49.8	119.2	510.0	1,105.7

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

C. National Benefits and Costs [6]

DOE's analyses indicate that the proposed standards would save a significant amount of energy. The lifetime energy savings from residential conventional cooking products purchased in the 30-year period that begins in the assumed year of compliance with the proposed standards (2019–2048), relative to the no-new-standards case without the proposed standards, amount to 0.76 quadrillion British thermal units (quads).[7] This represents a savings of 5.9 percent relative to the energy use of these products in the no-new-standards case.

The cumulative net present value (NPV) of total consumer costs and savings of the proposed standards for residential conventional cooking products ranges from $2.72 billion (at a 7-percent discount rate) to $6.24 billion (at a 3-percent discount rate). This NPV expresses the estimated present value of future operating-cost savings minus the estimated increased product costs for products purchased in 2019–2048.

In addition, the proposed standards are projected to yield significant environmental benefits. The energy savings described above are estimated to result in cumulative emission reductions of 45.3 million metric tons (Mt) [8] of carbon dioxide (CO_2), 6,369 thousand tons of methane, 23.6 thousand tons of sulfur dioxide (SO_2), 88.0 thousand tons of nitrogen oxides (NO_X), 0.50 thousand tons of nitrous oxide (N_2O), and 0.09 tons of mercury (Hg).[9] The cumulative reduction in CO_2 emissions through 2030 amounts to 9.057 Mt, which is equivalent to the emissions resulting from the annual electricity use of 0.826 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 Federal interagency working group.[10] The derivation of the SCC values is discussed in section IV.L of this SNOPR. Using discount rates appropriate for each set of SCC values (see Table I.7), DOE estimates the present monetary value of the CO_2 emissions reduction (not including CO_2 equivalent emissions of other gases with global warming potential) is between $0.3 billion and $4.5 billion, with a value of $1.5 billion using the central SCC case represented by $40.6/t in 2015. DOE also estimates the present monetary value of the NO_X emissions reduction to be $0.08 billion at a 7-percent discount rate and $0.19 billion

[6] All monetary values in this document are expressed in 2015 dollars, and where appropriate, are discounted to 2016 unless explicitly stated otherwise. Energy savings in this section refer to the full-fuel-cycle savings (see section IV.H of this SNOPR for discussion).

[7] 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 of this SNOPR.

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

[9] DOE calculated emissions reductions relative to the no-new-standards case, which reflects key assumptions in the *Annual Energy Outlook 2015* (*AEO 2015*) Reference case. *AEO 2015* generally represents current legislation and environmental regulations for which implementing regulations were available as of October 31, 2014.

[10] *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 July 2015) (Available at: *https://www.whitehouse.gov/sites/default/files/omb/inforeg/scc-tsd-final-july-2015.pdf*).

at 3-percent discount rate.[11] DOE is investigating appropriate valuation of the reduction in methane and other emissions, and did not include any values in this rulemaking.

Table I.6 summarizes the national economic costs and benefits expected to result from the proposed standards for residential conventional cooking products.

TABLE I.6—SUMMARY OF NATIONAL ECONOMIC BENEFITS AND COSTS OF PROPOSED ENERGY CONSERVATION STANDARDS (TSL2) FOR RESIDENTIAL CONVENTIONAL COOKING PRODUCTS *

Category	Present value (billion 2015$)	Discount rate (%)
Benefits		
Consumer Operating Cost Savings	3.2	7
	7.0	3
CO_2 Reduction Monetized Value ($12.4/t case) **	0.3	5
CO_2 Reduction Monetized Value ($40.6/t case) **	1.5	3
CO_2 Reduction Monetized Value ($63.2/t case) **	2.4	2.5
CO_2 Reduction Monetized Value ($118/t case) **	4.5	3
NO_X Reduction Monetized Value †	0.08	0.19
	7	3
Total Benefits ††	4.8	7
	8.7	3
Costs		
Consumer Incremental Installed Costs	0.5	7
	0.8	3
Total Net Benefits		
Including CO_2 and NO_X Reduction Monetized Value ††	4.3	7
	7.9	3

* This table presents the costs and benefits associated with residential conventional cooking products 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 2015$, 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 95th percentile of the SCC distribution calculated using a 3% discount rate. The SCC time series incorporate an escalation factor.

† DOE estimated the monetized value of NO_X emissions reductions associated with electricity savings using benefit per ton estimates from the *Regulatory Impact Analysis for the Clean Power Plan Final Rule,* published in August 2015 by EPA's Office of Air Quality Planning and Standards. (Available at:*http://www.epa.gov/cleanpowerplan/clean-power-plan-final-rule-regulatory-impact-analysis.) See supra* note 11 and accompanying text.

†† Total Benefits for both the 3% and 7% cases are derived using the series corresponding to average SCC with 3-percent discount rate ($40.6/t case).

The benefits and costs of the 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 national economic value of the benefits in reduced consumer operating costs, minus (2) the increase in product purchase prices and installation costs, plus (3) the value of the benefits of CO_2 and NO_X emission reductions, all annualized.[12]

Although the values of operating cost 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 cooking products shipped in 2019–2048. Because CO_2 emissions have a very long residence time in the atmosphere,[13] the SCC 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

[11] DOE estimated the monetized value of NO_X emissions reductions associated with electricity savings using benefit per ton estimates from the *Regulatory Impact Analysis for the Clean Power Plan Final Rule,* published in August 2015 by EPA's Office of Air Quality Planning and Standards. (Available at: *http://www.epa.gov/cleanpowerplan/clean-power-plan-final-rule-regulatory-impact-analysis.*) See section IV.L.2 of this SNOPR for further discussion. The U.S. Supreme Court has stayed the rule implementing the Clean Power Plan until the current litigation against it concludes. *Chamber of Commerce, et al.* v. *EPA, et al.,* Order in Pending Case, 577 U.S._(2016). However, the benefit-per-ton estimates established in the Regulatory Impact Analysis for the Clean Power Plan are based on scientific studies that remain valid irrespective of the legal status of the Clean Power Plan. DOE is primarily using a national benefit-per-ton estimate for NO_X emitted from the Electricity Generating Unit sector based on an estimate of premature mortality derived from the ACS study (Krewski et al., 2009). If the benefit-per-ton estimates were based on the Six Cities study (Lepuele et al., 2011), the values would be nearly two-and-a-half times larger.

[12] To convert the time-series of costs and benefits into annualized values, DOE calculated a present value in 2015, 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 2015. 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.7. 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.

[13] 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.

shown in Table I.7. 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 average SCC series corresponding to a value of $40.6/ton in 2015 (2015$)), the estimated cost of the proposed standards for cooking products is $42.6 million per year in increased equipment costs, while the benefits are $293 million per year in reduced equipment operating costs, $80.8 million in CO_2 reductions, and $7.4 million in reduced NO_X emissions. In this case, the net benefit amounts to $339 million per year.

Using a 3-percent discount rate for all benefits and costs and the average SCC series corresponding to a value of $40.6/ton in 2015 (2015$), the estimated cost of the proposed standards for cooking products is $42.3 million per year in increased equipment costs, while the benefits are $380 million per year in reduced operating costs, $80.8 million in CO_2 reductions, and $10.1 million in reduced NO_X emissions. In this case, the net benefit amounts to $429 million per year.

TABLE I.7—ANNUALIZED BENEFITS AND COSTS OF PROPOSED AMENDED STANDARDS (TSL 2) FOR CONVENTIONAL COOKING PRODUCTS SOLD IN 2019–2048

	Discount rate	Million 2015$/year		
		Primary estimate *	Low net benefits estimate *	High net benefits estimate *
Benefits				
Consumer Operating Cost Savings	7%	293	262	332.
	3%	380	336	439.
CO_2 Reduction Value ($12.4/t case) **	5%	23.8	21.7	26.5.
CO_2 Reduction Value ($40.6/t case) **	3%	80.8	73.6	90.5.
CO_2 Reduction Value ($63.2/t case) **	2.5%	118.6	107.9	132.8.
CO_2 Reduction Value ($118/t case) **	3%	246.3	224.1	275.6.
NO_X Reduction Value †	7%	7.4	6.8	18.2.
	3%	10.1	9.2	25.6.
Total Benefits ††	7% plus CO_2 range	325 to 547	290 to 493	377 to 626.
	7%	382	342	441.
	3% plus CO_2 range	414 to 637	367 to 569	491 to 740.
	3%	471	418	555.
Costs				
Consumer Incremental Installed Product Costs	7%	42.6	41.6	45.3.
	3%	42.3	41.3	45.2.
Net Benefits				
Total ††	7% plus CO_2 range	282 to 504	249 to 451	332 to 581.
	7%	339	301	396.
	3% plus CO_2 range	372 to 594	325 to 528	446 to 695.
	3%	429	377	510.

* This table presents the annualized costs and benefits associated with cooking products shipped in 2019–2048. Note that the benefits and costs may not exactly sum to the net benefits due to rounding. These results include benefits 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 the 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* Reference case, Low Economic Growth case, and High Economic Growth case, 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 in the High Benefits Estimate. The methods used to derive projected price trends are explained in section IV.F.1 of this SNOPR.

** The CO_2 values represent global monetized values of the SCC, in 2015$, 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 95th percentile of the SCC distribution calculated using a 3% discount rate. The SCC time series incorporate an escalation factor.

† DOE estimated the monetized value of NO_X emissions reductions associated with electricity savings using benefit per ton estimates from the *Regulatory Impact Analysis for the Clean Power Plan Final Rule,* published in August 2015 by EPA's Office of Air Quality Planning and Standards. (Available at: *http://www.epa.gov/cleanpowerplan/clean-power-plan-final-rule-regulatory-impact-analysis.*) See section IV.L.2 of this SNOPR for further discussion. For DOE's Primary Estimate and Low Net Benefits Estimate, the agency used a national benefit-per-ton estimate for NO_X emitted from the Electric Generating Unit sector based on an estimate of premature mortality derived from the ACS study (Krewski *et al.,* 2009). For DOE's High Net Benefits Estimate, the benefit-per-ton estimates were based on the Six Cities study (Lepuele *et al.,* 2011), which are nearly two-and-a-half times larger than those from the ACS study.

†† Total Benefits for both the 3% and 7% cases are derived using the series corresponding to the average SCC with a 3-percent discount rate ($40.6/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 SNOPR.

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, 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 TSLs, 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 SNOPR and related information collected and analyzed during the course of this rulemaking effort, DOE may adopt energy efficiency levels presented in this SNOPR 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 conventional cooking products.

A. Authority

Title III, Part B of the Energy Policy and Conservation Act of 1975 (EPCA or the Act), Public Law 94–163 (codified as 42 U.S.C. 6291–6309) 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 cooking tops and 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 directs DOE to conduct rulemakings to determine whether to amend these standards. (42 U.S.C. 6295(h)(2)) 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 6 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 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, including conventional cooking tops and ovens, 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 cooking products, 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

[14] DOE's regulations define kitchen ranges and ovens, or ''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 containing one or more surface units and/or one or more heating compartments. Based on this definition, in this SNOPR, DOE interprets kitchen ranges and ovens to refer more generally to all types of cooking products including, for example, microwave ovens.

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, EPCA 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. 6295(q)(1)) In determining whether a performance-related feature justifies a different standard for a group of products, DOE must consider such factors as the utility to the consumer of the feature and other factors DOE deems appropriate. *Id.* Any rule prescribing such a standard must include an explanation of the basis on which such higher or lower level was established. (42 U.S.C. 6295(q)(2))

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 the Energy Independence and Security Act of 2007 (EISA 2007), Public Law 110–140, any final rule for new or amended energy conservation standards promulgated after July 1, 2010, is required to address standby mode and off mode energy use. (42 U.S.C. 6295(gg)(3)) Specifically, when DOE adopts a standard for a covered product after that date, it must, if justified by the criteria for adoption of standards under EPCA (42 U.S.C. 6295(o)), incorporate standby mode and off mode energy use into 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 tops address standby mode and off mode energy use. In this rulemaking, DOE intends to incorporate such energy use into any new or amended energy conservation standards it adopts in the final rule. As discussed in section III.C, DOE is proposing to repeal the test procedures for conventional ovens. As a result, a performance standard that addresses standby mode and off mode energy use is not feasible for conventional ovens. However, as discussed in section III.B, DOE is proposing in this SNOPR to adopt prescriptive design requirements for the control system of conventional ovens that would address standby mode and off mode energy use.

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 and conventional ovens 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 a conventional range. 74 FR 16040, 16053.

2. History of Standards Rulemaking for Residential Conventional Cooking Products

The National Appliance Energy Conservation Act of 1987 (NAECA), Public Law 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 notice of proposed rulemaking (NOPR) proposing new standards or a notice of determination that the existing standards do not need to be amended. (42 U.S.C. 6295(m)(1)) Based on this provision, DOE was required to 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. Consequently, DOE initiated a rulemaking to determine whether to adopt new or amended standards for conventional cooking products.

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))

[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.

[16] As discussed in section III.A of this SNOPR, DOE is also tentatively planning to consider new energy conservation standards for commercial-style gas cooking products with higher burner input rates, for which DOE did not previously consider energy conservation standards.

On June 10, 2015, DOE published a NOPR (the June 2015 NOPR) proposing new and amended energy conservation standards for residential conventional ovens. 80 FR 33030. The June 2015 NOPR also announced that a public meeting would be held on July 14, 2015 at DOE headquarters in Washington, DC. At this meeting, DOE presented the methodologies and results of the analyses set forth in the NOPR, and interested parties that participated in the public meeting discussed a variety of topics. DOE received a number of comments from interested parties in response to the June 2015 NOPR. DOE considered these comments, as well as comments from the public meeting, in preparing this SNOPR. The commenters are summarized in Table II.1. Relevant comments, and DOE's responses, are provided in the appropriate sections of this SNOPR.

TABLE II.1—INTERESTED PARTIES PROVIDING COMMENTS ON THE JUNE 2015 NOPR FOR CONVENTIONAL OVENS

Name	Acronyms	Commenter type *
Air-conditioning, Heating, & Refrigeration Institute	AHRI	TA
Appliance Standards Awareness Project (ASAP), Alliance to Save Energy (ASE), American Council for an Energy-Efficient Economy (ACEEE), Consumer Federation of America (CFA), Consumers Union (CU), National Consumer Law Center (NCLC), Natural Resources Defense Council (NRDC), and Northwest Energy Efficiency Alliance (NEEA).	Joint Efficiency Advocates	EA
Arizona Senator		CM
Arizona Congressional Delegation		CM
Arizona Congress Member		CM
Association of Home Appliance Manufacturers	AHAM	TA
BSH Home Appliances	BSH	M
California Congress Member		CM
Cato Institute Center for the Study of Science	Cato	RO
Edison Electric Institute	EEI	UA
Electrolux North America	Electrolux	M
Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Natural Resources Defense Council, and Union of Concerned Scientists.	EDF, IPI, NRDC, UCS	EA
GE Appliances	GE	M
Haier America	Haier	M
Miele, Inc	Miele	M
National Propane Gas Association	NPGA	TA
Pacific Gas and Electric	PG&E	U
Sub-Zero Group, Inc	Sub-Zero	M
Tennessee Congress Member		TM
U.S. Chamber of Commerce, American Chemistry Council, American Coke and Coal Chemicals Institute, American Forest & Paper Association, American Fuel & Petrochemical Manufacturers, American Petroleum Institute, Brick Industry Association, Council of Industrial Boiler Owners, National Association of Home Builders, National Association of Manufacturers, National Mining Association, National Oilseed Processors Association, Portland Cement Association.	The Associations	TA
Whirlpool Corporation	Whirlpool	M
Wisconsin Senators		CM

* CM: Congress Member; EA: Efficiency Advocate; GA: Government Agency; IR: Industry Representative; M: Manufacturer; RO: Research Organization; TA: Trade Association; U: Utility.

As part of the June 2015 NOPR, DOE also noted that it was deferring its decision regarding whether to adopt amended energy conservation standards for conventional cooking tops, pending further study. 80 FR 33030, 33038–33040. In both the test procedure NOPR published on January 30, 2013 (78 FR 6232, the January 2013 TP NOPR) and the test procedure 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 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 further discussions with manufacturers, and performing additional analyses, DOE decided that further study was required before an updated cooking top test procedure could be established that produces test results which measure energy use during a representative average use cycle for all types of cooking tops, is repeatable and reproducible, and is not unduly burdensome to conduct. 80 FR 37954 (July 2, 2015).

As discussed in section III.C, on August 22, 2016, DOE published in the **Federal Register** a SNOPR proposing amendments to the test procedures for conventional cooking tops and ovens that include, among other things, test methods for induction cooking tops and gas cooking tops with high burner input rates. 81 FR 57374. DOE is publishing this document to propose new and amended energy conservation standards for conventional cooking tops based on the proposed amendments to the test procedure. As discussed in section III.C, DOE also proposed to repeal the test procedure for conventional ovens in the August 2016 TP SNOPR. As a result, DOE has also revised its proposal from the June 2015 NOPR for conventional ovens from a performance-based standard to a prescriptive standard.

III. General Discussion

A. Scope of Coverage

As discussed in section II.A of this SNOPR, 42 U.S.C. 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 containing one or more surface units[17] and/or one or more heating compartments. (10 CFR 430.2) In this SNOPR, DOE is considering energy conservation standards for certain residential conventional cooking products, namely, conventional cooking tops and conventional ovens.

DOE proposed in the August 2016 TP SNOPR to define a combined cooking product as a household cooking appliance that combines a conventional cooking top and/or conventional oven with other appliance functionality, which may or may not include another cooking product. 81 FR 57374, 57378. In this rulemaking, DOE is not considering combined cooking products as a distinct product category and is not basing its product classes on that category. Instead, DOE is considering energy conservation standards for conventional cooking tops and conventional ovens separately. Because combined cooking products consist, in part, of a cooking top and/or oven, any potential cooking top or oven standards would apply to the individual components of the combined cooking product.

As part of the 2009 standards rulemaking for conventional cooking products, DOE did not consider energy conservation standards for residential conventional gas cooking products with higher burner input rates, including products marketed as ''commercial-style'' or ''professional-style,'' due to a lack of available data for determining efficiency characteristics of those products. DOE considered such 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 DOE cooking products test procedures at that time 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 commercial-style 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).

As discussed in section III.C of this SNOPR, DOE is proposing to amend the conventional cooking top test procedure in Appendix I to, in part, measure the energy use of commercial-style gas cooking tops with high burner input rates. *See* 81 FR 57374, 57385–57386. As discussed in section III.B of this SNOPR, DOE proposed to repeal the conventional oven test procedure in the August 2016 TP SNOPR. Due to the uncertainties in analyzing a performance-based standard using oven testing provisions that DOE is proposing to remove from the test procedure, DOE is proposing to adopt prescriptive design requirements for the control system of conventional ovens, including commercial-style ovens with higher burner input rates.

DOE notes that the current definitions for ''conventional cooking top'' and ''conventional oven'' in 10 CFR 430.2 already cover commercial-style 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 tops and conventional ovens, including commercial-style products with higher burner input rates. As discussed in section IV.A.2 of this SNOPR, DOE is not proposing to establish a separate product class for gas cooking tops and ovens with higher burner input rates that are marketed as ''commercial-style'' and, as a result, DOE is not proposing separate definitions for these products.

In response to the June 2015 NOPR, AHAM and GE commented that DOE should revise the definition of conventional ovens to make it clear that the definition encompasses the primary cooking product in a home and does not include ancillary cooking products that do not fit conventional cooking product use patterns (*i.e.,* intermittent use products). Specifically, AHAM and GE stated that the definition should specify that conventional ovens include a thermostat setting that can be set to control the internal temperature of the oven to 325 degrees Fahrenheit (°F) higher than room ambient air temperature. (AHAM, No. 29 at p. 7;[18] GE, No. 32 at p. 2)

DOE notes that the change to the conventional oven definition proposed by AHAM and GE could result unintentionally in certain products not being covered. DOE currently defines ''conventional ovens'' in 10 CFR 430.2 as cooking products that are used as the major household cooking appliance and consist of one or more compartments intended for the cooking or heating of food by means of either a gas flame or electric resistance heating. DOE notes that the means of heating and description of the product are clearly specified in the current definition. DOE's definition relates to the functionality of the product, not its intended use, so a conventional oven would be considered a covered product whether it serves a primary or ancillary application. DOE is not proposing to define conventional ovens based on their intended use and a product that meets the existing definition would be considered a covered product. If a manufacturer is unable to test a product in accordance with the provisions in the test procedure (*e.g.,* setting the oven thermostat), a manufacturer may apply for a waiver from the test procedure, in accordance with 10 CFR 430.27, if it is able to provide an explanation for why its product design is unique and would require different considerations for the test conditions. DOE welcomes comments on whether there are products that would meet the definition of a conventional oven, but that could not be tested according to the DOE test procedure.

B. Prescriptive Standard for Conventional Ovens

This SNOPR proposes to adopt a prescriptive design requirement for the control system of conventional ovens. DOE considered a combination of factors in developing its proposal to prescribe a control design requirement for conventional ovens, rather than proposing to regulate IAEC with a performance standard. The rationale for this tentative decision is explained below.

DOE's analysis determined that the baseline efficiency level for conventional ovens corresponds to a linear power supply control design. For conventional gas ovens, DOE's analysis showed that the baseline control design also uses an ''intermittent ignition'' system with a glo-bar (also referred to as a hot surface) igniter. As discussed in section V.A of this SNOPR, the design

[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.

[18] A notation in the form ''AHAM, No. 29 at p. 7'' identifies a written comment (1) made by AHAM; (2) recorded in document number 29 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 7 of document number 29.

options analyzed to achieve the proposed standard level for conventional ovens involved changing from a control design that uses a linear power supply to one that incorporates a switch-mode power supply (SMPS). In addition, for gas ovens, the proposed standard level corresponds to switching from an intermittent glo-bar ignition system to an ''intermittent/interrupted ignition'' or ''intermittent pilot ignition'' (*e.g.,* electronic spark ignition). Descriptions of these design options are discussed further in section IV.A.3.b of this SNOPR. DOE notes that the currently applicable prescriptive standards for gas ovens prohibit constant burning pilot lights, which are a type of continuous ignition system that would be precluded by the proposed standards.

DOE conducted the analysis for conventional ovens for this SNOPR based on the test procedure adopted in the July 2, 2015 final rule (80 FR 37954, hereinafter referred to as the July 2015 TP Final Rule), which was the current test procedure at the time the standards analysis was conducted. After reviewing public comments and considering additional feedback and test data from manufacturers, DOE concluded that commercial-style ovens have inherently lower efficiencies than for residential-style ovens with comparable cavity sizes when measured using the previous version of the test procedure adopted in the July 2015 TP Final Rule, due to the greater thermal mass of the cavity and racks in commercial-style ovens. Due to uncertainty regarding such efficiency measurement, DOE is proposing to repeal the conventional oven test procedure, as described in the August 2016 TP SNOPR, and determined that further investigation would be required to develop test methods that appropriately account for the effects of certain commercial-style oven design features (*e.g.,* heavier-gauge cavity construction, high input rate burners, extension racks, *etc.*). 81 FR 57374, 57378–57379. The uncertainties in analyzing a performance-based standard using oven testing provisions that DOE proposed to remove from the test procedure in the August 2016 TP SNOPR have led DOE to propose prescriptive design requirements for the control system of conventional ovens.

As discussed in section II.B.1 of this SNOPR, manufacturers are not currently required to conduct testing to certify compliance with standards because DOE has promulgated only prescriptive standards for gas cooking products. The prescriptive-based standard for conventional ovens proposed in this SNOPR would continue to minimize burden on manufacturers because it would not require manufacturers to test, rate, and label conventional ovens.

For the reasons cited above, DOE is proposing a prescriptive requirement for conventional ovens that would require conventional electric ovens to not be equipped with a control system that uses a linear power supply. The proposed standards would also require that conventional gas ovens be equipped with a control system that uses intermittent/interrupted ignition or intermittent pilot ignition and does not use a linear power supply.

C. Test Procedure

EPCA sets forth generally applicable criteria and procedures for DOE's adoption and amendment of test procedures. (42 U.S.C. 6293) Manufacturers of covered products must use these test procedures to certify to DOE that their product complies with energy conservation standards and to quantify the efficiency of their product. DOE's test procedures for 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 International Electrotechnical Commission (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. These provisions for conventional cooking products are not currently used for compliance with any energy conservation standards because the present standards are design requirements; in addition, there is no EnergyGuide [19] labeling program for cooking products.

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 power in its test procedures for residential products, if technically feasible. (42 U.S.C. 6295(gg)(2)(A))

On January 30, 2013, DOE published a NOPR (78 FR 6232, the January 2013 TP NOPR) proposing amendments to Appendix I that would allow for testing the active mode energy consumption of induction cooking products; *i.e.,* conventional cooking tops 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).

In response to the February 2014 RFI, 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 comments opposing the proposed test procedure (as discussed in AHAM's comments on the January 2013 TP NOPR). Accordingly, AHAM stated that DOE should finalize amendments to the test procedure before conducting any analysis for the standards rulemaking, or else proceed without addressing induction cooking products in this round of standards rulemaking. (AHAM, 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

[19] For more information on the EnergyGuide labeling program, see: *www.access.gpo.gov/nara/cfr/waisidx_00/16cfr305_00.html.*

evaluate them in a standards analysis. (AHAM, No. 9 at p. 2; Whirlpool, 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, No. 9 at p. 4, 6, 7) AHAM added that it could not provide data regarding the differences between residential-style and commercial-style gas cooking products without a test procedure to measure higher input rate burners. (AHAM, No. 9 at p. 7) The California IOUs supported amending the test procedure to measure the energy use of residential commercial-style gas cooking products with higher burner input rates. (California IOUs, No. 11 at p. 2)

On December 3, 2014, DOE published an SNOPR (the December 2014 TP SNOPR), in which 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. 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.*

In the December 2014 TP SNOPR, DOE also proposed methods for measuring conventional oven volume, clarification that the existing oven test block must be used to test all ovens regardless of input rate, and a method to measure the energy consumption and efficiency of conventional ovens equipped with an oven separator. 79 FR 71894 (Dec. 3, 2014). DOE published the July 2015 TP Final Rule adopting the test procedure amendments discussed above for conventional ovens only. 80 FR 37954.

AHAM and Electrolux commented that DOE did not provide sufficient time after finalizing the test procedure for conventional ovens for stakeholders to evaluate the proposed conventional oven standards. AHAM and Electrolux stated that manufacturers do not regularly conduct energy tests because there is no current standard for conventional ovens. As a result, they stated that more time was needed for manufacturers to fully understand the impact of the final test procedure and evaluate the proposed standards for conventional ovens. (AHAM, No. 29 at pp. 4–5; Electrolux, No. 27 at pp. 2–3)

AHRI commented that DOE states in its regulations that it will finalize amended test procedures before introducing applicable amended standards.[20] AHRI noted that for conventional ovens, DOE published a final rule to amend the test procedure more than 3 weeks after the publication of the June 2015 NOPR which introduced amended standards and thus did not comply with the codified procedures noted above. AHRI believes that the comment period did not provide manufacturers with sufficient time to fully evaluate the proposed standards with the amended test procedure. (AHRI, No. 34 at p. 2)

Sub-Zero expressed concern that limitations in the test procedures and available data might unfairly impact commercial-style products in a rulemaking establishing energy conservation standards. (Sub-Zero, No. 25 at p. 2)

AHAM submitted an additional comment after the end of the June 2015 NOPR comment period to discuss additional industry product testing. As part of this comment, AHAM reiterated its concern that manufacturers were unable to adequately analyze DOE's proposed rule during the comment period because DOE did not provide sufficient time after finalizing the conventional oven test procedure for stakeholders to evaluate the proposed standards. (AHAM, No. 38 at p. 2)

DOE has considered these comments as part of this rulemaking and notes that this SNOPR provides additional opportunity for interested parties to provide comment based on the proposed cooking product test procedure discussed below. With respect to the process of establishing test procedures and standards for a given product, DOE notes that, while not legally obligated to do so, it generally follows the approach laid out in guidance found in 10 CFR part 430, subpart C, Appendix A (Procedures, Interpretations and Policies for Consideration of New or Revised Energy Conservation Standards for Consumer Products). That guidance provides, among other things, that, when necessary, DOE will issue final, modified test procedures for a given product prior to publication of the NOPR proposing energy conservation standards for that product. While DOE strives to follow the procedural steps outlined in its guidance, there may be circumstances in which it may be necessary or appropriate to deviate from it. In such instances, the guidance indicates that DOE will provide notice and an explanation for the deviation. Accordingly, DOE is providing notice that it continues to develop the final test procedure for conventional cooking products. As discussed below, DOE has carefully considered the significant comments regarding the test procedures for both induction cooking tops and commercial-style cooking products, which led to DOE publishing an additional SNOPR on August 22, 2016. DOE believes proposed amendments in the August 2016 TP SNOPR address the significant concerns regarding the conventional cooking products test procedure and will issue the final test procedure before the standards final rule. Furthermore, as discussed in section IV.C.5 of this SNOPR, DOE is proposing to adopt a prescriptive design requirement for conventional ovens. Because this proposed standard is a design requirement and not a performance standard (*i.e.,* minimum efficiency or maximum energy consumption), manufacturers would not be required to test using the DOE test procedure for conventional ovens to certify products to the proposed standards in this SNOPR.

As discussed in the June 2015 NOPR for conventional ovens, DOE received a significant number of comments regarding the proposed hybrid test block test method for cooking tops in response to the December 2014 TP SNOPR and in separate interviews conducted with conventional cooking product manufacturers in February and March of 2015. AHAM and manufacturers commented that the hybrid test block method, as proposed, presented many issues with the construction and configuration of the test block which had not yet been addressed, and which left the repeatability and reproducibility of the test procedure in question. 80 FR 33030, 33039–33040 (June 10, 2015). A number of manufacturers that produce and sell products in Europe supported the use of a water-heating test method and harmonization with International Electrotechnical Commission (IEC) Standard 60350–2 Edition 2, ''Household electric appliances—Part 2: Hobs—Method for measuring performance'' (IEC Standard 60350–2) for measuring the energy consumption of electric cooking tops. These manufacturers noted the test methods in IEC Standard 60350–2 are compatible with all electric cooking top types, specify additional cookware diameters

[20] AHRI made this comment in reference to 10 CFR part 430, subpart C, appendix A(7)(c).

to account for the variety of surface unit sizes on the market, and use test loads that represent real-world cooking top loads. Efficiency advocates also recommended that DOE require water-heating test methods to produce a measure of cooking efficiency for conventional cooking tops that is more representative of actual cooking performance than the hybrid test block method. 80 FR 33030, 33039–33040 (June 10, 2015).

For these reasons, DOE decided 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 was finalized. 80 FR 33030, 33040 (June 10, 2015).

AHAM, GE, and Electrolux commented in response to the June 2015 NOPR supporting DOE's decision to not propose standards for cooking tops because there was not yet a representative, repeatable, reproducible test procedure for this product category. (AHAM, No. 29 at p. 2; GE, No. 32 at p. 1; Electrolux, No. 27 at p. 2) AHAM stated that in addition to the time required to identify an appropriate test method for cooking tops, manufacturers will need time to obtain test equipment, verify that the test method is repeatable and reproducible, test their full product lines, and provide data to DOE to form the basis for any energy conservation standards. Therefore, AHAM believed that consideration of energy conservation standards for cooking tops would only be possible and appropriate in the next standards rulemaking cycle for conventional cooking products. (AHAM, No. 29 at p. 3)

AHAM, GE and Electrolux commented that 42 U.S.C. 6295(m)(4)(B), which specifies that a manufacturer shall not be required to apply new standards to a product with respect to which other new standards have been required during the prior 6-year period, prohibits DOE from proceeding with cooking tops on a different schedule than conventional ovens if DOE decides to proceed with standards for conventional ovens. (AHAM, No. 29 at pp. 2,3; GE, No. 32 at p. 2; Electrolux, No. 27 at p. 2) GE added that, regardless of when standards for cooking tops are proposed or finalized, the compliance date must not be until at least 6 years after the compliance date for the proposed standards for conventional ovens. (GE, No. 32 at p. 2)

Whirlpool commented that, although the FTC has not ruled on whether EnergyGuide labels will be justified for conventional ranges, Natural Resources Canada requires a comprehensive label that declares the energy consumption of the combined product. Whirlpool stated that DOE should consider this possibility when evaluating whether to align the compliance dates for conventional cooking tops and ovens. (Whirlpool, No. 33 at p. 4)

EEI commented that if DOE adopts new standards for both conventional cooking tops and ovens, the compliance dates for both products should be as close as possible to be market neutral. (EEI, Public Meeting Transcript, No. 35 at p. 18) [21]

DOE published an additional test procedure SNOPR on August 22, 2016 (81 FR 57374) that proposes to amend the test procedures for conventional cooking tops. Given the feedback from interested parties discussed above and based on the additional testing and analysis conducted for the test procedure rulemaking, in the August 2016 TP SNOPR, DOE withdrew its proposal for testing conventional cooking tops with a hybrid test block. Instead, DOE is proposing to amend its test procedure to incorporate by reference the relevant sections of European Standard EN 60350–2:2013 ''Household electric cooking appliances Part 2: Hobs—Methods for measuring performance'' [22] [23] (EN 60350–2:2013), which provide a water-heating test method to measure the energy consumption of electric cooking tops. The test method specifies the quantity of water to be heated in a standardized test vessel whose size is selected based on the diameter of the surface unit under test. The test vessels specified in EN 60350–2:2013 are compatible with all cooking top technologies and surface unit diameters available on the U.S. market. 81 FR 57374, 57381–57384.

DOE is also proposing to extend the test methods provided in EN 60530–2:2013 to gas cooking tops by correlating the burner input rate and test vessel diameters specified in EN 30–2–1:1998 ''Domestic cooking appliances burning gas—Part 2–1: Rational use of energy—General'' (EN 30–2–1) to the test vessel diameters and water loads already included in EN 60350–2:2013. The range of gas burner input rates covered by EN 30–2–1 includes surface units with burners exceeding 14,000 Btu/h, and thus EN 30–2–1 provides a method to test gas surface units with high input rate burners, which previously had not been addressed in the DOE test procedure or energy conservation standards. 81 FR 57374, 57385–57386.

In the August 2016 TP SNOPR, DOE proposed to amend the conventional cooking top test procedure to specify that the test energy consumptions measured for each surface unit be averaged together and then normalized to a representative load size to determine the total per-cycle energy consumption of the cooking top. The annual active mode energy consumption of the cooking top would be calculated by multiplying the total per-cycle energy consumption of the cooking top by the ''adjusted cooking frequency.'' 81 FR 57374, 57387–57388. As discussed in the August 2016 TP SNOPR, DOE determined the adjusted cooking frequency by comparing the energy use determined based on cooking frequency data from 2009 DOE Energy Information Administration (EIA) *Residential Energy Consumption Survey* (RECS 2009) [24] and the water heating test method, to recent field use data for cooking products.[25] [26] Based on this review, DOE determined that the estimated annual active mode cooking top energy consumption using the cooking frequency based on RECS 2009 data and the water heating test method did not adequately represent consumer use. As a result, DOE proposed in the August 2016 TP SNOPR

[21] A notation in the form ''EEI, Public Meeting Transcript, No. 35 at p. 18'' identifies an oral comment that DOE received during the July 14, 2015, residential conventional oven energy conservation standards NOPR public meeting. Oral comments were recorded in the public meeting transcript and are available in the residential conventional cooking products energy conservation standards rulemaking docket (Docket No. EERE–2014–BT–STD–0005). This particular notation refers to a comment: (1) Made by Edison Electric Institute during the public meeting; (2) recorded in document number 35, which is the public meeting transcript that is filed in the docket of this energy conservation standards rulemaking; and (3) which appears on page 18 of document number 35.

[22] Hob is the British English term for cooking top.

[23] On April 25, 2014, IEC made available the draft version of IEC Standard 60350–2 Edition 2.0 Committee Draft (IEC 60350–2 CD). DOE notes that the draft amendment to IEC 60350–2 on which testing for the January 2013 NOPR was based includes the same basic test method as the 2014 IEC 60350–2 CD. DOE also notes that the European standard EN 60350–2:2013 is based on the draft amendment to IEC 60350–2. DOE believes that the IEC procedure, once finalized, will retain the same basic test method as currently contained in EN 60350–2:2013.

[24] 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/*).

[25] California Energy Commission. 2009 California Residential Appliance Saturation Study, October 2010. Prepared for the California Energy Commission by KEMA, Inc. Contract No. 200–2010–004. <*http://www.energy.ca.gov/2010publications/CEC-200-2010-004/CEC-200-2010-004-V2.PDF*>.

[26] FSEC 2010. Updated Miscellaneous Electricity Loads and Appliance Energy Usage Profiles for Use in Home Energy Ratings, the Building America Benchmark and Related Calculations. Published as FSEC–CR–1837–10, Florida Solar Energy Center, Cocoa, FL.

to normalize the cooking frequency to account for differences between the duration of a cooking event represented in the RECS data and the water heating test method. DOE also proposed to calculate the integrated annual energy consumption for the cooking top as the sum of the annual active mode energy consumption and the combined low-power mode energy consumption. *Id.*

Because DOE has proposed test procedures for conventional cooking tops that produce representative, repeatable, reproducible test results, DOE is now combining the rulemaking to consider energy conservation standards for conventional cooking tops and ovens and is correspondingly aligning the compliance dates for both product categories. For this SNOPR, DOE evaluated its proposed energy conservation standards for conventional cooking tops based on the proposed cooking top test procedure discussed above.

As discussed in section III.B, DOE is proposing to repeal the conventional oven test procedure as discussed in the August 2016 TP SNOPR and is proposing to adopt prescriptive design requirements for the control system of conventional ovens. As a result, manufacturers would not need to test, rate, and label conventional ovens to demonstrate compliance with the proposed prescriptive design requirements.

Whirlpool and EEI support the use of an IAEC metric that includes cooking energy, standby energy, and self-clean energy because it allows manufacturers flexibility in incorporating cost-effective design options that improve energy efficiency. Whirlpool also believes it would allow manufacturers to consider tradeoffs between consumer utility and energy efficiency improvements. (Whirlpool, No. 33 at p. 5; EEI, No. 30 at p. 3) EEI added that an integrated metric would facilitate the development of ''smart'' ovens that are more interactive with energy supply grids to allow consumers to determine the most energy-efficient and cost-effective times to operate them. EEI stated that a smart oven may need to communicate with an energy grid on a continuous basis, but the communication function may require a very small increase in the energy used in the standby mode or off mode. According to EEI, a separate standard for standby mode or off mode could result in appliances that are not able to have the ''smart'' functionality. (EEI, No. 30 at p. 3)

In this SNOPR, DOE performed its analysis for both ovens and cooking tops using the IAEC metric to account for both active mode and standby mode design options. As described in section V.C.1 of this SNOPR, DOE is proposing a prescriptive standard for conventional ovens and a performance standard using the IAEC metric for conventional cooking tops. For conventional ovens, DOE tentatively determined that a prescriptive requirement would be a more effective means of achieving energy savings for all oven product types (*i.e.,* residential-style and commercial-style ovens) due to uncertainties in the methods used to measure conventional oven IAEC that DOE is proposing to remove from the test procedure in the August 2016 TP SNOPR. DOE also notes that the proposed prescriptive standards for conventional ovens would not preclude the introduction of connected products because the prescriptive design requirements for the control systems does not directly affect the design of the connected feature. Moreover, because DOE is not proposing a separate standby mode and off mode performance standard for conventional cooking tops, connected cooking tops would not be precluded.

In response to the June 2015 NOPR, Whirlpool also questioned the energy use metric for conventional ranges in light of the potentially separate standards schedule for conventional cooking tops and conventional ovens. Whirlpool stated that an integrated metric would allow manufacturers to pursue the most technically-feasible and/or economically-justifiable design options to meet the relevant standard while still achieving the same national energy conservation had they been separate. (Whirlpool, No. 33 at p. 3) Whirlpool noted that since standby power is included in the oven and cooking top test procedures, and that standby power for conventional ranges cannot be separated into oven and cooking top portions of standby energy, it is unclear how manufacturers would test and certify the oven and cooking top portions of conventional ranges separately. (Whirlpool, No. 33 at p. 3)

As discussed above, DOE is now proposing standards for both conventional cooking tops and ovens with the same compliance date. As noted in section III.A of this SNOPR, any potential cooking top or oven standard would apply to the individual components of the combined cooking product. As a result, DOE does not foresee any issues with compliance for combined cooking products, such as conventional ranges, that include both a conventional cooking top and conventional oven. The test procedure amendments proposed in the August 2016 TP SNOPR include provisions for measuring the standby power of combined cooking products and calculating the IAEC for the conventional cooking top component of combined cooking products. In addition, as discussed above, because DOE is proposing prescriptive standards for conventional ovens, manufacturers would not be required to conduct testing according to Appendix I to demonstrate compliance with standards.

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 SNOPR discusses the results of the screening analysis for residential conventional cooking products, particularly the designs DOE considered, those it screened out, and those that are the basis for the TSLs in this rulemaking. For further details on the screening analysis for this rulemaking, see chapter 4 of the SNOPR 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 cooking tops, 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 SNOPR 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).[27] 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 no-new-standards case. The no-new-standards case represents a 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 national energy savings (NES) from potential new and amended standards. The NIA spreadsheet model (described in section IV.H of this SNOPR) calculates energy savings in terms of site energy, which is the energy directly consumed by products at the locations where they are used. Based on the site energy, DOE calculates NES in terms of primary energy savings at the site or at power plants, and also in terms of full-fuel-cycle (FFC) energy savings. The FFC metric includes the energy consumed in extracting, processing, and transporting primary fuels (*i.e.,* coal, natural gas, petroleum fuels), and thus presents a more complete picture of the impacts of energy conservation standards.[28] DOE's approach is based on the calculation of an FFC multiplier for each of the energy types used by covered products or equipment. For more information on FFC energy savings, see section IV.H.2 of this SNOPR. For natural gas, the primary energy savings are considered to be equal to the site energy savings.

2. Significance of Savings

To adopt any new or amended standards for a covered product, DOE must determine that such action would result in ''significant'' energy savings. (42 U.S.C. 6295(o)(3)(B)) 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 of this SNOPR) are nontrivial, and, therefore, DOE considers them ''significant'' within the meaning of section 325 of EPCA.

F. Economic Justification

1. Specific Criteria

As noted above, 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 of this SNOPR. DOE first uses an annual cash-flow approach to determine the quantitative impacts. This step includes both a short-term assessment—based on the cost and capital requirements during the period between when a regulation is issued and when entities must comply with the regulation—and a long-term assessment over a 30-year period. The industry-wide impacts analyzed include (1) INPV, which values the industry on the basis of expected future cash flows; (2) cash flows by year; (3) changes in revenue and income; and (4) other measures of impact, as appropriate. Second, DOE analyzes and reports the impacts on different types of manufacturers, including impacts on small manufacturers. Third, DOE considers the impact of standards on domestic manufacturer employment and manufacturing capacity, as well as the potential for standards to result in plant closures and loss of capital investment. Finally, DOE takes into account cumulative impacts of various DOE regulations and other regulatory requirements on manufacturers. For individual consumers, measures of economic impact include the changes in LCC and PBP associated with new or amended standards. These measures are discussed further in the following section. For consumers in the aggregate, DOE also calculates the national net present value of the 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 (LCC and PBP)

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

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

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

For its LCC and PBP analysis, DOE assumes that consumers will purchase the covered products in the first year of compliance with amended standards. The LCC savings for the considered efficiency levels are calculated relative

[27] Each TSL is comprised of specific efficiency levels for each product class. The TSLs considered for this SNOPR are described in section V.A of this SNOPR. DOE conducted a sensitivity analysis that considers impacts for products shipped in a 9-year period.

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

to the case that reflects projected market trends in the absence of amended standards. DOE's LCC and PBP analysis is discussed in further detail in section IV.F of this SNOPR.

c. Energy Savings

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

d. Lessening of Utility or Performance of Products

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

e. Impact of Any Lessening of Competition

EPCA directs DOE to consider the impact of any lessening of competition, as determined in writing by the Attorney General, that is likely to result from a proposed standard. (42 U.S.C. 6295(o)(2)(B)(i)(V)) It also directs the Attorney General to determine the impact, if any, of any lessening of competition likely to result from a proposed standard and to transmit such determination to the Secretary within 60 days of the publication of a proposed rule, together with an analysis of the nature and extent of the impact. (42 U.S.C. 6295(o)(2)(B)(ii)) DOE will transmit a copy of this proposed rule to the Attorney General with a request that the Department of Justice (DOJ) provide its determination on this issue. DOE will publish and respond to the Attorney General's determination in the final rule. DOE invites comment from the public regarding the competitive impacts that are likely to result from this proposed rule. In addition, stakeholders may also provide comments separately to DOJ regarding these potential impacts. See **ADDRESSES** section for information to send comments to DOJ.

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 of this SNOPR.

The proposed 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 of this SNOPR; the emissions impacts are reported in section V.B of this SNOPR. DOE also estimates the economic value of emissions reductions resulting from the considered TSLs, as discussed in section IV.L of this proposed rule.

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.10 of this proposed rule.

G. Changes to 10 CFR 429.23 Addressing the Certification, Compliance and Enforcement Criteria for Conventional Cooking Products

In this SNOPR, DOE is proposing to update the certification requirements for cooking products in 10 CFR 429.23 to include the annual energy use and integrated annual energy use metrics for conventional gas and electric cooking tops in the sampling plan requirements. Additionally, DOE is proposing to update the reporting requirements for conventional ovens to reflect the proposed prescriptive design requirements. DOE notes that the certification and reporting requirements for conventional cooking tops and conventional ovens also apply to the conventional cooking top component and conventional oven component of combined cooking products.

H. Other Issues

AHAM submitted a late comment discussing additional industry product testing, and provided a recommendation regarding the proposed standard levels selected for electric self-clean ovens. In this comment, AHAM stated that DOE did not analyze a sufficient sample size of electric standard ovens and, as a result, the efficiency levels for electric standard ovens presented in the June 2015 NOPR are significantly stricter than for electric self-clean ovens. (AHAM, No. 39 at pp. 2–4) AHAM claimed that the standard levels proposed in the June 2015 NOPR could result in manufacturers adding a self-clean cycle to electric standard ovens instead of improving the oven's efficiency to meet the proposed standard for electric standard ovens, thus eliminating or reducing the availability of electric standard ovens from the market. AHAM further stated that electric standard ovens are the lowest-priced conventional ovens in the retail market, so eliminating them would provide a hardship for low-income and other consumers who rely on low purchase prices. (AHAM, No. 39 at pp. 4–5)

AHAM recommended standards for electric standard ovens that are based on subtracting the average self-clean energy consumption from the corresponding standard for electric self-clean ovens. AHAM believes this approach would mitigate the uncertainties of the analysis, avoid discriminating against consumers of electric standard ovens, and have a negligible effect on the total energy savings compared to the standard levels proposed in the June 2015 NOPR. (AHAM, No. 39 at pp. 7–8)

For the reasons discussed in section III.B of this SNOPR, DOE is proposing a prescriptive design requirement for the control system for conventional ovens in this SNOPR. This prescriptive standard would require the same design changes for both standard and self-clean ovens. As a result, DOE expects that the standards proposed in this SNOPR would not impose stricter requirements on electric standard ovens than on electric self-clean ovens, and would not eliminate or reduce the availability of electric standard ovens.

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 Web site for this rulemaking: *http://www1.eere.energy.gov/buildings/appliance_standards/rulemaking.aspx?ruleid=85*. Additionally, DOE used output from the EIA's *AEO 2015,* 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 SNOPR 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))

a. Conventional Cooking Tops

During the previous energy conservation standards rulemaking for cooking products, DOE evaluated product classes for conventional cooking tops based on energy source (*i.e.,* gas or electric). These distinctions initially yielded two conventional cooking product classes: (1) Gas cooking tops; and (2) electric cooking tops. For electric cooking tops, DOE determined that the ease of cleaning smooth elements provides enhanced consumer utility over coil elements. Because smooth elements typically use more energy than coil elements, DOE defined two separate product classes for electric cooking tops. DOE defined the following product classes in the TSD for the April 2009 Final Rule (2009 TSD)[29] for conventional cooking tops:

- Electric cooking tops—low or high wattage open (coil) elements;
- Electric cooking tops—smooth elements; and
- Gas cooking tops—conventional burners.

Induction Heating

As part of the February 2014 RFI, DOE stated that it tentatively planned to maintain the product classes for conventional cooking tops from the previous standards rulemaking, as presented above. DOE also stated that it planned to consider induction heating as a technology option for electric smooth cooking tops rather than as a separate product class. DOE noted that induction heating provides the same basic function of cooking or heating food as heating by gas flame or electric resistance, and that the installation options available to consumers are also the same for both cooking products with induction and electric resistance heating. DOE stated that it might consider whether separate product classes are warranted for commercial-style gas cooking products with higher burner input rates. 79 FR 8337, 8341–8342 (Feb. 12, 2014).

In response to the February 2014 RFI, Laclede Gas Company (Laclede) claimed that the two product classes for electric cooking tops are based solely on aesthetics, which is not a sufficient reason for establishing separate product classes. (Laclede, No. 8 at p. 5) As noted above, DOE determined that the ease of cleaning smooth elements provides enhanced consumer utility over coil elements. Because smooth elements typically use more energy than coil elements, DOE defined two separate product classes for electric cooking tops. DOE maintains this determination that electric smooth cooking tops provide enhanced utility while using more energy than coil elements, and as a result, proposes to consider separate product classes for this SNOPR.

Natural Resources Defense Council (NRDC) agreed with DOE that induction heating should not be considered a separate product class, and further recommended classifying all electric cooking tops in a single product class. NRDC commented that DOE determined in the previous standards rulemaking that smooth element cooking tops warranted a separate product class because they consume more energy than open coil element cooking tops and provide the consumer utility of ease of cleaning. NRDC stated, however, that electric cooking tops using induction technology are now available that provide both high energy efficiency and ease of cleaning. NRDC believes that open coil elements do not provide any additional benefit to consumers and therefore may not necessitate a separate product class. (NRDC, No. 12 at p. 2) DOE recognizes that smooth cooking tops with induction technology can achieve higher energy efficiency than electric coil cooking tops while providing ease of cleaning, as suggested by NRDC. However, DOE notes that the electric resistance heating technology more commonly found in smooth element cooking tops are typically less efficient than coil elements. As a result, DOE is not proposing to establish a single product class for all electric cooking tops.

In response to the February 2014 RFI, AHAM and Whirlpool commented that induction cooking tops should be considered a separate product class and

[29] 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.*

not a technology option for electric smooth cooking tops, due to the following claimed performance and consumer utility differences:

- Induction cooking tops are easier to clean than smooth cooking tops with electric resistance heating because there is less likelihood of baked-on foods, which are difficult to clean. With induction cooking tops, the pot alone is heated through electromagnetic energy, while the spilled food on the cooking top receives only a small amount of conduction heating from the pot;
- Induction cooking tops heat faster than smooth cooking tops with electric resistance heating. AHAM and Whirlpool stated that there is a precedent to establishing separate product classes based on cycle time. According to these commenters, in the clothes washer rulemaking, DOE separated front-loading and top-loading clothes washers because the cycle times varied, significantly impacting consumer utility and product performance;
- Standby energy use will typically be higher for induction cooking tops than for smooth cooking tops because there are more advanced electronics, especially for full surface induction cooking tops that sense a pot when it is placed anywhere on the unit's surface. To maintain that consumer utility, induction cooking tops need a higher standby energy for the sensors to detect the placement of a pot;
- Magnetic cookware is needed for induction cooking tops, but not for smooth cooking tops with electric resistance heating. This may affect cooking performance and energy use by the end user, as certain non-magnetic cookware, such as aluminum, does not retain heat well; and
- Induction is an entirely different method of heating food (electromagnetic energy) than smooth cooking tops with electric resistance heating (radiant and conduction energy). (AHAM, No. 9 at pp. 4–5, 6, 7; Whirlpool, No. 13 at pp. 3, 4, 5)

NRDC and the California IOUs agreed with DOE that induction heating should be considered as a technology option for electric smooth cooking tops. (NRDC, No. 12 at p. 2; California IOUs, No. 11 at p. 2) NRDC noted that many induction cooking top models from multiple brands and manufacturers have entered the market, and that some manufacturers offer induction ''hot plates,'' as well as hybrid ranges and cooking tops that have electric and induction elements. NRDC also stated that induction cooking tops hold a significant portion of the market in Europe and Asia. For these reasons, NRDC urged DOE to consider induction technology in its analysis. (NRDC, No. 12 at pp. 1–2) The California IOUs urged DOE to review the Food Service Technology Center reports available on induction technology for commercial cooking products, which include measurements of energy input rate, heat-up temperature response, and heavy-load energy efficiency under the American Society for Testing and Materials (ASTM) Standard F1521–03. According to the California IOUs, these reports would be helpful in assessing the test procedures and measured energy efficiency of induction cooking tops. (California IOUs, No. 11 at p. 2)

DOE observes that induction cooking tops provide the same basic function of cooking or heating food as does electric resistance heating. In addition, in considering whether there are any performance-related features that justify a higher energy use standard to establish a separate product class, DOE notes that the utility of speed of cooking, ease of cleaning, and requirements for specific cookware for induction cooking tops do not appear to be uniquely associated with higher energy use compared to other smooth cooking tops with electric resistance heating elements. DOE recognizes that induction cooking tops are only compatible with ferromagnetic cooking vessels. However, DOE does not identify any consumer utility unique to any specific type of cookware that would warrant establishing separate product classes. As discussed in section IV.F.2 of this SNOPR, DOE considered the cost of replacing cookware as part of the LCC analysis. DOE also conducted standby testing on full-surface induction cooking tops. Based on DOE's testing, the sensors required to detect the presence of a pot placed on the cooking surface do not remain active while the product is in standby mode. In addition, DOE notes that the standby power required for the tested model (0.25 watts (W)) was below the average standby power for other cooking tops in DOE's test sample (2.25 W). For these reasons, DOE is not considering a separate product class for induction cooking products in this proposal. As noted in section IV.A.3 of this SNOPR, DOE is considering induction heating as a technology option for electric smooth cooking tops. Because residential induction cooking tops are available on the market, DOE analyzed these products rather than information from commercial products, as suggested by the California IOUs, as part of the engineering analysis, including testing and tearing down multiple sample units.

Commercial-Style Cooking Tops

With regard to commercial-style cooking products, including those with higher burner input rates, AHAM commented in response to the February 2014 RFI that without a definition or test procedure for commercial-style cooking products, neither AHAM nor DOE can determine whether these products would warrant a separate product class. AHAM stated 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 conventional gas cooking tops available on the market, DOE determined that products marketed as commercial-style cannot be distinguished from standard residential-style products based on performance characteristics or consumer utility. While conventional gas cooking tops marketed as commercial-style have more than one burner rated above 14,000 Btu/h and cast iron grates, approximately 50 percent of cooking top models marketed as residential-style also have one or more burners rated above 14,000 Btu/h and cast iron grates.

DOE considered whether separate product classes for commercial-style gas cooking tops with higher burner input rates are warranted by comparing the test energy consumption of individual surface units in a sample of cooking tops tested by DOE.[30] DOE measured the test energy consumption of gas surface units in a sample of twelve gas cooking tops, which included six products marketed as commercial-style. The number of surface units per cooking top ranged from four to six. Figure IV.1 shows test energy consumption for an individual surface unit, normalized by the mass of the test load (as specified in the proposed cooking tops test procedure in the August 2016 TP SNOPR), versus burner input rate for each surface unit in the test sample. Because the mass of the test load depends on the input rate of the burner, the test energy consumption must be normalized for comparison. The higher the ratio of test energy consumption to

[30] DOE originally conducted testing on its test sample using the withdrawn hybrid test block method proposed in the December 2014 TP SNOPR. DOE tested four of the twelve units in its test sample using both the withdrawn hybrid test block method and the water heating test method proposed in the August 2016 TP SNOPR. DOE then used the relative difference in results between the two test methods to scale the normalized test energy consumption by surface unit for the remaining units in its test sample. Additional details of this analysis are provided in chapter 5 of the NOPR TSD.

test load mass, the less efficient the surface unit.

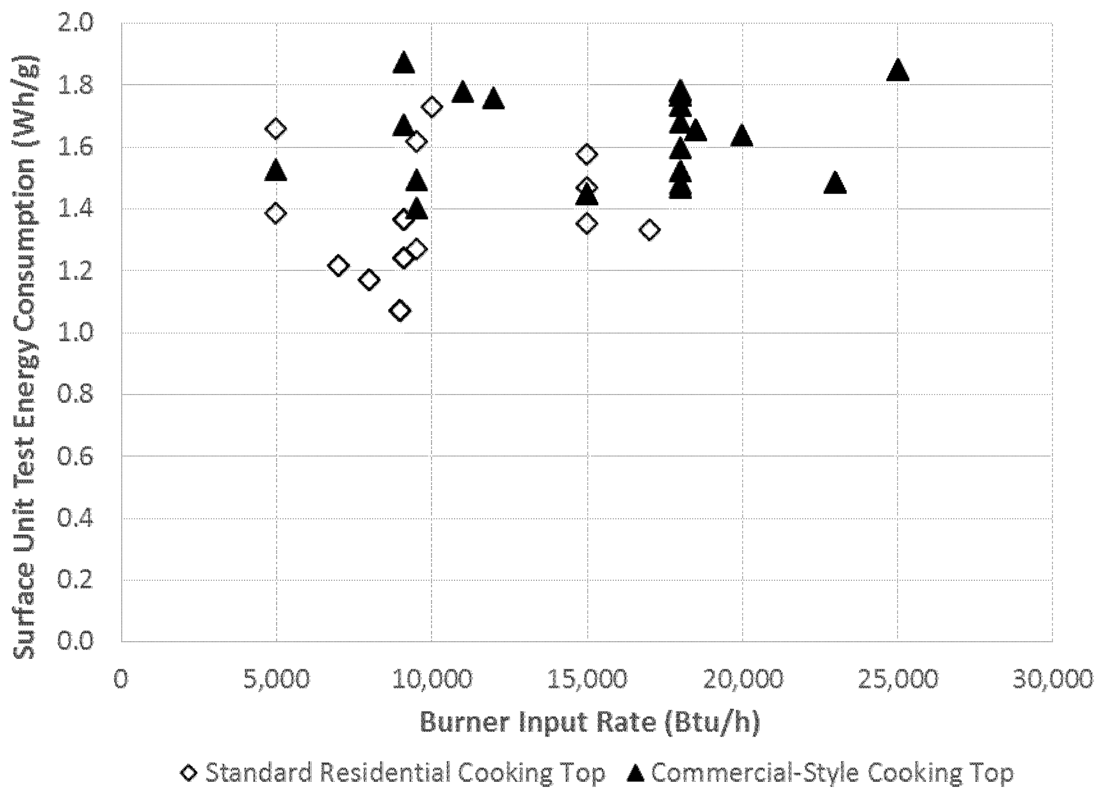

Figure IV.1 Gas Cooking Top Surface Unit Normalized Energy Consumption versus Burner Input Rate

As indicated in Figure IV.1, there was no statistically significant correlation between burner input rate and the ratio of surface unit energy consumption to test load mass for cooking tops marketed as either residential-style or commercial-style. DOE's testing, as presented further in section IV.C.2 of this SNOPR, showed that this efficiency ratio for gas cooking tops is more closely related to burner and grate design rather than input rate.

In response to the June 2015 NOPR, Sub-Zero and BSH submitted late comments regarding commercial-style cooking tops. Sub-Zero commented that ''high-performance cooking'' is a better descriptor of this product segment than ''commercial-style.'' Sub-Zero stated that high-performance cooking products can be defined as cooking products that offer residential consumers performance similar to that found in restaurant equipment at a safety and convenience level that is acceptable for residential use. (Sub-Zero, No. 40 at p. 2)

Sub-Zero commented that a separate product class should be established for high-performance gas cooking tops to recognize the unique utility and performance attributes associated with high-performance cooking products. Sub-Zero expressed concern that DOE may not be adequately considering cooking performance in its analysis for cooking tops, and that DOE may not be fully addressing any combustion and emissions issues arising from potential design changes made to improve the efficiency of gas cooking tops. (Sub-Zero, No. 40 at p. 2)

Sub-Zero and BSH stated that customer input drives the design and cooking performance requirements for their gas cooking tops, and that high-performance gas cooking tops include design features that enhance cooking performance (rapid boiling, precision simmering, and even heat distribution) but negatively impact efficiency. (Sub-Zero, No. 25 at pp. 2–3; BSH, No. 41 at pp. 1–2) Sub-Zero and BSH noted that these features include:

- High input rate burners with large diameters provide faster heat up times and allow consumers to use larger cooking vessels while maintaining even heat distribution (Sub-Zero, No. 25 at p. 3; BSH, No. 41 at p. 2);
- High input rate burners with high levels of flame controllability, specifically high turndown ratios, allow for simmering of foods such as chocolates and sauces while also providing faster heat up times (Sub-Zero, No. 25 at p. 3; BSH, No. 41 at p. 2);
- Spacing between the gas flame, grate, and cooking vessel must be greater for high input rate burners than low input rate burners to meet performance and safety requirements, specifically even heat distribution and reduction of carbon monoxide. Reducing the spacing between the gas flame and the cooking vessel can increase efficiency, but flame quenching due to flame impingement and contact with the grate/cooking vessel can lead to increased carbon monoxide emissions and combustion by-products (Sub-Zero, No. 25 at p. 3);
- Heavy cast iron grates allow for better heat distribution to cooking vessels while also providing the strength required to support large loads and increased product longevity. (Sub-Zero, No. 25 at p. 4; BSH, No. 41 at p. 2) Heavier cast iron grates also retain

more heat once the burner is turned down during simmer or shut off. (Sub-Zero, No. 25 at p. 2–4)

Sub-Zero and BSH commented that safety, performance, and efficiency attributes of the cooking top must be considered systematically in terms of product design (*e.g.,* mass of the grates, diameter of the burner, distance from the burner to the cooking vessel, and open area allotted for exhaust of combustion by-products), because changes to one attribute can significantly impact the others (Sub-Zero, No. 40 at p. 3; BSH, No. 41 at p. 2)

For these reasons, Sub-Zero requested that DOE consider the impact that any proposed standard levels would have on small, niche-market, high-performance cooking product manufacturers and their ability to serve their unique set of customers. According to Sub-Zero, eliminating the unique features of commercial-style gas cooking tops would not allow companies such as Sub-Zero to adequately serve their customer base. (Sub-Zero, No. 40 at p. 4)

BSH commented that although it agrees with DOE's general approach of not analyzing cooking performance, commercial-style products must meet greater customer demands than residential-style products. BSH also commented that if DOE does not differentiate between commercial-style and residential-style products, more stringent standards would apply primarily to commercial-style products and have no effect on residential-style products. BSH commented that this could result in the elimination of commercial-style products from the market and limit consumer choice. BSH commented, therefore, that DOE should consider either a different test procedure or a separate product class for commercial-style products. (BSH, No. 41 at p. 3)

The Wisconsin Senators expressed concern that recombining the rulemaking to consider standards for both cooking tops and ovens would likely impact high performance products and would require significant design changes resulting in lessened consumer utility and product performance. (Wisconsin Senators, No. 45 at p. 1) Arizona Congress Member Grijalva and the Arizona Congressional Delegation similarly noted that recombining the rulemaking will make it more difficult to have separate product classes to account for the unique features of high performance products. (Arizona Congress Member Grijalva, No. 43 at p. 1; Arizona Congressional Delegation, No. 44 at pp. 1–2) The Wisconsin Senators, Arizona Congress Member Grijalva, and the Arizona Congressional Delegation noted that new standards could negatively impact manufacturers like Sub-Zero and their ability to compete in the marketplace if high performance cooking products are not distinguished from conventional residential-style products. (Wisconsin Senators, No. 45 at p. 1; Arizona Congress Member Grijalva, No. 43 at p. 1)

DOE recognizes that the presence of certain features, such as heavy cast iron grates and multiple high input rate burners, may help consumers perceive a difference between commercial-style and residential-style gas cooking top performance. However, DOE is not aware of clearly-defined and consistent design differences and corresponding utility provided by commercial-style gas cooking tops as compared to residential-style gas cooking tops. Although DOE's testing, presented in section IV.C.2, indicates there is a difference in energy consumption between residential-style and commercial-style gas cooking tops, this difference could not be correlated to any specific utility provided to consumers. Moreover, DOE is not aware of an industry test standard that evaluates cooking performance and that would quantify the utility provided by these products. In addition, as discussed above, DOE's testing showed that there was no statistically significant correlation between burner input rate and the ratio of surface unit energy consumption to test load mass for cooking tops marketed as either residential-style or commercial-style.

For these reasons, DOE is not proposing to establish a separate product class for gas cooking tops marketed as commercial-style or conventional gas cooking tops with higher burner input rates. However, as discussed in sections IV.C.3.b and V.C.1 of this SNOPR, DOE conducted its engineering analysis consistent with products currently available on the market and is proposing energy conservation standards for gas cooking tops in this SNOPR that would maintain the features available in conventional cooking tops marketed as commercial-style (*e.g.,* multiple high input rate burners, cast iron gates, *etc.*) that may be used to differentiate these products in the marketplace. In addition, the standards proposed in this SNOPR are based on burner and grate system designs that are available on the market and thus would not alter the safety of existing commercial-style gas cooking top in terms of combustion products or emissions.

b. Conventional Ovens

During the first 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 more recently 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. Therefore, DOE defined the following product classes in the TSD for the April 2009 Final Rule (2009 TSD) [31] for conventional ovens:

- Electric ovens—standard oven with or without a catalytic line;
- 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 planned to maintain the product classes for conventional ovens from the previous standards rulemaking, as presented above. DOE stated that it might consider whether separate product classes are warranted for commercial-style gas ovens with higher burner input rates. 79 FR 8337, 8341–8342 (Feb. 12, 2014).

Self-Cleaning Technology

Based on DOE's review of conventional gas ovens available on the U.S. market, and based on manufacturer interviews and testing conducted as part of the engineering analysis, DOE noted in the June 2015 NOPR 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. 80 FR 33030, 33043. Specifically, DOE noted that it 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-

[31] 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.*

cleaning mode that is user-selectable and must be tested separately. In the June 2015 NOPR, DOE clarified that a conventional self-clean electric or gas 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. *Id.*

Whirlpool agreed that separate product classes are justified for standard and self-clean ovens. (Whirlpool, No. 33 at p. 6) Whirlpool also agreed with DOE that ovens that provide the same consumer utility and benefits of self-clean via means other than a standard pyrolytic process should be subject to the same standards as those that employ a pyrolytic process because this framework promotes innovation in self-clean performance and energy efficiency. (Whirlpool, No. 33 at p. 5) GE commented that, while it supports the treatment of self-clean ovens as a separate product class, including non-pyrolytic models in the definition of self-clean would require unique provisions in the test procedure for this technology. In particular, GE suggested that DOE determine whether a usage factor of four times per year is appropriate for both pyrolytic and non-pyrolytic self-clean technologies, since the former is not as effective and requires additional cycles per year to achieve the same performance. (GE, No. 32 at p. 3)

DOE is not aware of any differences in consumer behavior in terms of the frequency of use of the self-clean function that would be predicated on the type of self-cleaning technology rather than on cleaning habits or cooking usage patterns that are not dependent on the type of technology. Therefore, DOE is not proposing a different usage factor for non-pyrolytic self-clean operation. However, DOE welcomes data on the consumer usage patterns of pyrolytic versus non-pyrolytic self-cleaning functions in conventional ovens.

Commercial-Style Ovens

With regards to gas oven burner input rates, DOE noted in the June 2015 NOPR that based on its 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.[32] 80 FR 33030, 33043. 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 cavity volumes range from 2.5 to 5.6 cubic feet (ft^3) 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. *Id.*

DOE conducted testing for the June 2015 NOPR using the version of the test procedure later adopted in the July 2015 TP Final Rule to determine whether commercial-style gas ovens with higher burner input rates warrant establishing a separate product class.

DOE evaluated the cooking efficiency of eight conventional gas ovens, including five ovens with burners rated at 18,000 Btu/h or less and the remaining three with burner input rates ranging from 27,000 Btu/h to 30,000 Btu/h. 80 FR 33030, 33043. DOE's testing showed that 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. DOE's testing of a 30,000 Btu/h oven suggested that much of the energy input to commercial-style ovens with higher burner input rates goes to heating the added mass of the cavity, rather than the test load, resulting in relatively lower measured efficiency when measured according to the test procedure adopted in the July 2015 TP Final Rule. 80 FR 33030, 33043–33044. 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 °F above its initial temperature, as specified in the DOE test procedure in Appendix I at the time of the testing. DOE's testing showed that 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 concluded in the June 2015 NOPR 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. 80 FR 33030, 33045.

Based on DOE's testing, reverse engineering, and additional discussions with manufacturers, DOE posited in the June 2015 NOPR 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 did not propose to establish a separate product class for commercial-style gas ovens with higher burner input rates. 80 FR 33030, 33045.

The Joint Efficiency Advocates agreed with DOE's determination that commercial-style gas ovens do not provide any unique utility. The Joint Efficiency Advocates added that Consumer Reports similarly found in their tests that ''higher Btu hasn't guaranteed faster heating.'' They noted that Consumer Reports also found that ''pro-style ranges are big on style, but aren't the best ranges'' and that ''even regular ranges now have beefy knobs, rugged grates, and stainless trim for a lot less money,'' observations which support DOE's decision not to establish a separate product class for commercial-style gas ovens with higher burner input rates. (Joint Efficiency Advocates, No. 31 at p. 2)

As noted for cooking tops, Sub-Zero commented that ''high performance cooking'' is a better descriptor of this product segment than ''commercial-style.'' Sub-Zero commented that a separate product class should be established for high performance electric and gas ovens to recognize the unique utility and performance attributes associated with high performance cooking products. Sub-Zero expressed concern that DOE did not consider cooking performance in its analysis for this rulemaking. According to Sub-Zero, the ability of any oven to bake and broil evenly, allow yeast products to rise consistently, and produce consistent quality from rack to rack when several racks are being used

[32] 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.

are key criteria for consumer acceptance. (Sub-Zero, No. 25 at p. 2)

Sub-Zero and BSH stated that inputs from their customers drive the design and cooking performance requirements for their ovens. (Sub-Zero, No. 25 at pp. 2, 3; BSH, No. 41 at pp. 1–2) Sub-Zero commented that high performance ovens include the following design features that enhance cooking performance (professional quality baking, broiling, roasting, slow bake, proofing, and other functions) but negatively impact efficiency:

- Heavier gauge materials which extend product life and enhance product quality, cooking functionality and durability;
- Configurations that allow for up to six-rack baking capability with full extension, heavy-gauge oven racks to support large loads and provide enhanced safety and ergonomic benefit;
- Full oven-height dual convection blowers to optimize cooking air flow;
- Hidden bake elements that enhance customer safety, cleanability and heat distribution for better cooking performance;
- Controls and software to maximize the long-term reliability of oven cavity porcelain when employing a hidden bake element; and
- Cooling fans for the electronic printed circuit boards that provide precise oven control and touch-screen user interface for cooking modes and other features. (Sub-Zero, No. 25 at pp. 3, 5–6)

BSH also noted that commercial-style ovens include design features identified by Sub-Zero, including: Robust, full-extension ball-bearing oven racks to support heavy food loads; the ability to cook on three racks simultaneously with high output heating elements for even heat distribution; hidden bake elements. (BSH, No. 41 at p. 2) BSH also noted the following additional design features associated with commercial-style products:

- Soft-close hinges to handle constant loading and unloading of the oven to eliminate the noise of slamming doors;
- A variety of modes and options not typically found in residential-style products (*e.g.,* rapid steam generator, additional convection heating element, high power combination modes such as convection broil and steam convection);
- Powerful heating elements to maintain set temperatures during sessions of loading and unloading food (*e.g.,* caterers and entertainers at large house parties); and
- Very large usable baking space, *e.g.,* two ovens in a 60-inch range that operate independently to provide more versatility in cooking with each cavity capable of cooking one to three racks of food. In addition, commercial-style ovens can accommodate commercial baking pans that are more than twice the size of standard residential baking pans. (BSH, No. 41 at p. 2)

Sub-Zero commented that testing of their products shows that the standard levels must be increased for ovens with enhanced high performance and customer utility attributes. Its test data showed that there are significant differences in efficiency levels when comparing high performance oven designs to conventional oven designs. (Sub-Zero, No. 25 at pp. 2–3)

For these reasons, Sub-Zero requested that DOE reconsider the impact that the proposed standard levels will have on small, niche-market, high-performance cooking manufacturers and their ability to serve their unique set of customers. According to Sub-Zero, the proposed standard levels would not allow companies such as Sub-Zero to adequately serve their customer base. Sub-Zero added that the proposed standards would force them and other high performance cooking product manufacturers to compete in the conventional oven market space by requiring them to employ lighter gauge materials, exposed heating elements, lighter racks, simpler controls, and single versus dual convection fan systems, which Sub-Zero claims would eliminate the utility and performance features that market analysis shows is needed for its company to stay viable. (Sub-Zero, No. 25 at p. 6)

An Arizona Senator, California Congress Member, and Tennessee Congress Member separately commented that the proposed rule lacks any sort of distinction among residential ovens based on the cooking features they provide to the consumer, and may compromise the quality, functionality, and features associated with high-performance ovens. (Arizona Senator, No. 37 at p. 1; California Congress Member, No. 47 at p. 1; Tennessee Congress Member, No. 46 at p. 1) The Arizona Senator, the Arizona Congressional Delegation, California Congress Member, and Tennessee Congress Member encouraged DOE to work with the affected industry entities to reevaluate its proposal to prescribe a separate set of standards for high-performance ovens that acknowledges the unique characteristics of high-performance products and preserves customer choice. (Arizona Senator, No. 37 at p. 1; Arizona Congressional Delegation, No. 36 at p. 1; California Congress Member, No. 47 at pp. 1–2; Tennessee Congress Member, No. 46 at p. 2) The Arizona Congressional Delegation, California Congress Member, and Tennessee Congress Member also commented that the proposed rule is overly burdensome and would impose significant costs for companies in the high-performance oven market, including Sub-Zero and BSH. (Arizona Congressional Delegation, No. 36 at pp. 1; California Congress Member, No. 47 at pp. 1; Tennessee Congress Member, No. 46 at p. 1) The Arizona Congressional Delegation added that forcing a manufacturers like Sub-Zero to abandon its distinct line of cooking products and to manufacture mass-market products would lessen customer utility and the performance of its ovens, and create a significant disparity in the company's competitive landscape. (Arizona Congressional Delegation, No. 36 at p. 1)

As discussed previously for cooking tops, BSH commented that although it agrees with DOE's general approach of not analyzing cooking performance for ovens, commercial-style products have to fulfill higher customer demands than residential-style products. BSH stated that if DOE does not differentiate between commercial-style and residential-style products, more stringent standards would apply mainly to commercial-style products and have no effect on residential-style products. BSH commented that this could result in the elimination of commercial-style products from the market and limit consumer choice. Based on this, BSH commented that DOE should either consider a different test procedure or a separate product class for commercial-style products. (BSH, No. 41 at p. 3)

Miele also submitted a late comment in response to the June 2015 NOPR regarding commercial-style ovens. Miele commented that DOE should either consider establishing a separate product class and exempt commercial-style ovens from standards or delay the rulemaking until there is a finalized test procedure that adequately measures commercial-style products energy use and accounts for the enhanced cooking performance so that these products are not eliminated from the market. Miele commented that the DOE test procedure does not adequately reflect the energy use of commercial-style products because it does not account for the effects of door openings and the energy required for thermal recovery. Miele noted that the added mass of commercial-style ovens provides the advantage of requiring less energy and time to recover, which alters the quality of foods being cooked. (Miele, No. 42 at pp. 1–2)

To further address whether commercial-style ovens provide a unique utility that would warrant establishing a separate product class, DOE conducted additional interviews with manufacturers of commercial-style cooking products and reviewed additional commercial-style test data. While these data demonstrated a difference in energy consumption between residential-style and commercial-style ovens when measured according to the test procedure adopted in the July 2015 TP Final Rule, this difference could not be correlated to any specific utility provided to consumers. Moreover, DOE is not aware of an industry test standard that evaluates cooking performance and that would quantify the utility provided by these products. DOE also notes that all conventional ovens, regardless of whether or not the product is marketed as commercial-style, must meet the same safety standards for the construction of the oven. American National Standards Institute (ANSI) Z21.1 ''Household Cooking Gas Appliances'' (ANSI Z21.1), Section 1.21.1, requires that the oven structure, and specifically the baking racks, have sufficient strength to sustain a load of up to 25 pounds depending on the width of the rack. A similar standard (Underwriters Laboratories (UL) 858 ''Household Electric Ranges'' (UL 858)) exists for electric ovens.

Furthermore, DOE has observed many of the design features identified by manufacturers as unique to commercial-style ovens and that may impact the energy consumption, such as extension racks, convection fans, cooling fans, and hidden bake elements, in residential-style products. DOE recognizes that the presence of these features, along with thicker oven cavity walls and higher burner input rates, may help consumers perceive a difference between commercial-style and residential-style ovens. However, DOE is not aware of a clearly-defined and consistent design difference and corresponding utility provided by commercial-style ovens as compared to residential-style ovens.

For these reasons, DOE is not proposing to establish a separate product class for commercial-style ovens. As discussed in sections III.B and III.C of this SNOPR, DOE is proposing to repeal the oven test procedure in the August 2016 TP SNOPR, noting that further investigation would be required to develop test methods that appropriately account for the effects of certain commercial-style oven design features (*e.g.,* heavier-gauge cavity construction, high input rate burners, extension racks, *etc.*). However, as discussed in sections III.B and V.C.1 of this SNOPR, the prescriptive control system design requirements proposed in this SNOPR would apply to all conventional oven product types and would maintain the features available in conventional ovens marketed as commercial-style that may be used to differentiate these products in the marketplace.

Installation Configuration

As discussed in section III.C of this SNOPR, in the October 2012 TP Final Rule, DOE amended Appendix I to include methods for measuring fan-only mode.[33] Based on DOE's testing of freestanding, built-in, and slide-in conventional gas and electric ovens, DOE observed 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, which corresponds to 0.25 to 7.6 kWh/yr. Based on DOE's reverse engineering analyses discussed in section IV.C of this SNOPR, DOE noted that built-in and slide-in products incorporated an additional exhaust fan and vent assembly that was not present in freestanding products. The additional energy required to 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 proposed in the June 2015 NOPR to include separate product classes for freestanding and built-in/slide-in ovens. 80 FR 33030, 33045.

AHAM, Whirlpool, and Electrolux supported DOE's proposal to establish separate product classes for freestanding and built-in/slide-in ovens. (AHAM, No. 29 at p. 8; Whirlpool, No. 33 at p. 6; Electrolux, No. 27 at p. 4) In the absence of adverse comments, and for the reasons discussed above, DOE is maintaining its proposal to establish separate product classes for freestanding and built-in/slide-in ovens.

In summary, DOE proposes the product classes listed in Table IV.1 for this SNOPR.

TABLE IV.1—PROPOSED PRODUCT CLASSES FOR CONVENTIONAL COOKING PRODUCTS

Product class	Product type	Sub-category	Installation type
1	Electric cooking top	Open (coil) elements.	
2		Smooth elements.	
3	Gas cooking top	Conventional burners.	
4	Electric oven	Standard with or	Freestanding.
5		without a catalytic line	Built-in/Slide-in.
6		Self-clean	Freestanding.
7			Built-in/Slide-in.
8	Gas oven	Standard with or	Freestanding.
9		without a catalytic line	Built-in/Slide-in.
10		Self-clean	Freestanding.
11			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.

a. Conventional Cooking Tops

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

[33] 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.

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.2 for conventional cooking tops. 79 FR 8337, 8342–8343.

TABLE IV.2—FEBRUARY 2014 RFI TECHNOLOGY OPTIONS FOR CONVENTIONAL COOKING TOPS

Open (coil) element electric cooking tops:
1. Electronic controls.
2. Improved contact conductance.
3. Insulation.
4. Reflective Surfaces.
Smooth element electric cooking tops:
5. Electronic controls.
6. Halogen elements.
7. Induction elements.
8. Low-standby-loss electronic controls.
Gas Cooking Tops:
9. Catalytic burners.
10. Insulation.
11. Radiant gas burners.
12. Reduced excess air at burner.
13. Reflective surfaces.
14. Sealed burners.
15. Thermostatically controlled burners.

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

Whirlpool commented that there would not be efficiency gains from insulation for electric coil and gas cooking tops. Whirlpool further questioned where extra insulation would be placed on an electric coil or gas cooking top and whether consumers would accept that in the product's design. (Whirlpool, No. 13 at pp. 3, 4) Based on discussions with multiple manufacturers, DOE agrees that it is unclear where insulation could be placed in electric coil and gas cooking tops to improve efficiency, nor were manufacturers able to provide data demonstrating any measurable efficiency improvement association with added insulation. As a result, DOE did not further analyze this technology option for these proposed product classes.

Whirlpool commented that small energy savings are associated with thermostatically controlled burners for gas cooking tops, and that manufacturers would need to assess the possible quality impact from subjecting the electronics to high temperatures. (Whirlpool, No. 13 at p. 4) Whirlpool also commented that most electric coil element and smooth element cooking tops on the market today have electronic controls. (Whirlpool, No. 13 at p. 4) Based on DOE's review of products on the market, DOE agrees that the majority of electric smooth cooking tops on the market today have electronic controls. However, all of the electric coil cooking tops reviewed by DOE were equipped with electromechanical controls. Nonetheless, DOE determined that thermostatically controlled burners and electronic controls, which allow the burners or heating elements to automatically adjust in response to cooking-state set points (*e.g.,* cooking vessel temperature), would not improve efficiency based on the current DOE test procedure because the efficiency benefits of these design options can only be realized under variable burner or heating element conditions. As a result, DOE is not proposing to include these technologies in its analyses.

AHAM and Whirlpool commented that halogen elements should not be considered as a technology option for electric smooth cooking tops because they may not heat enough to properly cook food. AHAM and Whirlpool stated that they do not believe that these elements typically are capable of achieving temperatures greater than about 350 °F. (AHAM, No. 9 at p. 5; Whirlpool, No. 13 at p. 4) DOE notes that this technology option would incorporate radiant heating coils around the halogen element to provide supplemental heat around the element's edge, producing a highly responsive element with an even temperature distribution. Based on data presented in the 2009 TSD, halogen elements may increase efficiency by approximately 1.5 percent. As a result, DOE is retaining halogen elements as a technology option for electric smooth cooking tops.

Whirlpool commented that there may be negligible savings from improved contact conductance, as the coil element changes shape when heating, making it difficult to keep the element completely flat throughout the cooking cycle. According to Whirlpool, radiation also acts like conduction at very short distances (*i.e.,* the distance between test load and surface of non-flat coil element). Additionally, Whirlpool commented that the possible energy savings from improved contact conductance would not be realized by consumers because many do not have the completely flat cookware. (Whirlpool, No. 13 at pp. 4, 6) DOE recognizes that only minimal energy savings may be possible due to improved contact conductance. However, DOE understands that the thermal contact resistance between two bodies results in a temperature drop and that improving the flatness of this interface, by improving the overall flatness of either surface, can improve the heat transfer between the two bodies. According to the 2009 TSD, DOE determined that improved contact conductance, by improving the flatness of the coil heating element, could result in a relative efficiency increase of approximately 3 percent.[34] As a result, DOE retained the technology option for the purposes of this SNOPR. DOE welcomes additional comment on whether improved contact conductance should be considered as a technology option, in particular information and data substantiating the claims that radiation acts like conduction at very short distances and the degree to which the heating element or cookware may deform and impact the heat transfer between the two surfaces.

Whirlpool commented that small energy savings are possible with low-standby-loss electronic controls for electric smooth cooking tops, but they are not expected to be economically justified. (Whirlpool, No. 13 at p. 4) As part of DOE's testing and reverse engineering analyses, DOE observed that a large percentage of cooking top models incorporate SMPS, which result in lower standby power consumption compared to products with conventional linear power supplies. Based on discussions with manufacturers, DOE notes that multiple manufacturers are already transitioning to SMPS for their full product offerings. DOE also observed that one electric smooth cooking top in its test sample is equipped with an automatic power-down function in addition to the SMPS that powers down the controls to a lower-power state after a period of user inactivity to reduce standby power. As a result, DOE maintained low-standby-loss electronic controls as a technology option and assessed the associated costs in the engineering analysis.

Whirlpool commented that about 99 percent of electric coil cooking tops already have chrome drip bowls, which act as a reflective surface. (Whirlpool, No. 13 at p. 4) Whirlpool commented that there are possible savings associated with reflective surfaces for gas cooking tops, which could be implemented by the use of stainless steel, but consumers would not accept cooking products being available only in stainless steel. (Whirlpool, No. 13 at p. 3) Based on DOE's review of products on the market, DOE is unaware of any

[34] *TSD:* Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Residential Dishwashers, Dehumidifiers, and Cooking Products, and Commercial Clothes Washers. March 2009. Washington, DC. Chapter 3, p. 3–54.

electric coil cooking tops that do not have chrome drip bowls. As a result, DOE believes this technology is associated with the baseline design and did not consider reflective surfaces as a technology option for further improving product efficiency for electric coil cooking tops. DOE agrees with Whirlpool's assertion that there is a potential for energy savings associated with reflective surfaces for gas cooking tops. As a result, DOE retained this technology option for the SNOPR. DOE considers issues related to consumer utility, such as the lack of consumer acceptance of cooking top surfaces being available only in stainless steel noted by Whirlpool, as part of the screening analysis.

Whirlpool commented that there could be savings from less waste heat and increased burner efficiency from radiant gas burners, but it would not be economically justifiable. (Whirlpool, No. 13 at p. 3) DOE notes that the 2009 TSD indicated that prototype designs using radiant gas burners showed improved efficiency for gas cooking tops. As a result, DOE retained this as a technology option for further consideration. Economic impacts are addressed in the engineering, LCC, and PBP analyses.

DOE notes that sealed burners for conventional gas cooking tops were considered a technology option in the 2009 TSD. However, as discussed in section IV.C.2 of this SNOPR, DOE determined based on its testing that neither sealed nor open burner types clearly performed better or worse than the other. As a result, DOE is not considering sealed burners as a technology option for conventional gas cooking tops for this SNOPR.

DOE is proposing to consider an additional technology option for conventional gas cooking tops based on product testing and reverse engineering analyses conducted for this SNOPR. DOE testing, described in in section IV.C.2 of this SNOPR and chapter 5 of the SNOPR TSD, revealed that gas cooking top efficiency was correlated to burner system design (*e.g.,* grate weight, flame angle, distance from burner ports to the cooking surface). For example, heavier grates result in more input energy being absorbed by the grate instead of the pan. Because design of burner system components are interdependent and must also consider combustion efficiency to maintain approved levels of carbon monoxide emissions, DOE included optimized gas cooking top burner and grate designs for increasing efficiency consistent with products available on the market.

Table IV.3 lists the proposed technology options for cooking tops that DOE is considering for this SNOPR.

TABLE IV.3—PROPOSED TECHNOLOGY OPTIONS FOR CONVENTIONAL COOKING TOPS

Open (coil) element electric cooking tops:
1. Improved contact conductance.
Smooth element electric cooking tops:
2. Halogen elements.
3. Induction elements.
4. Low-standby-loss electronic controls.
Gas Cooking Tops:
5. Radiant gas burners.
6. Reduced excess air at burner.
7. Reflective surfaces.
8. Optimized burner and grate design.

b. Conventional Ovens

In the June 2015 NOPR, DOE proposed to consider the technology options listed in Table IV.4. 80 FR 33030, 33046–33047.

TABLE IV.4—JUNE 2015 NOPR 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 (electric standard ovens only).
11. Reflective surfaces.
12. Low-standby-loss electronic controls.
13. Optimized burner and cavity design.

In the June 2015 NOPR, DOE stated that it was considering an additional technology option for optimizing the burner and cavity design for gas ovens based on product testing and reverse engineering analyses. 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 proposed 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. 80 FR 33030, 33047.

AHAM commented that the market already incentivizes manufacturers to reduce the gauge of the metals they use to the extent practical, and that products that just meet the proposed standard level are already doing this t. AHAM stated that there is only so far a manufacturer can reduce gauge and retain consumer utility, product functionality and performance, and safety. (AHAM, No. 29 at p. 8) Electrolux similarly disagreed with the DOE position that optimizing the oven cavity, by reducing the gauge of steel (and thus thermal mass) used in manufacturing the oven cavity, is a viable means for reducing energy consumption. Electrolux stated that it has already reduced the thermal mass of the oven cavity in its products and there is no more efficiency that can be safely gained by reducing the gauge of steel any further. (Electrolux, No. 27 at p. 4)

As part of DOE's reverse-engineering analyses, described in section IV.C of this SNOPR and chapter 5 of the SNOPR TSD, DOE observed that the commercial-style ovens in its test sample had wall thicknesses approximately 1.5 times greater than those of residential-style ovens. Additionally, DOE observed that these products had heavier rack weights. DOE's testing showed that by optimizing the burner/cavity design, IAEC could be reduced by approximately 22 percent, depending on the oven cavity volume. DOE also notes that, as discussed in section IV.A.2.b of this SNOPR, ANSI Z21.1 and UL 858 include requirements for the oven structure and racks to be able to support loads with a certain weight range, depending on the width of the rack. For these reasons, DOE maintained the optimized burner/cavity design as a technology option.

DOE's analysis revealed that conventional ovens at the baseline efficiency level use a conventional linear power supply control design. A linear power supply typically produces unregulated as well as regulated power. The main characteristic of an unregulated power supply is that its output may contain significant voltage ripple and that the output voltage will usually vary with the current drawn. The voltages produced by regulated power supplies are typically more stable, exhibiting less ripple than the output from an unregulated power supply and maintaining a relatively constant voltage within the specified current limits of the device(s) regulating the power. The unregulated portion of a linear power supply typically consists of a transformer that steps alternating current (AC) line voltage down, a voltage rectifier circuit for AC to direct current (DC) conversion, and a capacitor to produce unregulated, direct current output. However, there are many means of producing and implementing an unregulated power supply such as transformerless capacitive and/or resistive rectification circuits.

Within a linear power supply, the unregulated output serves as an input into a single or multiple voltage-regulating devices. Such regulating devices include Zener diodes, linear voltage regulators, or similar components which produce a lower-potential, regulated power output from a higher-potential direct current input. This approach results in a rugged power supply which is reliable, but typically has an efficiency of about 40 percent. As discussed in section IV.C.3.b of this SNOPR, DOE's analysis showed that switching from a conventional linear power supply to an SMPS reduces the standby mode energy consumption for conventional ovens. An SMPS offer higher conversion efficiencies of up to 75 percent in appliance applications for power supply sizes similar to those of conventional ovens. An SMPS also reduces the no-load standby losses.

AHRI commented that DOE's discussion of the electronic spark ignition design option and the proposed standard levels in the June 2015 NOPR strongly suggest a practical effect of eliminating glo-bar ignition systems. AHRI commented that the typical glo-bar ignition systems currently used in gas ovens remain energized during the entire time that the main burner is on. AHRI noted that this is directly related to a key safety feature of these ignition systems—that the electric current sufficient to open the gas valve cannot pass through the igniter until the igniter has attained a temperature that will ignite the gas at the burner. According to AHRI, DOE's analysis is technically inaccurate and the major reduction in the electrical consumption of the ignition systems is not due to replacing the glo-bar with a spark igniter, but instead to changing the ignition system to an ''interrupted'' type of system. AHRI noted that the North American safety standard for automatic gas ignition systems specifies that an intermittent/interrupted ignition system is energized prior to the admission of fuel to the main burner and is de-energized when the main burner flame is established. AHRI stated that this is the proper technical description of the technology option that was analyzed. (AHRI, No. 34 at p. 1)

AHRI also commented that it understands that the proposed maximum energy use standards for gas ovens in the June 2015 NOPR do not require the use of an electronic spark ignition system, but that if this understanding is not correct, then DOE would be proposing a prescriptive design requirement within a rule that is intended to be a performance standard. (AHRI, No. 34 at p. 2)

DOE acknowledges that by describing the gas ignition system technology option analyzed in the June 2015 NOPR as electronic spark ignition, DOE could potentially preclude certain ignition types from consideration that may result in reduced energy consumption. As a result, DOE conducted a review of ignition systems available on the market as well as various industry definitions for automatic gas ignition available in household gas appliances. DOE based its analysis on existing industry terminology such as definitions available in ANSI Z21.1 and ANSI Z21.20, ''Automatic Electrical Controls for Household and Similar Use Part 2: Particular Requirements for Automatic Burner Ignition Systems and Components.''

When a conventional gas oven cooking cycle is initiated, an ignition system is energized before gas is allowed to flow to the main burner to be lit. Ignition types observed on the market for conventional gas ovens fall under four categories: (1) Continuous (*e.g.,* constant-burning or ''standing'' pilot) (2) intermittent ignition (3) intermittent/interrupted ignition and (4) intermittent pilot ignition. These ignition types are described in the following paragraphs.

Continuous ignition systems are a type of ignition that, once placed in operation, are intended to remain ignited or energized continuously until manually interrupted. Thus, they would remain energized throughout, and outside of, a cooking cycle. Constant burning pilot igniters are considered continuous ignition systems. As noted in section II.B.1 of this SNOPR, in the April 2009 Final Rule, DOE prescribed the current energy conservation standards for conventional cooking products to prohibit constant burning pilots for all gas cooking products.

For intermittent ignition systems, the ignition source is ignited or energized when the appliance controls call for heat. The ignition source remains continuously ignited or energized during each period of main burner operation and is extinguished or de-energized when each main burner operating cycle is completed. DOE's analysis determined that baseline conventional gas ovens are equipped with an intermittent ignition system that uses a glo-bar igniter (also referred to as a hot surface igniter). For these ignition systems, when the thermostat is set to a specific temperature and the oven controls call for heat, line voltage is applied to the igniter. As the glo-bar heats and increases in temperature, the current draw decreases. A safety valve is installed in series with the igniter such that the valve allows gas flow to the main burner only when the current draw of the glo-bar falls below a certain point, which corresponds to a temperature capable of igniting the gas at the burner. Because the safety valve remains open only when the glo-bar igniter is drawing the correct current, the igniter must continually draw power to keep the burner ignited. Based on DOE's testing, glo-bar ignition systems consume between 300 W and 450 W when energized.

For intermittent/interrupted ignition systems, the ignition source is ignited or energized each time the appliance controls call for heat. However, the ignition source is extinguished or de-energized after the main burner flame is ignited. DOE notes that some conventional ovens on the market use a direct electronic spark ignition, which is a type of intermittent/interrupted ignition system. When the direct electronic spark igniter receives a signal from the controls (either by a rotary-actuated control dial or from an electronic control system), the spark electrode sparks to ignite the main burner directly. The spark igniter is de-energized once ignition of the main burner is complete. DOE is also aware of a ceramic glo-bar igniter designed to be used in an intermittent/interrupted ignition system, which is energized when there is a call for heat and de-energized once the main burner flame has been ignited.

For intermittent pilot ignition systems, upon a call for the burner to ignite, a spark module lights a pilot flame, which in turn ignites the main burner. In the systems reviewed by DOE, DOE observed that when the main burner shuts off, the pilot also shuts off. DOE welcomes comment that would confirm the operation sequence of intermittent pilot ignition systems used in conventional gas oven applications. DOE notes that battery-power ignition systems would be considered an intermittent pilot ignition system and already exist in conventional gas ovens available on the market. DOE further notes that a similar electronic spark ignition system that uses line power and that ignites a pilot flame would also be considered an intermittent pilot ignition system.

As discussed in section IV.C.3.b of this SNOPR, DOE's testing conducted for the June 2015 NOPR showed that intermittent pilot ignition systems (*i.e.*. electronic spark ignition systems) reduce energy consumption as compared to intermittent glo-bar ignition systems. However, based on DOE's review of different ignition systems, DOE has additionally determined that energy savings can be achieved from switching from the baseline intermittent glo-bar ignition system to either an intermittent/interrupted ignition or intermittent pilot ignition. As a result, DOE is expanding the gas ignition system technology option to account for both of these options.

As discussed in section I and section III.B of this SNOPR, DOE is proposing to adopt a prescriptive standard for the control system of conventional gas ovens to require the use an intermittent/interrupted ignition or intermittent pilot ignition. As a result, DOE is proposing to define intermittent/interrupted ignition and intermittent pilot ignition in 10 CFR 430.2. DOE would define intermittent/interrupted ignition to be an ignition source which is ignited or energized upon initiation of each main burner operational cycle and which is extinguished or no longer energized after the main burner is ignited. DOE would define intermittent pilot ignition to be an ignition source which, upon initiation of each main burner operational cycle, ignites a pilot that remains lit continuously during the main burner operational cycle and is extinguished when the main burner operational cycle is completed. DOE seeks comment on the use of these terms as descriptors for the ignition systems capable of reducing the energy consumption of conventional gas ovens.

In the June 2015 NOPR, DOE proposed to consider reducing the vent rate as a technology option for standard-clean electric ovens. 80 FR 33030, 33047. Electrolux stated that the technology option of providing for a reduced vent rate is not practical and cannot be used to increase the energy efficiency of conventional ovens because venting of the oven cavity during the cooking operation is necessary for the optimum cooking performance of the oven. (Electrolux, No. 27 at p. 5)

DOE recognizes that some electric standard ovens may already have a reduced vent rate. However, this may not be the case for all electric standard ovens on the market. For example, DOE's test sample included standard and self-clean versions of the same basic model of electric oven, and during the reverse engineering analysis described in section IV.C.2 of this SNOPR, DOE observed that both units had the same design, construction, and fan-only mode energy consumption, indicating that their vent rate was identical. This indicates that a reduced vent rate could be considered for the standard version of this model. Additionally, in the previous rulemaking, manufacturers themselves confirmed that vent rate could be reduced for electric standard ovens. Thus, DOE continues to include this design option as part of its analysis but requests comment on whether a reduced vent rate could be used to increase the energy efficiency of conventional electric standard ovens.

In the June 2015 NOPR, DOE proposed to consider improved insulation as a technology option for standard-clean ovens. 80 FR 33030, 33047. AHAM and Electrolux commented that DOE has not clearly defined high density insulation. AHAM added that, as a result, they cannot comment on the whether this technology is already in use in standard-clean ovens. (AHAM, No. 29 at p. 8; Electrolux, No. 27 at pp. 4–5) As noted in chapter 5 of the NOPR TSD, DOE considers the improved insulation technology option to consist of switching from the low-density (~1.09 pounds (lb)/ft^3) fiberglass insulation typically used in standard-clean ovens, to a higher density (~1.90 lb/ft^3) insulation, as commonly incorporated in self-clean ovens to meet UL surface temperature requirements during the high-temperature pyrolysis self-clean cycle.

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

a. Conventional Cooking Tops

For conventional cooking tops, DOE screened out radiant gas burners, catalytic burners, reduced excess air at burner, and reflective surfaces for the reasons that follow.

In the previous rulemaking, manufacturers concluded that infrared jet-impingement radiant gas burners would not be able to comply with the ANSI Standard Z21.1–2005, ''Household Cooking Gas Appliances.'' Field testing had shown that users were unable to turn down the burner satisfactorily, which indicated a potential health and safety risk. 72 FR 64432, 64455 (Nov. 15, 2007). No more recent designs of radiant gas burners for residential cooking tops have resolved this issue, and therefore, due to potential impacts on consumer health and safety, DOE screened out radiant gas burners from further analysis.

In response to the February 2014 RFI, Whirlpool commented that catalytic burners are not applicable to today's market for gas cooking tops. Whirlpool stated that these seem to be more applicable to industrial furnaces than residential gas cooking top burners. (Whirlpool, No. 13 at p. 3) In the absence of any commercialized catalytic burners for residential gas cooking tops, DOE asserts that it would not be practicable to manufacture, install and service this technology on the scale necessary to serve the relevant market at the time of the effective date of an amended standard. Also, because this technology is in the research stage, it is not possible to assess whether it will have any adverse impacts on utility to consumers or product availability, or any adverse impacts on consumers' health or safety. As a result, DOE screened out catalytic burners from further analysis.

Whirlpool commented that reduced excess air at burner does not seem to be applicable to residential gas cooking tops, as excess air is needed for clean, safe, and complete combustion. (Whirlpool, No. 13 at p. 3) Reduced excess air at the burner has not been definitively shown to increase efficiency. In addition, DOE cannot assess adverse impacts on consumers' utility, health, or safety or equipment availability for this technology. Reducing excess air at the burner increases the possibility of adverse conditions such as poor flame quality and elevated carbon monoxide levels, which would suggest adverse impacts on consumers' utility, health, and safety. For these reasons, DOE screened out reduced excess air at the burner from further analysis.

Reflective surfaces for gas cooking tops utilize highly polished or chromed drip pans underneath the burner. The primary mechanism for heat transfer to the cooking vessel for gas cooking tops is convection. As a result, the efficiency gains resulting from using reflective pans are extremely small because gas flames and burners have minimal infrared emissions. Based on data provided by manufacturers through AHAM, DOE estimated in the 2009 TSD that an efficiency increase of only 0.1 percent was possible. Also, as reported in the 1996 TSD,[35] manufacturers stated that any increase in efficiency due to a reflective surface could easily be negated if the consumer fails to regularly clean the surface or uses an abrasive pad to clean the surface. As a result, DOE screened out this technology option from further analysis.

b. Conventional Ovens

For conventional ovens, in the June 2015 NOPR, DOE screened out added insulation, bi-radiant oven, halogen lamp oven, no oven door window, and reflective surfaces. 80 FR 33030, 33047–33048.

DOE did not receive any comments opposing the technology options screened out in the June 2015 NOPR. For the same reasons discussed in the June 2015 NOPR, DOE is continuing to screen out added insulation, bi-radiant oven, halogen lamp oven, no oven door window, and reflective surfaces from further analysis.

Additionally, as discussed in section IV.A.3.b of this SNOPR, the optimized burner and cavity design technology option would require changes to commercial-style ovens that include reducing the thermal mass of the oven cavity. DOE recognizes that an energy conservation standard that requires this technology option may result in the unavailability of a certain product type, *i.e.,* commercial-style ovens that include features (*e.g.,* thicker oven cavity walls, high input rate burners, extension racks, *etc.*) that are used to differentiate these products from residential-style products. As a result, DOE has screened out optimized burner and cavity design from further analysis.

2. Remaining Technologies

Based on the screening analysis, DOE considered the design options listed in Table IV.5 for conventional cooking tops and Table IV.6 for conventional ovens.

TABLE IV.5—REMAINING CONVENTIONAL COOKING TOP TECHNOLOGY OPTIONS

Open (coil) element electric cooking tops:
1. Improved contact conductance.

Smooth element electric cooking tops:
2. Halogen elements.
3. Induction elements.
4. Low-standby-loss electronic controls.

Gas Cooking Tops:
5. Optimized burner and grate design.

TABLE IV.6—REMAINING CONVENTIONAL OVEN TECHNOLOGY OPTIONS

1. Intermittent/interrupted ignition or intermittent pilot ignition system.
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 (electric standard ovens only).
8. Low-standby-loss electronic controls.

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.

To determine the cost-efficiency relationship, DOE structured its engineering analysis for this SNOPR 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 considered cost-efficiency data from the 2009 TSD. DOE also conducted interviews with manufacturers of conventional cooking products 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.

a. Conventional Cooking Tops

For conventional cooking tops, DOE's test sample included four gas cooking tops, eight gas ranges, six electric cooking tops, and two electric ranges for a total of 20 conventional cooking tops

[35] Available online at *http://www.regulations.gov/#!documentDetail;D=EERE-2006-STD-0070-0053.*

covering all of the product classes considered in this SNOPR. The test units are described in detail in chapter 5 of the SNOPR TSD.

DOE first conducted testing on each cooking top in its test sample. 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 section IV.C.3 and section IV.C.4 of this SNOPR.

Table IV.7 and Table IV.8 present the testing results for the conventional gas and electric cooking tops, respectively. Residential conventional ranges include both a cooking top and oven but each component is tested individually and falls into a separate product class. Thus, DOE separated the range components for its analysis and each of the units in the following tables represent a cooking top that may be either a standalone unit or a component of a range.

TABLE IV.7—DOE CONVENTIONAL GAS COOKING TOP TEST RESULTS [36]

Test unit No.	Cooking top product class	Burner type	Burner input rating (Btu)	Grate material	Grate weight per burner (pounds (lbs)) *	IAEC (kBtu/yr)
1	Conventional Gas	Open	4 × 9,000	Steel	0.5	655.2
2	Conventional Gas	Open	4 × 9,100	Steel	1.1	760.5
3	Conventional Gas	Open	4 × 9,100	Steel	1.1	834.3
4	Conventional Gas	Sealed	5,000; 9,500; 10,000; 15,000; 17,000.	Cast Iron	2.2	960.4
5	Conventional Gas	Sealed	2 × 7,000; 2 × 8,000	Cast Iron	2.1	730.4
6	Conventional Gas	Sealed	4 × 18,000	Cast Iron	6.1	1067.0
7	Conventional Gas	Sealed	5,000; 2 × 9,100; 11,000; 20,000.	Cast Iron	4.2	1033.5
8	Conventional Gas	Sealed	4 × 18,000	Cast Iron	4.8	928.6
9	Conventional Gas	Sealed	2 × 9,500; 2 × 15,000; 2 × 18,500.	Cast Iron	5.4	924.4
10	Conventional Gas	Open	4 × 23,000	Cast Iron	8.6	909.1
11	Conventional Gas	Open	12,000; 2 × 18,000; 3 × 25,000.	Cast Iron	6.3	1104.8
12	Conventional Gas	Closed	2 × 15,000; 9,500 5,000	Cast Iron	3.7	837.9

* For cooking tops with continuous grates covering multiple surface unit burners, the total grate weight was divided by the number of burners.

TABLE IV.8—DOE CONVENTIONAL ELECTRIC COOKING TOP TEST RESULTS [37]

Test unit No.	Cooking top product class	Surface unit input rating * (W)	IAEC (kWh/yr)
1	Smooth Element—Induction	1,900; 2,600; 3,200; 3,400	119.9
2	Smooth Element—Induction	Max 3,600	105.7
3	Smooth Element—Induction	1,800; 2 × 2,500; 3,700	121.0
4	Smooth Element—Electric Resistance	3 × 1,200; 2,000; 2,400; 3,000	139.1
5	Smooth Element—Electric Resistance	3 × 1,200; 1,500; 2,400; 2 × 3,000	125.9
6	Open (Coil) Element	3 × 1,300; 1 × 2,100	111.4
7	Open (Coil) Element	2 × 1,300; 2 × 2,400	115.0
8	Open (Coil) Element	3 × 1,250; 2,100	124.1

* Includes wattages for surface units with multiple concentric heating elements for a single surface unit.

b. Conventional Ovens

As noted in the June 2015 NOPR, DOE's test sample for conventional ovens 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 considered product classes. DOE conducted testing according to the test procedure adopted in the July 2015 TP Final Rule. 80 FR 33030, 33048–33049. As discussed in section III.B of this SNOPR, although DOE has since proposed to repeal the conventional oven test procedure in Appendix I, DOE based its analyses for this SNOPR on the data measured using that test procedure. Table IV.9 and Table IV.10 present the testing results for the conventional gas and electric ovens, respectively. As with cooking tops, DOE used the results from testing, reverse engineering, and manufacturer interviews to develop the efficiency levels and manufacturing costs for conventional ovens discussed in section IV.C.3 and section IV.C.4 of this SNOPR.

[36] As discussed in section IV.A.2 of this SNOPR, DOE originally conducted testing using the withdrawn hybrid test block method proposed in the December 2014 TP SNOPR. DOE tested four of the twelve units in its test sample using both the hybrid test block method and the water heating test method proposed in the August 2016 TP SNOPR. DOE then used the relative difference in results between the two test methods to scale the normalized total cooking top energy consumption for the remaining units in its test sample.

[37] DOE originally conducted testing using the withdrawn hybrid test block method proposed in the December 2014 TP SNOPR. DOE tested five of the eight electric units in its test sample using both the hybrid test block method and the water heating test method proposed in the August 2016 TP SNOPR. DOE then used the relative difference in results between the two test methods to scale the normalized test energy consumption by surface unit for the remaining units in its test sample. Additional details of this analysis for electric cooking tops are provided in chapter 5 of the SNOPR TSD.

TABLE IV.9—DOE CONVENTIONAL GAS OVEN TEST RESULTS

Test unit No.	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	1489.1
3	Gas Self-Clean—Freestanding	18,000	5.0	Glo-bar	Y	1403.4
4	Gas Standard—Freestanding	16,500	4.4	Glo-bar	N	1501.3
5	Gas Self-Clean—Built-in/Slide-in	13,000	2.8	Glo-bar	N	1159.9
6	Gas Standard—Freestanding	28,000	5.3	Glo-bar	Y	2061.3
7	Gas Standard—Built-in/Slide-in	27,000	4.4	Glo-bar	Y	1922.9
8	Gas Standard—Freestanding	30,000	5.4	Glo-bar	Y	2296.9

* The IAEC values presented here differ slightly from those in the June 2015 NOPR due to a minor technical correction in the method used to calculate the electrical energy contribution to IAEC for gas ovens in the test procedure adopted in the July 2015 TP Final Rule. Further information on this correction is available in section IV.C.3.c and chapter 5 of the SNOPR TSD.

TABLE IV.10—DOE CONVENTIONAL ELECTRIC OVEN TEST RESULTS

Test unit No.	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	213.6
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	287.7
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 SNOPR 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 efficiency levels to the energy consumption of the baseline unit. Similarly, to determine the changes in price to the consumer that will result from an amended energy conservation standard, DOE compares the price of a unit at each higher efficiency level to the price of a unit at the baseline.

Conventional Cooking Tops

As part of the February 2014 RFI, DOE initially developed baseline efficiency levels by considering the current standards for conventional gas cooking tops and the baseline efficiency levels for conventional electric cooking tops from the previous standards rulemaking analysis. DOE developed tentative baseline efficiency levels for the February 2014 RFI using the former test block-based test procedure and the proposed test procedure amendments in the January 2013 TP NOPR that included modifications to the test block to allow for the test of induction cooking tops. The baseline efficiency levels proposed in the February 2014 RFI are presented in Table IV.11. 79 FR 8337, 8343 (Feb. 12, 2014). DOE developed baseline efficiency levels for standby mode and off mode based on test data presented in the microwave oven test procedure SNOPR.[38]

TABLE IV.11—FEBRUARY 2014 RFI CONVENTIONAL COOKING TOP BASELINE EFFICIENCY LEVELS

Product class	2009 standards rulemaking		Proposed test procedure cooking efficiency	Proposed IAEC
	Cooking efficiency	Energy factor (EF)		
Electric Cooking Tops—Open (Coil) Elements	0.737	0.737	0.674	256.7 kWh/yr.
Electric Cooking Tops—Smooth Elements	0.742	0.742	0.679	280.6 kWh/yr.
Gas Cooking Tops	0.399	0.399	0.365	1445.0 kBtu/yr.

As discussed in III.C, DOE recently published the August 2016 TP SNOPR proposing to amend the cooking tops test procedure in Appendix I to be based on the water heating test method. DOE developed baseline efficiency levels for this SNOPR considering both data from the previous standards rulemaking and the energy use for the test units based

[38] 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).

on the water heating test procedure proposed in the August 2016 TP SNOPR. DOE conducted testing for units in its test sample to measure IAEC, which includes energy use in active 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 SNOPR differ from those presented in the 2014 RFI for each product class. This is primarily due to the difference between the withdrawn hybrid test block method and the adopted water-heating test methods, and the differences in the calculation of annual energy consumption. As outlined in section III.C of this SNOPR, in the August 2016 TP SNOPR, DOE proposed to adjust its calculation of annual energy consumption for cooking tops to account for changes in consumer cooking frequency and differences between actual field usage of the cooking top and the DOE test method. 81 FR 57374, 57387–57388. As a result, the IAEC for each cooking top included in DOE's test sample, as calculated using the methods adopted in the August 2016 TP SNOPR, is lower than the baseline IAEC values established in the 2009 cooking products energy conservation standards rulemaking as well as those presented in the 2014 RFI for each product class. However, after scaling the baseline values from the 2014 RFI to reflect the updated IAEC calculation method, the highest measured IAEC in DOE's test sample for this SNOPR was higher than the baseline IAEC observed during the 2009 rulemaking for each cooking top product class, suggesting that the baseline energy consumption of cooking tops has increased since 2009. Thus, to establish the new baseline IAEC for cooking tops, DOE set the baseline IAEC equal to the maximum IAEC measured in the test sample for each product class.

Because baseline electric coil cooking tops and gas cooking tops have only electromechanical controls, the baseline IAEC for these product classes is calculated based on zero standby mode and off mode energy consumption. In contrast, baseline electric cooking tops with smooth elements have electronic controls which consume energy in standby and off mode. To determine the baseline IAEC for smooth element electric cooking tops, DOE set baseline standby energy consumption equal to that of the cooking top with the highest standby energy consumption in its test sample to maintain the full functionality of controls for consumer utility.

The proposed baseline efficiency levels for conventional cooking tops for this SNOPR are presented in Table IV.12. Additional details on the development of the proposed baseline efficiency levels for conventional cooking tops are included in chapter 5 of the SNOPR TSD. The baseline efficiency levels were based on testing of DOE's sample of products, as presented in section IV.C.2. DOE recognizes that manufacturers implement different heating element or burner designs and welcomes additional data regarding the proposed baseline efficiency levels.

TABLE IV.12—CONVENTIONAL COOKING TOP BASELINE EFFICIENCY LEVELS

Product class	Proposed IAEC
Electric Cooking Tops—Open (Coil) Elements	118.1 kWh/yr.
Electric Cooking Tops—Smooth Elements	144.7 kWh/yr.
Gas Cooking Tops	1104.8 kBtu/yr.

Conventional Ovens

For the June 2015 NOPR, DOE developed baseline efficiency levels for conventional ovens considering both data from the previous standards rulemaking and the measured energy use for the test units. 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, DOE noted that very little energy use information was available. 80 FR 33030, 33050.

To establish the baseline efficiency levels for conventional ovens, first DOE derived a relationship between IAEC and cavity volume as discussed in section IV.C.3.c of this SNOPR. 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 (including the oven component of a 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. *Id.*

DOE developed separate baseline efficiency levels for each proposed product class based on testing conducted for the June 2015 NOPR. The proposed baseline efficiency levels for the NOPR are presented in Table IV.13 and are based on an oven with a cavity volume of 4.3 ft^3. *Id.*

TABLE IV.13—JUNE 2015 NOPR 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.

TABLE IV.13—JUNE 2015 NOPR CONVENTIONAL OVEN BASELINE EFFICIENCY LEVELS—Continued

Product class	Sub type	Proposed IAEC *
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.

As noted in section III.H of this SNOPR, AHAM, Whirlpool, and Electrolux expressed concern that DOE has based its analysis on an insufficient sample size of models, in particular for the electric standard oven baseline efficiency levels. (AHAM, No. 29 at p. 5; AHAM, No. 38 at pp. 2–3; Whirlpool, No. 33 at p. 5; Electrolux, No. 27 at pp. 3–4)

To address concerns regarding the limited data used to establish the baseline efficiency levels for the electric standard oven product classes, DOE augmented its analysis of electric standard ovens by considering the energy use of the electric self-clean units in its test sample, adjusted to account for the differences between standard-clean and self-clean ovens. For these electric self-clean ovens, DOE first subtracted the annual self-cleaning energy consumption and adjusted the cycles per year [39] to recalculate IAEC. DOE also adjusted the IAEC for each electric self-clean oven model to account for the design differences between self-clean ovens and standard clean ovens, noting that baseline self-clean ovens are typically designed with the improved insulation and improved door seals design options that were not considered to be part of the baseline efficiency level for standard clean ovens. Additional details regarding this analysis are presented in chapter 5 of the SNOPR TSD. The resulting expanded dataset is shown in Figure IV.2.

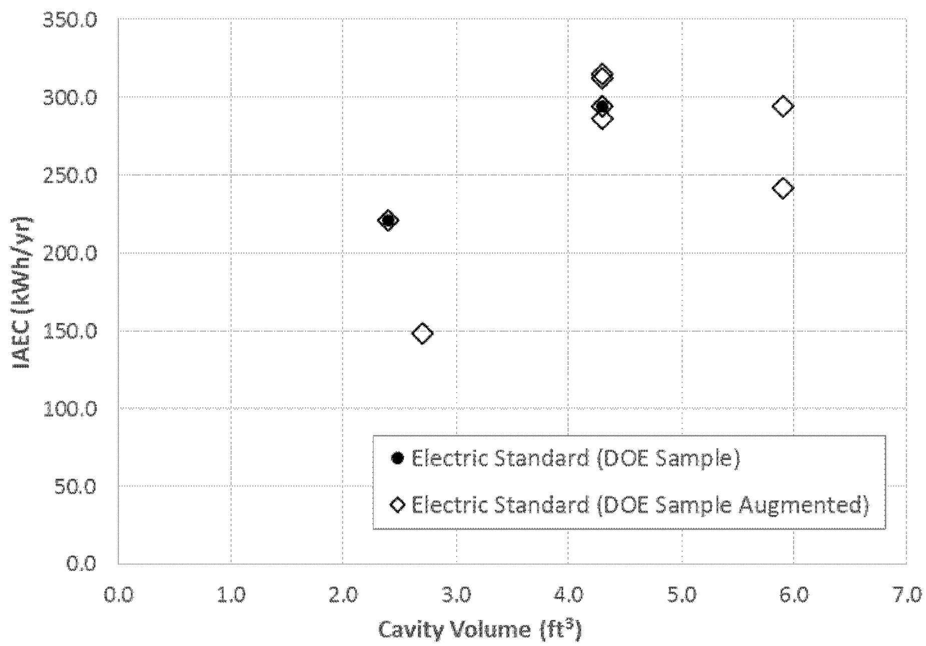

Figure IV.2 Augmented Electric Standard Oven Data from the DOE Test Sample

Augmenting the electric standard oven dataset with self-clean models from the DOE test sample allowed DOE to consider a wider range of cavity volumes in its analysis. Based on this analysis, DOE adjusted the baseline IAEC versus cavity volume relationship for electric standard ovens so that no models in DOE's dataset, including those in the augmented sample, were cut off by the baseline curve.

The proposed baseline efficiency levels for this SNOPR are presented in Table IV.14 and are based on an oven with a cavity volume of 4.3 ft^3.

TABLE IV.14—CONVENTIONAL OVEN BASELINE EFFICIENCY LEVELS

Product class	Sub type	Proposed IAEC *†
Electric Oven—Standard Oven with or without a Catalytic Line	Freestanding	315.2 kWh.
	Built-in/Slide-in	322.3 kWh.

[39] In the current DOE test procedure for conventional ovens in Appendix I, the cycles per year used to calculate IAEC is 219 for electric standard ovens and 204 for electric self-clean ovens.

TABLE IV.14—CONVENTIONAL OVEN BASELINE EFFICIENCY LEVELS—Continued

Product class	Sub type	Proposed IAEC *†
Electric Oven—Self-Clean Oven	Freestanding	354.9 kWh.
	Built-in/Slide-in	362.0 kWh.
Gas Oven—Standard Oven with or without a Catalytic Line	Freestanding	2083.1 kBtu.
	Built-in/Slide-in	2093.0 kBtu.
Gas Oven—Self-Clean Oven	Freestanding	1959.6 kBtu.
	Built-in/Slide-in	1969.6 kBtu.

* Proposed IAEC baseline efficiency levels are normalized based on a 4.3 ft^3 volume oven.
† The baseline IAEC values presented here differ slightly from those in the June 2015 NOPR due to a minor technical correction in the method used to calculate the electrical energy contribution to IAEC for gas ovens in the test procedure adopted in the July 2015 TP Final Rule. Further information on this correction is available in section IV.C.3.c and chapter 5 of the SNOPR TSD.

b. Incremental Efficiency Levels

For each product class for both conventional cooking tops and conventional ovens, DOE analyzes several efficiency levels and determines the incremental cost at each of these levels.

Conventional Cooking Tops

For the February 2014 RFI, DOE tentatively proposed the incremental efficiency levels for conventional cooking tops presented in Table IV.15 through Table IV.17. DOE developed these levels based primarily on the efficiency levels presented in the 2009 TSD, adjusted using the former test block-based test procedure and the proposed test procedure amendments in the January 2013 TP NOPR that included modifications to the test block to allow for the test of induction cooking tops. DOE also considered separate efficiency levels associated with reducing standby mode and off mode energy use by first changing conventional linear power supplies to SMPS and then by meeting the 1 W maximum standby power limit set forth in the Commission of the European Communities Regulation 1275/2008 (hereinafter ''Ecodesign regulation''). 79 FR 8337, 8345–8346 (Feb. 12, 2014).

TABLE IV.15—FEBRUARY 2014 RFI OPEN (COIL) ELEMENT ELECTRIC COOKING TOP EFFICIENCY LEVELS

Level	Efficiency level source	Proposed IAEC (kWh/yr)
Baseline	2009 TSD (Baseline)	256.7
1	2009 TSD (Improved Contact Conductance)	246.0

TABLE IV.16—FEBRUARY 2014 RFI SMOOTH ELEMENT ELECTRIC COOKING TOP EFFICIENCY LEVELS

Level	Efficiency level source	Proposed IAEC (kWh/yr)
Baseline	2009 TSD (Baseline)	280.6
1	Baseline + Switch-Mode Power Supply (SMPS)	268.6
2	Baseline + 1 W Standby	263.5
3	2009 TSD (Halogen Lamp Element) + 1 W Standby	259.8
4	Induction + SMPS	245.9
5	Induction + 1 W Standby	240.7

TABLE IV.17—FEBRUARY 2014 RFI GAS COOKING TOP EFFICIENCY LEVELS

Level	Efficiency level source	Proposed IAEC (kBtu/yr)
Baseline	2009 TSD (Electronic Ignition)	1445.0
1	2009 TSD Max-Tech (Sealed Burners)	1372.7

In response to the February 2014 RFI, AHAM disagreed with DOE's consideration of the 1–W Ecodesign regulation standby power requirement because products sold in the European Union are different from the products sold in the United States. (AHAM, No. 9 at p. 6) As discussed below, DOE reevaluated the efficiency levels associated with standby power improvements based on product testing and reverse engineering. As a result, DOE is no longer considering an efficiency level specifically associated with the 1–W Ecodesign regulation standby power requirement.

Laclede commented that induction cooking tops save a significant amount of energy and meet the criteria of technologically feasible and economically justified based upon their widespread commercial availability. Consequently, Laclede urged DOE to use electric induction cooking top efficiencies to set the minimum efficiencies of electric cooking tops. (Laclede, No. 8 at pp. 4, 5) DOE included an efficiency level associated with this technology based on product testing. As discussed in section II.A of this SNOPR, DOE follows specific statutory criteria prescribed by EPCA for determining whether proposed energy conservation standards are technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(B)(i)(I)–(VII)) DOE considered these criteria when evaluating each proposed efficiency level, including the level associated with induction heating.

Whirlpool commented that sealed burners already comprise a majority of the market (<90 percent), so this technology is not appropriate as a max-tech level for gas cooking tops. Whirlpool commented that it is unaware of any technologies or efficiency levels for max-tech for gas cooking tops. (Whirlpool, No. 13 at p. 6) Based on DOE's testing of both sealed and open burners, presented in section IV.C.2 of this SNOPR, DOE noted that neither burner type clearly performed better or worse than the other. As a result, DOE did not consider an efficiency level associated with sealed burners for conventional gas cooking tops.

For this SNOPR, DOE developed incremental efficiency levels for each cooking top 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 identified an additional efficiency level for smooth element electric cooking tops associated with low-standby-loss controls for an automatic power-down function that shuts off certain power-consuming components after a specified period of user inactivity that was observed during testing and teardowns.

DOE also considered additional efficiency levels associated with optimized burner and grate design for conventional gas cooking tops. DOE's testing, as presented in sections IV.A.2 and IV.C.2 of this SNOPR, showed that energy use was correlated to burner design (*e.g.,* grate weight, flame angle, distance from burner ports to the cooking surface) and could be reduced by optimizing the design of the burner and grate system. DOE reviewed the test data for the conventional gas cooking tops in its test sample and identified three efficiency levels associated with improving the burner and grate design.

Although, as discussed in section IV.A.2 of this SNOPR, DOE's testing showed that there was no statistically significant correlation between burner input rate and cooking energy consumption of the cooking top, DOE notes that cooking tops that incorporate different combinations of burners, including high input rate burners for larger food loads, have differing capabilities to cook or heat different sized food loads. As a result, DOE is proposing multiple efficiency levels that take into account key burner configurations. DOE is proposing Efficiency Level 1 based on an optimized burner and improved grate design of the unit in the test sample with the lowest measured IAEC among those with cast iron grates and a six surface unit configuration with at least four out of the six surface units having burner input rates exceeding 14,000 Btu/h. DOE selected these criteria to maintain the full functionality of cooking tops marketed as commercial-style. DOE notes that while there are some such products with fewer than six surface units and fewer than four high burner input rate burners, DOE did not observe any products marketed as residential-style with the burner configuration DOE is associating with Efficiency Level 1.

DOE is proposing Efficiency Level 2 for conventional gas cooking tops based on an optimized burner and further improved grate design of the unit in the DOE test sample with the lowest measured IAEC among those units with cast iron grates and at least one surface unit having a burner input rate exceeding 14,000 Btu/h. None of the gas units in the DOE test sample marketed as commercial-style were capable of achieving this efficiency level. The cooking tops in the DOE test sample capable of meeting this efficiency level were marketed as residential-style and had significantly lighter cast-iron grates than the commercial-style units.

DOE established Efficiency Level 3 (max-tech) based on the unit in the DOE test sample with the lowest measured IAEC among those with cast iron grates, regardless of the number of burners or burner input rate. DOE notes that the grate weight for this unit was not lowest in the DOE test sample, confirming that a fully optimized burner and grate design, and not a reduction in grate weight alone, is required to improve cooking top efficiency.

Table IV.18 through Table IV.20 show the incremental efficiency levels for each cooking top product class, including whether the efficiency level is from the 2009 TSD or based on testing for the SNOPR. Details of the derivations of each efficiency level are provided in chapter 5 of the SNOPR TSD. The efficiency levels were based, in part, on testing of DOE's sample of products, as presented in section IV.C.2 of this SNOPR. DOE recognizes that manufacturers implement different heating element or burner designs and welcomes additional test data regarding the proposed efficiency levels.

TABLE IV.18—OPEN (COIL) ELEMENT ELECTRIC COOKING TOP EFFICIENCY LEVELS

Level	Efficiency level source	Design option	Proposed IAEC (kWh/yr)	Relative % decrease in IAEC
Baseline	SNOPR Testing	Baseline	118.1	
1	2009 TSD	Baseline + Improved Contact Conductance.	113.2	−4.2

TABLE IV.19—SMOOTH ELEMENT ELECTRIC COOKING TOP EFFICIENCY LEVELS

Level	Efficiency level source	Design option	Proposed IAEC (kWh/yr)	Relative % decrease in IAEC
Baseline	SNOPR Testing	Baseline	144.7	
1	SNOPR Testing	Baseline + SMPS	137.0	−5.3
2	SNOPR Testing	1 + Automatic Power Down	121.2	−11.5
3	2009 TSD	2 + Halogen Lamp Element	119.5	−1.4
4	SNOPR Testing	2 + Induction Heating Element	102.3	−14.4

TABLE IV.20—GAS COOKING TOP EFFICIENCY LEVELS

Level	Efficiency level source	Design option	Proposed IAEC (kBtu/yr)	Relative % decrease in IAEC
Baseline	SNOPR Testing	Baseline	1104.6	
1	SNOPR Testing	Baseline + Optimized Burner/Improved Grates (Achievable with a 6 surface unit configuration with 4 or more high input rate burners and cast iron grates).	924.4	−16.3
2	SNOPR Testing	Baseline + Optimized Burner/Optimized Grates (Achievable with at least one high input rate burners and cast iron grates).	837.8	−9.4
3	SNOPR Testing	Baseline + Optimized Burner/Optimized Grates (Highest efficiency unit with cast iron grates).	730.2	−12.8

Conventional Ovens

For the June 2015 NOPR, DOE developed incremental efficiency levels for each conventional oven 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 2009 TSD, 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. 80 FR 33030, 33051–33052.

Table IV.21 through Table IV.24 show the incremental efficiency levels presented in the June 2015 for each conventional oven 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. *Id.*

TABLE IV.21—JUNE 2015 NOPR ELECTRIC STANDARD OVEN EFFICIENCY LEVELS

Level	Efficiency level source	Design option	Proposed IAEC (kWh)	
			Freestanding	Built-in/slide-in
Baseline	NOPR Testing	Baseline	294.5	301.5
1	NOPR Testing	Baseline + SMPS	284.6	291.4
2	2009 TSD	1 + Reduced Vent Rate	271.7	278.2
3	2009 TSD	2 + Improved Insulation	259.2	265.4
4	2009 TSD	3 + Improved Door Seals	254.9	261.0
5	NOPR Testing	4 + Forced Convection	244.6	250.5
6	NOPR Testing	5 + Oven Separator	207.8	212.8
7	2009 TSD	6 + Reduced Conduction Losses	207.3	212.2

TABLE IV.22—JUNE 2015 NOPR ELECTRIC SELF-CLEAN OVEN EFFICIENCY LEVELS

Level	Efficiency level source	Design option	Proposed IAEC (kWh)	
			Freestanding	Built-in/slide-in
Baseline	NOPR Testing	Baseline	355.0	361.1
1	NOPR Testing	Baseline + SMPS	345.1	351.0
2	NOPR Testing	1 + Forced Convection	327.2	332.7
3	NOPR Testing	2 + Oven Separator	278.9	283.7
4	2009 TSD	3 + Reduced Conduction Losses	278.1	282.9

TABLE IV.23—JUNE 2015 NOPR GAS STANDARD OVEN EFFICIENCY LEVELS

Level	Efficiency level source	Design option	Proposed IAEC (kBtu)	
			Freestanding	Built-in/slide-in
Baseline	2009 TSD	Baseline	2118.2	2128.1
1	NOPR Testing	Baseline + Optimized Burner/Cavity.	1649.3	1657.0
2	NOPR Testing	1 + SMPS	1614.7	1622.2
3	NOPR Testing	2 + Electronic Spark Ignition	1490.7	1497.7
4	2009 TSD	3 + Improved Insulation	1414.8	1421.5
5	2009 TSD	4 + Improved Door Seals	1400.6	1407.2

TABLE IV.23—JUNE 2015 NOPR GAS STANDARD OVEN EFFICIENCY LEVELS—Continued

Level	Efficiency level source	Design option	Proposed IAEC (kBtu)	
			Freestanding	Built-in/slide-in
6	NOPR Testing	5 + Forced Convection	1355.6	1362.0
7	2009 TSD	6 + Reduced Conduction Losses.	1347.0	1353.3

TABLE IV.24—JUNE 2015 NOPR GAS SELF-CLEAN OVEN EFFICIENCY LEVELS

Level	Efficiency level source	Design option	Proposed IAEC (kBtu)	
			Freestanding	Built-in/slide-in
Baseline	2009 TSD	Baseline	1883.8	1893.7
1	NOPR Testing	Baseline + SMPS	1848.2	1858.0
2	NOPR Testing	1 + Electronic Spark Ignition	1668.7	1677.5
3	NOPR Testing	2 + Forced Convection	1596.3	1604.7
4	2009 TSD	3 + Reduced Conduction Losses	1591.0	1599.4

GE commented that DOE's estimate of a 9.71 percent decrease in IAEC when converting from glo-bar to spark ignition is overestimated. GE stated that its data indicate that the actual improvement would be only 60 percent of DOE's estimate. (GE, No. 32 at p. 3) As discussed in chapter 5 of the SNOPR TSD, DOE determined the relative decrease in energy consumption due to electronic spark ignition by comparing two gas ovens of similar design but different ignition systems. DOE notes that this efficiency improvement is also on the same order of magnitude considered in the 2009 rulemaking analysis. Therefore, DOE retains its estimated decrease in IAEC for this technology option in this SNOPR. DOE also notes that, as discussed in section IV.A.3.b of this SNOPR, it has revised the description of this technology option to include intermittent/interrupted ignition systems in addition to intermittent pilot ignition systems, recognizing that other ignition systems are available that reduce the energy of consumption of a gas oven. DOE welcomes any additional data demonstrating the reduction in IAEC resulting from use of intermittent/interrupted ignition or intermittent pilot ignition systems as compared to intermittent glo-bar ignition systems.

AHAM and Electrolux commented that, once DOE establishes an accurate baseline for conventional ovens, as discussed in section IV.C.3.a of this SNOPR, DOE should adjust the proposed efficiency levels to be proportionate to the new baseline efficiency levels. (AHAM, No. 29 at p. 7; Electrolux, No. 27 at p. 4)

As discussed in section IV.C.3.a of this SNOPR, DOE has updated its estimates of the baseline efficiency levels for conventional ovens for this SNOPR. DOE has accordingly updated the incremental efficiency levels relative to the new baseline estimates for each product class. In addition, as discussed in section IV.A.3.b and IV.B.1.b of this SNOPR, DOE revised its description of the design options pertaining to gas ignition systems and screened out the optimized burner and cavity design option from the engineering analysis. Table IV.25 through Table IV.28 present the updated efficiency levels for each product class, normalized based on an oven with a cavity volume of 4.3 ft^3.

TABLE IV.25—ELECTRIC STANDARD OVEN EFFICIENCY LEVELS

Level	Efficiency level source	Design option	Proposed IAEC (kWh)	
			Freestanding	Built-in/slide-in
Baseline	NOPR Testing	Baseline	315.2	322.3
1	NOPR Testing	Baseline + SMPS	306.3	313.3
2	2009 TSD	1 + Reduced Vent Rate	292.3	299.0
3	2009 TSD	2 + Improved Insulation	278.7	285.0
4	2009 TSD	3 + Improved Door Seals	274.0	280.3
5	NOPR Testing	4 + Forced Convection	262.8	268.8
6	NOPR Testing	5 + Oven Separator	222.8	227.8
7	2009 TSD	6 + Reduced Conduction Losses	222.2	227.2

TABLE IV.26—ELECTRIC SELF-CLEAN OVEN EFFICIENCY LEVELS

Level	Efficiency level source	Design option	Proposed IAEC (kWh)	
			Freestanding	Built-in/slide-in
Baseline	NOPR Testing	Baseline	354.9	362.0
1	NOPR Testing	Baseline + SMPS	346.0	353.0
2	NOPR Testing	1 + Forced Convection	327.9	334.5
3	NOPR Testing	2 + Oven Separator	279.3	284.9

TABLE IV.26—ELECTRIC SELF-CLEAN OVEN EFFICIENCY LEVELS—Continued

Level	Efficiency level source	Design option	Proposed IAEC (kWh)	
			Freestanding	Built-in/slide-in
4	2009 TSD	3 + Reduced Conduction Losses	278.5	284.1

TABLE IV.27—GAS STANDARD OVEN EFFICIENCY LEVELS

Level	Efficiency level source	Design option	Proposed IAEC (kBtu)	
			Freestanding	Built-in/slide-in
Baseline		Baseline (Intermittent Glo-bar Ignition)	2083.1	2093.0
1	NOPR Testing	Baseline + SMPS	2052.5	2062.4
2	NOPR Testing	1 + Intermittent/interrupted Ignition or Intermittent Pilot Ignition.	1849.9	1858.8
3	2009 TSD	2 + Improved Insulation	1754.6	1763.1
4	2009 TSD	3 + Improved Door Seals	1736.8	1745.1
5	NOPR Testing	4 + Forced Convection	1665.7	1673.7
6	2009 TSD	5 + Reduced Conduction Losses	1654.9	1662.9

TABLE IV.28—GAS SELF-CLEAN OVEN EFFICIENCY LEVELS

Level	Efficiency level source	Design option	Proposed IAEC (kBtu)	
			Freestanding	Built-in/slide-in
Baseline		Baseline (Intermittent Glo-bar Ignition)	1959.6	1969.6
1	NOPR Testing	Baseline + SMPS	1929.0	1939.0
2	NOPR Testing	1 + Intermittent/interrupted Ignition or Intermittent Pilot Ignition.	1740.5	1749.4
3	NOPR Testing	2 + Forced Convection	1664.5	1673.0
4	2009 TSD	3 + Reduced Conduction Losses	1658.9	1667.4

Implicit in the design option descriptor for Efficiency Level 1 for each conventional oven product class is that an SMPS replaces any linear power supply in the control system. DOE notes that conventional ovens equipped with electromechanical control systems have neither a linear power supply nor an SMPS, but do not consume energy in standby mode. As a result, DOE is not proposing a prescriptive design standard to require SMPS and is instead proposing to exclude linear power supplies for all conventional ovens.

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 larger ovens having 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.

For the June 2015 NOPR, 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 suggested in the June 2015 NOPR that these slopes continue to be relevant based on DOE's testing. 80 FR 33030, 33053 (June 10, 2015). For electric ovens, DOE considered the data for standard and self-clean ovens available in the Natural Resources Canada product databases.[40] DOE noted that these data are based on the same test procedure considered for the previous DOE standards rulemaking, and as a result, DOE stated that 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. The values for the slopes and intercepts for each conventional oven product class developed in the June 2015 NOPR are presented in Table IV.29 and Table IV.30. 80 FR 33030, 33053.

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

TABLE IV.29—JUNE 2015 NOPR 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.30—JUNE 2015 NOPR 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		

As part of the analyses conducted for this SNOPR, DOE reviewed the slopes for electric ovens derived for the 2009 rulemaking analysis. Both electric standard and self-clean ovens but a different baseline y-intercept. As noted in the SNOPR TSD, due to the conversion from EF to IAEC, the relationship between IAEC and cavity volume developed for the June 2015 NOPR analysis, using the 2009 slope, was not linear. Thus, for this SNOPR, DOE performed a linear curve fit on the IAEC evaluated at discrete cavity volumes that were considered to represent the range of cavity volumes available on the market. This resulted in different slopes for the electric standard and self-clean oven product classes. After expanding the dataset used to establish baseline energy consumption for electric standard ovens, as described in section IV.C.3.a of this SNOPR, to include a wider range of cavity volumes, DOE modified the slope for the electric oven product classes so that it was representative of the augmented dataset.

Table IV.31 and Table IV.32 present the updated results. IAEC versus cavity volume relationship for each product class. DOE also notes that for gas ovens, the slope and y-intercepts have changed slightly from the values presented in June 2015 NOPR. This is related to a minor technical error in IAEC calculation specified in the test procedure. The conventional oven test procedure adopted in the July 2015 TP Final Rule calculates the annual secondary energy consumption for gas ovens (*i.e.,* the electrical energy component of the total annual energy consumption) using the annual useful cooking energy output constant intended for electric ovens instead of the constant specified for gas ovens. Because, this constant represents the typical field usage of the oven, the factor used to calculate the annual secondary energy consumption for gas ovens should correspond to the same usage factor used to calculate the annual primary energy consumption. Specific information on this minor technical change is available in chapter 5 of the SNOPR TSD.

TABLE IV.31—SLOPES AND INTERCEPTS OF ELECTRIC OVEN IAEC VERSUS CAVITY VOLUME RELATIONSHIP

Level	Standard electric ovens		Self-clean electric ovens	
	Slope = 46.3		Slope = 46.3	
	Freestanding intercepts	Built-in/slide-in intercepts	Freestanding intercepts	Built-in/slide-in intercepts
Baseline	116.3	123.3	156.0	163.1
1	107.3	114.4	147.1	154.1
2	93.4	100.1	129.0	135.6
3	79.7	86.1	80.4	86.0
4	75.1	81.4	79.5	85.1
5	63.9	69.9		

TABLE IV.31—SLOPES AND INTERCEPTS OF ELECTRIC OVEN IAEC VERSUS CAVITY VOLUME RELATIONSHIP—Continued

Level	Standard electric ovens		Self-clean electric ovens	
	Slope = 46.3		Slope = 46.3	
	Freestanding intercepts	Built-in/slide-in intercepts	Freestanding intercepts	Built-in/slide-in intercepts
6	23.9	28.9		
7	23.3	28.2		

TABLE IV.32—SLOPES AND INTERCEPTS OF GAS OVEN IAEC VERSUS CAVITY VOLUME RELATIONSHIP

Level	Standard gas ovens		Self-clean gas ovens	
	Slope = 229.5		Slope = 229.5	
	Freestanding intercepts	Built-in/slide-in intercepts	Freestanding intercepts	Built-in/slide-in intercepts
Baseline	1096.1	1106.1	972.7	982.6
1	1065.5	1075.5	942.1	952.0
2	863.0	871.9	753.6	762.5
3	767.7	776.1	677.6	686.1
4	749.8	758.2	672.0	680.5
5	678.7	686.7		
6	668.0	675.9		

4. Incremental Manufacturing Production Cost Estimates

a. Conventional Cooking Tops

Based on the analyses discussed above, DOE developed the cost-efficiency results for each conventional cooking top product class shown in Table IV.33. 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 SNOPR, 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.[41]

TABLE IV.33—CONVENTIONAL COOKING TOP INCREMENTAL MANUFACTURING PRODUCTION COST (2014$)

Level	Open (coil) element electric cooking tops	Smooth element electric cooking tops	Gas cooking tops
Baseline			
1	$2.71	$0.70	$11.33
2		2.42	11.33
3		108.19	11.33
4		186.08	

b. Conventional Ovens

For the June 2015 NOPR, DOE developed the cost-efficiency results for each conventional oven product class shown in Table IV.34. DOE noted that the estimated incremental MPCs would be equivalent for the freestanding and built-in/slide-in oven product classes. 80 FR 33030, 33053–33054.

TABLE IV.34—JUNE 2015 NOPR CONVENTIONAL OVEN INCREMENTAL MANUFACTURING PRODUCTION COST (2014$)

Level	Electric ovens		Gas ovens	
	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	

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

AHAM disagreed with DOE's conclusion that the optimized burner/cavity design option has a zero-cost. AHAM stated that for manufacturers that have not reduced the gauge of the metals, this change would require a retooling cost for reducing the gauge. (AHAM, No. 29 at p. 8) As discussed in section IV.B.1.b of this SNOPR, DOE screened out the optimized burner and cavity design option from the engineering analysis. As a result, DOE removed this efficiency level from the analysis for this SNOPR. The cost-efficiency results for each conventional oven product class are shown in Table IV.35.

TABLE IV.35—CONVENTIONAL OVEN INCREMENTAL MANUFACTURING PRODUCTION COST (2014$)

Level	Electric ovens		Gas ovens	
	Standard	Self-clean	Standard	Self-clean
Baseline				
1	0.82	0.82	0.82	0.82
2	2.76	25.00	7.31	7.31
3	7.89	56.74	12.44	27.96
4	10.22	61.93	14.77	33.15
5	34.40		35.43	
6	66.14		39.74	
7	70.36			

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 U.S.C. 6295(o)(2)(B)(i)(IV))

a. Conventional Cooking Tops

In response to the February 2014 RFI, AHAM and Whirlpool commented that new energy conservation standards could likely impact the utility of conventional cooking tops 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 require changes to grate materials. Heavy duty grates, such as cast iron grates, hold larger cooking vessels and provide for better pot stability. Thus, a change to less sturdy grates would impact consumer utility;

• 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, No. 9 at p. 7; Whirlpool, 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, No. 9 at p. 7; Whirlpool, No. 13 at p. 8)

DOE conducted the engineering analysis by considering cooking top design options that are consistent with products currently on the market, and as a result, DOE did not consider changes that would result in removal of accent lighting and display features. For gas cooking tops, DOE considered efficiency levels associated with optimizing the burner and grates, but selected efficiency levels based on products tested with cast iron grates to maintain ability to provide stability for pots containing larger loads. As discussed in section V.B.8 of this SNOPR, the energy conservation standards for gas cooking tops proposed in this SNOPR correspond to the efficiency level that maintains features of gas cooking tops marketed as commercial-style, namely multiple high input rate burners (*i.e.,* greater than 14,000 Btu/h) that would allow for quicker cooking times. As a result, DOE does not believe that the design options and efficiency levels associated with the proposed standards in this SNOPR would impact the consumer utility of conventional cooking tops, as suggested by AHAM and Whirlpool, nor preclude the availability of cooking tops marketed as commercial-style.

b. Conventional Ovens

In the June 2015 NOPR, DOE noted that it conducted the engineering analysis by considering design options that are consistent with products currently on the market and that it did not believe that any of the design options and efficiency levels considered would impact the consumer utility of conventional ovens. 80 FR 33030, 33054.

DOE also noted that gas ovens with higher burner input rates did not have significantly faster cooking times when tested according to the test procedure adopted in the July 2015 TP Final Rule. This is likely due in large part to the fact that gas ovens with higher burner input rates marketed as commercial-style often have significantly larger thermal masses, which absorb a significant amount of additional heat. 80 FR 33030, 33054.

Sub-Zero commented in response to the June 2015 NOPR for conventional ovens in which DOE did not consider a separate product class for commercial-style products, that manufacturers of commercial-style ovens differentiate their product offerings based on features such as heavier gauge materials and higher input rate burners. According to Sub-Zero, these manufacturers may be forced to exit the market if a standard were to require that they produce gas ovens that can no longer meet customer expectations. (Sub-Zero, No. 25 at p. 7)

As discussed in section IV.A.2.b of this SNOPR, DOE was not able to identify a clearly-defined utility provided to consumers by commercial-style ovens and, as a result, DOE did not establish separate product classes for these products. However, DOE recognizes that commercial-style ovens are a product type that typically incorporate certain features that may be expected by purchasers of such products (*e.g.,* heavier-gauge cavity construction, high input rate burners, and extension racks). DOE also recognizes that these features result in inherently lower efficiencies for commercial-style ovens than for residential-style ovens with comparable cavities sizes, due to the greater thermal mass of the cavity and racks, when measured using the test procedure adopted in the July 2015 TP Final Rule. As discussed in section III.B and III.C of this SNOPR, DOE is proposing to repeal the oven test procedure in the August 2016 TP SNOPR due to uncertainties in its ability to measure representative energy use of commercial-style ovens, and thus is not proposing a performance-based standard for conventional ovens. Instead, DOE is proposing to adopt a prescriptive design requirement for the conventional oven control system.

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.[42]

AHAM criticized DOE's reliance on the concept of incremental markups, stating that its theory has been disproved and it is in contradiction to empirical evidence. (AHAM, No. 29 at p. 9) In an attachment to AHAM's comment, Shorey Consulting, Inc. (Shorey Consulting) stated that (1) DOE requires a strong form of economic theory, since it is saying that something will happen solely because theory says it should; and (2) an a priori resort to economic theory without clear empirical support is highly problematic. Shorey Consulting interviewed a sample of local/regional and national appliance retailers and reported that, with very few exceptions, they reacted to the DOE concept that percentage margins will be lower in a post-standards situation with incredulity. It concluded that DOE needs to abandon the incremental margin approach and revert to the average margin approach that corresponds to actual industry practice. (AHAM, No. 29 at pp. A–10–A–11)

DOE disagrees that the theory behind the concept of incremental markups has been disproved. The concept is based on a simple notion: An increase in profitability, which is implied by keeping a fixed markup when the product price goes up, is not likely to be viable over time in a business that is reasonably competitive. DOE agrees that empirical data on markup practices would be desirable, but such information is closely held and difficult to obtain.

Regarding the interviews with appliance retailers, it is difficult for DOE to evaluate the characterization of the responses without knowing what questions were posed to the retailers. DOE's analysis necessarily considers a very simplified version of the world of appliance retailing: Namely, a situation in which nothing changes except for those changes in appliance offerings that occur in response to amended standards. DOE implicitly asks: Assuming the product cost increases while the other costs remain constant (no change in labor, material and operating costs), are retailers still able to keep the same markup over time as before? DOE recognizes that retailers are likely to seek to maintain the same markup on appliances if the price they pay goes up as a result of appliance standards, but it believes that over time adjustment is likely to occur due to competitive pressures. Other retailers may find that they can gain sales by reducing the markup and maintaining the same per-unit operating profit. The incremental markup approach reflects a similar perspective as the ''preservation of per-unit operating profit markup scenario'' used in the MIA (see section IV.J of this document).

In summary, DOE acknowledges that its approach to estimating retailer markup practices after amended standards take effect is an approximation of real-world practices that are both complex and varying with business conditions. However, DOE maintains that its assumption that standards do not facilitate a sustainable increase in profitability is reasonable. DOE welcomes information that could support improvement in its methodology.

Chapter 6 of the SNOPR TSD provides details on DOE's development of markups for conventional cooking products.

E. Energy Use Analysis

The energy use analysis provides estimates of the annual energy consumption of cooking tops and 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. DOE's energy use analysis estimated the range of energy use of cooking products in the field, *i.e.,* as they are actually used by consumers.

For this SNOPR, DOE used the 2009 California Residential Appliance Saturation Survey (RASS)[43] and a Florida Solar Energy Center (FSEC) study[44] to establish representative annual energy use values for conventional cooking tops and ovens. These studies confirmed that annual cooking energy use has been consistently declining since the late 1970s.

Energy use by residential cooking products varies greatly based on consumer usage patterns. DOE established a range of energy use from data in the Energy Information Administration (EIA)'s 2009 *Residential Energy Consumption Survey* (RECS 2009).[45] RECS 2009 does not provide the annual energy consumption of cooking products, but it does provide the frequency of cooking product use.[46] 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

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

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

[44] 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).

[45] 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/*). RECS 2009 is based on a sample of 12,083 households statistically selected to represent 113.6 million housing units in the United States. (Available at: *www.eia.gov/consumption/residential/*).

[46] 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.

of a cooking event to allow for an annual energy use calculation. DOE therefore relied on California RASS and FSEC studies to establish the average annual energy consumption of conventional cooking tops and ovens.

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. DOE utilized the frequency of use to define the variability of the annual energy consumption. First, DOE assumed that the weighted-average cooking frequency from RECS represents the average energy use values based on the California RASS and FSEC studies. DOE then varied the annual energy consumption across the RECS households based on their reported cooking frequency relative to the weighted-average cooking frequency.

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

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 cooking tops and 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.[47]

TABLE IV.36—SUMMARY OF INPUTS AND METHODS FOR THE LCC AND PBP ANALYSIS *

Inputs	Source/method
Product Cost	Derived by multiplying MPCs by manufacturer and retailer markups and sales tax, as appropriate. Used historical data to derive a price scaling index to forecast product costs.
Installation Costs	Baseline installation cost determined with data from RS Means. Assumed no change with efficiency level, except for induction heating design option of electric smooth cooking top.
Annual Energy Use	The total annual energy use was based on CA RASS and FSEC Studies. Variability: Based on the 2009 RECS.
Energy Prices	Electricity: Based on EIA's Form 861 data for 2012. Variability: Regional energy prices determined for 27 regions.
Energy Price Trends	Based on *AEO2015* price forecasts.
Repair and Maintenance Costs	Assumed no change with efficiency level for all cooking tops and electric ovens. Used industry input to estimate change in repair and maintenance costs to switch from glo-bar ignition to electronic spark ignition.
Product Lifetime	16 years for electric and 13 years for gas cooking products.
Discount Rates	Approach involves identifying all possible debt or asset classes that might be used to purchase the considered appliances, or might be affected indirectly. Primary data source was the Federal Reserve Board's Survey of Consumer Finances.
Compliance Date	2019.

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

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 SNOPR contains detailed discussion of the methodology and data utilized for the LCC and PBP analysis.

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 PPI for the period 1982–2013. This index, adjusted for inflation, shows a declining trend. The decline for gas cooking products is somewhat more

[47] 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.

significant than that for electric cooking products (see appendix 10–D of the SNOPR 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 SNOPR, DOE used data from the 2013 RS Means Mechanical Cost Data on labor requirements to estimate installation costs for conventional cooking products.[48]

In general, DOE estimated that installation costs would be the same for different efficiency levels. In the case of electric smooth cooking tops, the induction heating design option requires a change of utensils to those that are ferromagnetic to operate the cooking tops. DOE treated this as additional installation cost for this particular design option. DOE used average number of pots and pans utilized by a representative household to estimate this portion of the installation cost. See chapter 8 of the SNOPR TSD for details about this component. Given the installation costs of the induction cooktop, the market share is expected to remain at 2.6% in the standards case. See section IV.F.9 and IV.H.1 for details on the market shares.

3. Unit Energy Consumption

Section IV.E of this SNOPR describes the derivation of annual energy use for conventional cooking products.

DOE did not find any evidence of a rebound effect, in which consumers use a more efficient appliance more intensively, for conventional cooking products. 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 of this SNOPR).

4. Energy Prices

DOE derived marginal residential electricity and natural gas prices for 27 geographic areas.[49] Marginal prices are appropriate for determining energy cost savings associated with possible changes to efficiency standards.

For electricity, DOE derived marginal and average prices which vary by season, region, and baseline electricity consumption level. DOE estimated these prices using data published with EEI, Typical Bill and Average Rates reports for summer and winter 2014.[50] For the residential sector each report provides, for most of the major investor-owned utilities (IOUs) in the country, the total bill assuming household consumption levels of 500, 750, and 1,000 kWh for the billing period. DOE defined the average price as the ratio of the total bill to the total electricity consumption. DOE also used the EEI data to define a marginal price as the ratio of the change in the bill to the change in energy consumption.

For the residential sector, DOE defined the average price as the ratio of the total bill to the total electricity consumption. DOE also used the EEI data to define a marginal price as the ratio of the change in the bill to the change in energy consumption. DOE first calculated weighted-average values for each geographic area for each type of price. Each EEI utility in an area was assigned a weight based on the number of consumers it serves. Consumer counts were taken from the most recent EIA Form 861 data (2012).[51]

DOE assigned seasonal average prices to each household in the LCC sample based on its location and its baseline monthly electricity consumption for an average summer or winter month. For sampled households who were assigned a product efficiency greater than or equal to the considered level for a standard in the no-new-standards case, DOE assigned marginal price to each household based on its location and the decremented electricity consumption. In the LCC sample, households could be assigned to one of 27 geographic areas.

DOE obtained data for calculating prices of natural gas from the EIA publication, Natural Gas Navigator.[52] DOE used the complete annual data for 2013 to calculate an average annual price for each geographic area. (For use in the LCC model, prices were scaled to 2015$.) For each State, DOE calculated the annual residential price of natural gas using a simple average of data. DOE then calculated a price for each geographic area, weighting each State in an area by its number of households.

The method used to calculate marginal natural gas prices differs from that used to calculate electricity prices, because EIA does not provide consumer- or utility-level data on gas consumption and prices. EIA provides historical monthly natural gas consumption and expenditures by State. This data was used to determine 10-year average marginal price factors for the geographical areas. These factors are then used to convert average monthly energy prices into marginal monthly energy prices. Because cooking products operate all year around, DOE determined summer and winter marginal price factors.

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

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

See Chapter 8 of the SNOPR TSD for more information on the derivation of energy prices.

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. For the July 2015 NOPR for conventional ovens, DOE estimated an average repair cost of $170 occurring every fifth year during the product's lifetime. 80 FR 33030, 33056.

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

[49] DOE characterized the geographic distribution into 27 geographic areas to be consistent with the 27 states and group of states reported in RECS 2009.

[50] Edison Electric Institute. Typical Bills and Average Rates Report. Winter 2014 published April 2014, Summer 2014 published October 2014. Available at: *http://www.eei.org/resourcesandmedia/products/Pages/Products.aspx*.

[51] U. S. Department of Energy, Energy Information Administration. Form EIA–861 Annual Electric Power Industry Database. *http://www.eia.doe.gov/cneaf/electricity/page/eia861.html.*

[52] U.S. Department of Energy—Energy Information Administration. Natural Gas Navigator. 2013. (Last accessed April 26, 2015.) *http://tonto.eia.doe.gov/dnav/ng/ng_pri_sum_dcu_nus_m.htm.*

For electronic spark ignition systems, DOE estimated an average repair cost of $206 occurring in the tenth year of the product's life. DOE received comments regarding the frequency of repair for the electric globar/hot surface ignition systems. AHAM commented that a globar is replaced less often than three times during the lifetime of an oven. (AHAM, No. 29 at p. 8) Electrolux noted that during their life-cycle testing of an oven using globars, they estimated a replacement rate of approximately 0.70 glo-bars. (Electrolux, No. 27 at p.5) GE commented that the globar replacement occurs significantly less frequently than the three times DOE estimated. (GE, No.32 at p.3) Utilizing these inputs along with the earlier data from manufacturer inputs, DOE revised the average repair cost attributable to globar and electronic spark ignition systems and annualized it over the life of the unit at $21.04 and $20.60 for globar and electronic spark ignition systems, respectively. Based on input from manufacturers, DOE did not include maintenance costs for glo-bars or electronic ignitions.

DOE seeks comments on its repair cost estimation for gas ovens, as well as on its decision not to include changes in repair and maintenance costs for products more efficient than baseline products for electric cooking products (see section VII.B of this SNOPR).

See chapter 8 of the TSD accompanying this SNOPR 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. In the July 2015 NOPR, DOE utilized data from Appliance Magazine Market Insight, and established average product lifetimes of 15 years for conventional electric cooking products and 17 years for conventional gas cooking products.[53] 80 FR 33030, 33056. AHAM commented that their data indicated average product lifetimes of 16 years for conventional electric ovens and 13 years for conventional gas ovens. (AHAM, No. 29 at p. 9) For the SNOPR, DOE revised the average lifetime estimates to reflect the new data, extending the revision as applicable also to electric and gas cooking tops, thereby establishing an average product lifetimes of 16 years for all electric cooking products and 13 years for all conventional gas cooking products. DOE characterized the product lifetimes with Weibull probability distributions. DOE requests comment on using the data it received from AHAM on the average lifetime for gas and electric ovens and extending it to cooktops (See Section VII E. Issues on Which DOE Seeks Comment).

See chapter 8 of the TSD accompanying this SNOPR 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 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, 2010, and 2013.[54] 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 4.4 percent. See chapter 8 in the SNOPR 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 a new product in the year that compliance with amended standards is required. Any final rule establishing amended standards would apply to conventional cooking products manufactured 3 years after the date on which the final rule is published (42 U.S.C. 6295(m)(4)(A)(i)). 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. No-New-Standards Case Efficiency Distribution

To estimate the share of consumers that would be affected by a potential energy conservation standard at a particular efficiency level, DOE's LCC analysis considered the projected distribution (market shares) of product efficiencies in the no-new-standards case (*i.e.,* the case without amended or new energy conservation standards). This approach reflects the fact that some consumers may purchase products with efficiencies greater than the baseline levels.

To establish the current efficiency distribution for electric cooking products and conventional gas ovens, DOE developed and implemented a consumer-choice model[55] that assumes most consumers (*i.e.,* home owners[56]) are sensitive to the appliance first cost, and calculates the market share for available efficiency options based on the initial cost of electric cooking products and gas ovens at each efficiency level. DOE used a logit model to characterize historical shipments as a function of purchase price. In order to develop the logit model, DOE utilized shipments data collected by Market Research Magazine[57] and the PPI of household cooking appliance manufacturing[58] in the years 2002–2012, along with the consumer purchase price derived from the engineering analysis, to analyze factors that influence consumer purchasing decisions. Using this model, DOE found that historical shipments

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

[54] 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.

[55] DOE developed this consumer choice model for this rulemaking, the details of which are outlined in Chapter 8 of the SNOPR TSD. This consumer choice framework has been used in many rulemakings and is also a key component in EIA's NEMS residential model to simulate appliance purchases over a range of efficiencies.

[56] DOE assumed that landlords would have no economic incentive to purchase higher-efficiency products and renters would have no decision making power to purchase or replace an electric cooking products or gas oven.

[57] UBM Canon, Market Research Magazine: Appliance Historical Statistical Review, 2014.

[58] U.S. Bureau of Labor Statistics, Producer Price Index Industry Data: Household cooking appliance manufacturing, 2014.

show a strong dependence on the first costs for electric cooking products and conventional gas ovens, and developed the best-fit logit parameters to capture this relationship. DOE then used the parameters to derive the market share for available efficiency options for home owners. Given that landlords generally have little incentive to install higher-efficiency products, DOE assigned the purchases of renters in the RECS sample to the baseline efficiency level.

To establish the current efficiency distribution for gas cooking tops, DOE relied on publicly available data on gas cooking top models in the market[59] and their configuration with regard to grates and burner input rates to characterize the efficiency distribution.

Given the lack of data on historic efficiency trends, DOE assumed that the estimated current distributions would apply in 2019.

Table IV.37, Table IV.38, and Table IV.39 present the market shares of the efficiency levels in the no-new-standards case for conventional cooking products.[60] See chapter 8 of the SNOPR TSD for further details on the development of these market shares.

Table IV.37. Conventional Cooking Tops: No-New-Standards Case Efficiency Distribution

Electric Coil Cooking Tops			Electric Smooth Cooking Tops			Gas Cooking Tops		
Standard Level	IAEC (kWh)	Market Share	Standard Level	IAEC (kWh)	Market Share	Standard Level	IAEC (kBtu)	Market Share
Baseline	118.1	66.6%	Baseline	144.7	52.2%	Baseline	1104.6	26.1%
1	113.2	33.4%	1	137.0	19.7%	1	924.4	24.0%
			2	121.2	19.4%	2	837.9	36.7%
			3	119.5	6.1%	3	730.4	13.2%
			4	102.3	2.6%			

Table IV.38. Conventional Electric Ovens: No-New-Standards Case Efficiency Distribution

Standard Ovens				Self-Clean Ovens			
Standard Level	IAEC (kWh)		Market Share	Standard Level	IAEC (kWh)		Market Share
	Free-Standing	Built-in/ Slide-in			Free-Standing	Built-in/ Slide-in	
Baseline	315.2	322.3	40.4%	Baseline	354.9	362.0	46.5%
1	306.3	313.3	9.7%	1	346.0	353.0	15.8%
2	292.3	299.0	9.6%	2	327.9	334.5	14.0%
3	278.7	285.0	9.3%	3	279.3	284.9	12.0%
4	274.0	280.3	9.2%	4	278.5	284.1	11.7%
5	262.8	268.8	8.1%				
6	222.8	227.8	6.9%				
7	222.2	227.2	6.8%				

[59] Model data collected from the Web sites of A J Madison, Best Buy, and Lowe's.

[60] For the conventional oven product classes, the efficiency levels are based on an oven with a cavity volume of 4.3 ft^3. As discussed in section IV.C.3 of this notice, DOE developed slopes and intercepts to characterize the relationship between IEAC and cavity volume for each efficiency level.

Table IV.39. Conventional Gas Ovens: No-New-Standards Case Efficiency Distribution

Standard Ovens				Self-Clean Ovens			
Standard Level	IAEC (kBtu)		Market Share	Standard Level	IAEC (kBtu)		Market Share
	Free-Standing	Built-in/ Slide-in			Free-Standing	Built-in/ Slide-in	
Baseline	2,083.1	2,093.0	43.7%	Baseline	1,959.6	1,969.6	47.5%
1	2,052.5	2,062.4	9.8%	1	1,929.0	1,939.0	13.6%
2	1,849.9	1,858.8	9.7%	2	1,740.5	1,749.4	13.4%
3	1,754.6	1,763.1	9.5%	3	1,664.5	1,673.0	12.8%
4	1,736.8	1,745.1	9.5%	4	1,658.9	1,667.4	12.6%
5	1,665.7	1,673.7	8.9%				
6	1,654.9	1,662.9	8.8%				

DOE seeks comments on its use of consumer choice model for establishing no-new standards efficiency distribution for some of the product classes (see section VII.B of this SNOPR).

See chapter 8 of the TSD accompanying this SNOPR for further information regarding no-new standards efficiency distribution.

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. While DOE examined the rebuttable-presumption criterion, it considered whether the standard levels considered for this rule are economically justified through a more detailed analysis of the economic impacts of those levels pursuant to 42 U.S.C. 6295(o)(2)(B)(i) (See section V.B.1.c.).

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. For conventional cooking products, DOE accounted for three market segments: (1) New construction, (2) existing homes (*i.e.,* replacing failed products), and (3) retired but not replaced products.

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. The market saturation data for new housing came from RECS 2009.

DOE estimated replacements using product retirement functions developed from product lifetimes. 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 over the period 2013–2048. The not-replaced rate is distributed across electric and gas cooking products.

DOE allocated shipments to each product class based on the current market share of the class. DOE developed the market shares based on data collected from Appliance Magazine Market Research report[61] and U.S. Appliance Industry Statistical Review.[62] The shares are kept constant over time.

DOE did not estimate any fuel switching for electric and gas cooking products, as no significant switching was observed from historical data.

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

[62] Appliance 2011. U.S. Appliance Industry Statistical Review: 2000 to YTD 2011.

Table IV.40 summarizes the approach and data DOE used to derive the inputs to the shipments analysis for the SNOPR.

TABLE IV.40—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 *AEO2015* projections. New housing product saturations based on RECS 2009. 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*, *Appliance Magazine* and Association of Home Appliance Manufacturers.
Impacts Due to Efficiency Standards.	Considered an impact on the replacement market through possible repair of older cooking units to extend their lifetime, in response to an increase in price.

DOE considered the impact of prospective standards on product shipments. DOE concluded that it is unlikely that the price increase due to the proposed standards would impact the decision to install a cooking product in the new construction market. In the replacement market, DOE assumed that, in response to an increased product price, some consumers will choose to repair their old cooking product and extend its lifetime instead of replacing it immediately. DOE estimated the magnitude of such impact through a purchase price elasticity of demand. The estimated price elasticity of −0.367 is based on data on cooking products as described in appendix 9A of the SNOPR TSD. This elasticity relates the repair or replace decision to the incremental installed cost of higher efficiency cooking products. DOE estimated that the average extension of life of the repaired unit would be 5 years, and then that unit will be replaced with a new cooking unit.

DOE seeks comments on its approach and use of data for shipments analysis (see section VII.B of this SNOPR).

For further details on the shipments analysis, please refer to chapter 9 of the SNOPR 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.[63] 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 potential standards for conventional cooking products by comparing a case without such standards with standards-case projections. The no-new-standards case characterizes energy use and customer costs for each product class in the absence of proposed energy conservation standards. DOE compares the no-new-standards case with projections characterizing the market for each product class if DOE adopted new or amended standards at specific energy efficiency levels (*i.e.,* the TSLs or standards cases) for that class.

Table IV.41 summarizes the key inputs for the NIA. The sections following provide further details, as does chapter 10 of the SNOPR TSD.

TABLE IV.41—INPUTS FOR THE NATIONAL IMPACT ANALYSIS

Input	Description
Shipments	Annual shipments from shipments model.
Compliance date	January 1, 2019.
No-new-standards-case efficiency	Based on consumer choice model for electric cooking products and gas ovens and model web-based data for gas cooking tops.
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	2016.

[63] 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.

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 no-new-standards case, DOE utilized the consumer choice model (as described in section IV.F.9 of this SNOPR) in combination with the equipment price projection (as described in section IV.F.1 of this SNOPR) to determine the efficiencies in each future year.

To estimate the impact that standards would have in the year compliance becomes required, DOE assumed that equipment efficiencies in the no-new-standards case that do not meet the standard level under consideration would ''roll up'' to meet the new standard level, and market shares at efficiencies above the standard level under consideration will shift based on the consumer choice model. In the case of gas cooking tops, which do not follow a consumer choice model, the market shares at efficiencies above the standard level under consideration would remain unchanged.

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 cooking products 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 no-new-standards 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 no-new-standards 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 no-new-standards case. Note that total shipments are nearly the same in the standards cases as in the no-new-standards case.

DOE converted the site electricity consumption and savings to primary energy (power sector energy consumption) using annual conversion factors derived from the *AEO 2015* version of the National Energy Modeling System (NEMS).

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 also 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 SNOPR, and the FFC multipliers that were applied, are described in appendix 10A of the SNOPR TSD. Table IV.42 through Table IV.46 present the FFC equivalent of IAEC for the considered efficiency levels.

Table IV.42 Conventional Cooking Tops: FFC Equivalent of IAEC*

Electric Coil Cooking Top			Electric Smooth Cooking Top			Gas Cooking Top		
Standard Level	IAEC - Site (kWh)	IAEC – FFC (kWh)	Standard Level	IAEC - Site (kWh)	IAEC - FFC (kWh)	Standard Level	IAEC - Site (kBtu)	IAEC - FFC (kBtu)
Baseline	118.1	389	Baseline	144.7	477	Baseline	1,104.6	1,236
1	113.2	373	1	137.0	451	1	924.0	1,034
			2	121.2	399	2	838.0	938
			3	119.5	394	3	730.0	817
			4	102.3	337			

* The FFC equivalent is presented in kWh for electricity to facilitate comparison. The actual upstream energy use is mostly fossil fuels.

TABLE IV.43—CONVENTIONAL ELECTRIC STANDARD OVENS: FFC EQUIVALENT OF IAEC

Standard level	IAEC—Site (kWh)		IAEC—FFC (kWh)	
	Free-standing	Built-in/ slide-in	Free-standing	Built-in/ slide-in
Baseline	315.2	322.3	1,039	1,062
1	306.3	313.3	1,009	1,032
2	292.3	299.0	963	985
3	278.7	285.0	918	939

TABLE IV.43—CONVENTIONAL ELECTRIC STANDARD OVENS: FFC EQUIVALENT OF IAEC—Continued

Standard level	IAEC—Site (kWh)		IAEC—FFC (kWh)	
	Free-standing	Built-in/ slide-in	Free-standing	Built-in/ slide-in
4	274.0	280.3	903	924
5	262.8	268.8	866	886
6	222.8	227.8	734	751
7	222.2	227.2	732	749

TABLE IV.44—CONVENTIONAL ELECTRIC SELF-CLEAN OVENS: FFC EQUIVALENT OF IAEC

Standard level	IAEC—Site (kWh)		IAEC—FFC (kWh)	
	Free-standing	Built-in/ slide-in	Free-standing	Built-in/ slide-in
Baseline	354.9	362.0	1,170	1,193
1	346.0	353.0	1,140	1,163
2	327.9	334.5	1,080	1,102
3	279.3	284.9	920	939
4	278.5	284.1	918	936

TABLE IV.45—CONVENTIONAL GAS STANDARD OVENS: FFC EQUIVALENT OF IAEC

Standard level	IAEC—Site (kBtu)		IAEC—FFC (kBtu)	
	Free-standing	Built-in/ slide-in	Free-standing	Built-in/ slide-in
Baseline	2,083.1	2,093.0	2,332	2,343
1	2,052.5	2,062.4	2,297	2,308
2	1,849.9	1,858.8	2,071	2,081
3	1,754.6	1,763.1	1,964	1,973
4	1,736.8	1,745.1	1,944	1,953
5	1,665.7	1,673.7	1,864	1,873
6	1,654.9	1,662.9	1,852	1,861

TABLE IV.46—CONVENTIONAL GAS SELF-CLEAN OVENS: FFC EQUIVALENT OF IAEC

Standard level	IAEC—Site (kBtu)		IAEC—FFC (kBtu)	
	Free-standing	Built-in/ slide-in	Free-standing	Built-in/ slide-in
Baseline	1,959.6	1,969.6	2,193	2,204
1	1,929.0	1,939.0	2,159	2,170
2	1,740.5	1,749.4	1,948	1,958
3	1,664.5	1,673.0	1,863	1,873
4	1,658.9	1,667.4	1,857	1,866

The National Propane Gas Association (NPGA) commented that DOE uses FFC to project the energy savings and energy consumption of ovens under the proposed standards, but DOE also employs a separate methodology exclusively to forecast savings for electricity, which seems to double estimates of electricity savings. NPGA stated that DOE's primary energy savings calculations are in addition to FFC energy savings. Therefore, electricity receives two energy savings estimates: That of primary energy savings calculations and FFC energy savings calculations. (NPGA, No. 35 at p. 3)

The estimated primary energy savings from energy conservation standards are not in addition to the FFC savings. DOE continues to report primary energy savings because this is a metric that has been familiar to stakeholders. However, DOE regards FFC energy savings as providing a more complete picture of the impacts of potential standards.

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 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 no-new-standards 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 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 typical repairs in cooking products.

As noted in section IV.F.1 of this SNOPR, DOE assumed a declining trend in the conventional cooking product 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 than the reference trend, 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 SNOPR TSD.

b. Total Annual Operating Cost Savings

The per-unit energy savings were derived as described in section IV.H.2 of this SNOPR. To calculate future electricity and natural gas prices, DOE applied the projected trend in national-average residential electricity and natural gas prices 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.

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 SNOPR 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.[64] The discount rates for the determination of NPV are in contrast to the discount rates used in the LCC analysis, which are designed to reflect a consumer's perspective. The 7-percent real value is an estimate of the average before-tax rate of return to private capital in the U.S. economy. The 3-percent real value represents the ''social rate of time preference,'' which is the rate at which society discounts future consumption flows to their present value.

I. Consumer Subgroup Analysis

In analyzing the potential impact of new or amended standards on individual consumers, DOE evaluates the impact on identifiable subgroups of consumers that may be disproportionately affected by a national standard level. The purpose of a subgroup analysis is to determine the extent of any such disproportional impacts. DOE evaluates impacts on particular subgroups of consumers by analyzing the LCC impacts and PBP for those particular consumers from alternative standard levels. For this SNOPR, 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. DOE used the LCC and PBP spreadsheet model to estimate the impacts of the considered efficiency levels on these subgroups.

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

J. Manufacturer Impact Analysis

1. Overview

DOE conducted an MIA for residential conventional cooking products 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 cooking products covered in this rulemaking. The key GRIM inputs are data on the industry cost structure, manufacturer production 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 no-new-standards case and various TSLs in the standards cases. The difference in INPV between the no-new-standards and standards cases represent the financial impact of new and amended energy conservation standards on residential conventional cooking product 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, as well as 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, all of whom accounted for more than 85 percent of domestic residential conventional cooking product 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 cooking product 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 SNOPR contains a discussion on the estimated changes in the number of domestic employees involved in manufacturing residential conventional cooking products covered by the proposed standards. Section IV.J.4 of this SNOPR 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 two manufacturer subgroups for a separate impact analysis—small business manufacturers and commercial-style manufacturers.

[64] 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/*).

Small business manufacturers are defined by the Small Business Administration (SBA) for this particular industry as having less than 1,500 total employees. This threshold includes all employees in a business' parent company and any other subsidiaries. Based on this classification, DOE identified nine residential conventional cooking product manufacturers that qualify as small businesses. Commercial-style manufacturers are defined as manufacturers primarily selling residential gas cooking products that are marketed as commercial-style. DOE identified five commercial-style manufacturers primarily selling commercial-style cooking products covered by this rulemaking. The impacts on the small business manufacturer subgroup are discussed in greater detail in section VI.B of this SNOPR and the impacts on the commercial-style manufacturer subgroup are discussed in greater detail in section V.B.2.d of this SNOPR.

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 cases compared to a case where new and amended standards have not been set (no-new-standards case). The GRIM analysis uses a standard annual cash flow analysis that incorporates manufacturer costs, manufacturer markups, industry shipments, and industry financial information as inputs. It then models changes in manufacturer production costs, manufacturer 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 reference year of the analysis, 2016, 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 cooking product 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 cooking product manufacturers. Many inputs into the GRIM came from the engineering analysis, the shipment analysis, 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 cooking products 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 cooking product 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 cooking product at specific efficiency levels. DOE then summed these values provided by manufacturers to arrive at total top-down industry conversion cost for residential conventional cooking products.

See chapter 12 of the SNOPR 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 cooking products 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 cooking product manufacturers. DOE developed MPCs for each representative unit at each efficiency level analyzed. DOE purchased a number of units from 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 cooking product, 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 cooking products; 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 SNOPR.

c. Shipment Scenarios

INPV, the key GRIM output, depends on industry revenue, which depends on the quantity and prices of residential conventional cooking products shipped in each year of the analysis period. Industry revenue calculations require forecasts of: (1) The total annual shipment volume of residential conventional cooking products; (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).

For the no-new-standards case scenario of the shipment analysis, DOE develops shipment projections based on historical data and an analysis of key market drivers. In the standards cases, DOE modeled a roll-up scenario. The roll-up scenario represents the case in which all shipments in the no-new-standards case that do not meet the new and amended standards are redesigned to now meet the new and amended standards levels, but do not exceed the new and amended standards levels. 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 no-new-standards case and standards cases see the shipments analysis discussion in section IV.G of this SNOPR.

d. Markup Scenarios

As discussed in the manufacturer production costs section previously, the MPCs for each of the product classes of residential conventional cooking products 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 cooking product manufacturers from their customers, typically retail outlets, regardless of the downstream distribution channel through which the residential conventional cooking products are ultimately sold. The MSP is not the cost the end-user pays for residential conventional cooking products 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 cooking product 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 cooking product manufacturers equals the MSPs at each efficiency level for each product class multiplied by the number of shipments at each efficiency level for each product class.

Modifying these manufacturer markups in the standards cases yields a different set of impacts on residential conventional cooking product manufacturers than in the no-new-standards case. For the MIA, DOE modeled two standards case markup scenarios for residential conventional cooking products to represent the uncertainty regarding the potential impacts on prices and profitability for residential conventional cooking product manufacturers following the implementation of new and amended 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 cooking product manufacturers.

The preservation of gross margin markup scenario assumes that the COGS for each residential conventional cooking product 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 cases as in the no-new-standards case throughout the entire analysis period. This markup scenario represents the upper bound of the residential conventional cooking product industry profitability in the standards cases because residential conventional cooking product 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 cooking products, DOE examined the SEC 10–Ks of all publicly traded residential conventional cooking product manufacturers to estimate the industry average gross margin percentage. DOE estimated that the manufacturer markup is 1.20 for all residential conventional cooking products. Manufacturers were then asked about this industry gross margin percentage derived from SEC 10–Ks during interviews. Residential conventional cooking product 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 as a manufacturer markup for all residential conventional cooking products.

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 cases, given the highly competitive residential conventional cooking product market. The preservation of operating profit markup scenario assumes that manufacturers are able to maintain only the no-new-standards case total operating profit in absolute dollars in the standards cases, despite higher production costs and investment. The no-new-standards case total operating profit is derived from marking up the COGS by the preservation of gross margin markup previously described. In the standards cases for the preservation of operating profit markup scenario, DOE adjusted the residential conventional cooking product manufacturer markups in the GRIM at each TSL to yield approximately the same earnings before interest and taxes in the standards cases in the year after the compliance date of the new and amended standards as in the no-new-standards case. Under this scenario manufacturers are not able to earn additional operating profit on higher per unit production costs and increased capital and product investments required to comply with new and amended energy conservation standards. However, they are able to maintain the same operating profit in absolute dollars in the standards cases that was earned in the no-new-standards case.

The preservation of operating profit markup scenario represents the lower bound of industry profitability in the standards cases. 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 for residential conventional cooking products 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 this February 2014 RFI. However, during the July 2015 NOPR public meeting for residential conventional ovens, interested parties commented on the assumptions and results of the residential conventional ovens NOPR. These issues included, test procedure, safety requirements, and the cumulative regulatory burden placed on manufacturers.

a. Test Procedure

AHAM commented that DOE's recent practice of amending the test procedure parallel to proposing amended standards increases the burden on manufacturers of residential conventional cooking products in responding to DOE's proposed rules. When the rulemakings are parallel to each other, it is difficult to comment on the proposed energy conservation standard because the test procedure is not yet finalized. (AHAM, No. 38 at p. 10) DOE has considered these comments as part of this rulemaking and notes that this SNOPR provides additional opportunity for interested parties to provide comment based on the proposed cooking product test procedure discussed in section III.C.

b. Safety Requirements

Manufacturers expressed concern that the new safety requirements, UL 858 and Canadian Standards Association (CSA) C22.2.61 ''Household Cooking Ranges,'' for conventional cooking products would consume a significant amount of human and capital resources until 2018, which would cause a strain on resources needed for the implementation of energy conservation standards. It was suggested that the effective date of standards be shifted to allow manufacturers first to meet safety standards and then focus their limited resources on meeting the new and amended energy conservation standards. (Whirlpool, No. 33 at p. 4, 5, and 7; Electrolux, No. 27 at p. 5) DOE understands manufacturers must comply with several regulations, including UL 858 and CSA C22.2.61, and included this in analyzing impacts of the proposed standard on manufacturers in the cumulative regulatory burden section, section V.B.2.e of this SNOPR. DOE understands manufacturers have limited resources, however DOE feels that setting an effective date at the end of 2019 balances the benefits and costs associated with this rulemaking.

c. Cumulative Regulatory Burden

Several manufacturers noted the regulatory burden that numerous regulations will have on manufacturers. The regulatory burden of new safety requirements, UL 858 and CSA C22.2.61; DOE energy conservation standards on other home appliances; and the dual investments for adopting oven and cooking top standards are a concern amongst manufacturers. Manufacturers stated that DOE should also consider additional products that manufacturers of residential conventional cooking products make, which are also subject to potential DOE energy conservation standards. This places further cumulative regulatory burden on time and resources needed to evaluate and respond to both test procedures and energy conservation standards. (Whirlpool, No. 33 at p. 4 and 7; Electrolux, No. 27 at p. 5; AHAM, No. 38 at p. 10) DOE analyzed cumulative regulatory burden, V.B.2.e, and included this in analyzing impacts of the proposed standard on manufacturers.

4. Manufacturer Interviews

DOE conducted manufacturer interviews following publication of the February 2014 RFI in preparation for the June 2015 NOPR analysis. In these interviews, DOE asked manufacturers to describe their major concerns with this residential conventional cooking products rulemaking. The following section describes the key issues identified by residential conventional cooking product manufacturers during these interviews. DOE conducted additional discussions with select manufacturers to follow up on information received on the June 2015 NOPR, but those discussions focused primarily on the engineering analysis.

a. Premium Products Tend To Be Less Efficient

Manufacturers stated that their premium products (*i.e.,* gas cooking tops and ovens marketed as commercial-style) are usually less efficient than products marketed as residential-style. Commercial-style cooking tops typically have less efficient features such as larger cast iron grates that act as an additional thermal load. Also, this style of gas cooking top typically has a wider gap between the burner and grate surface, further reducing the efficiency of the cooking top. Conversely, gas cooking tops marketed as residential-style tend to have inner, lower grates so the cooking vessels resting on them are closer to the heat sources. Commercial-style ovens typically have large, heavier-gauge cavity construction and extension racks that result in inherently lower efficiencies compared to residential-style ovens with comparable cavities sizes, due to the greater thermal mass of the cavity and racks, when measured according to the DOE test procedure in effect at the time of the interviews. Manufacturers warned DOE that focusing only on the efficiency of residential conventional cooking products could cause some manufacturers to redesign their products in a way that reduces consumer satisfaction as consumers tend to value premium features, even though they may be less efficient.

b. Induction Cooking Products

Some manufacturers stated that induction cooking tops should be considered as a separate product class apart from electric smooth cooking tops. Manufacturers stated that while induction cooking tops tends to be more efficient that other electric smooth cooking tops, induction cooking tops could require consumers to replace some or all of their cookware if they are not ferromagnetic.

c. Product Utility

Manufacturers stated that energy efficiency is not one of the most important attributes that consumers value when purchasing residential conventional cooking products. Manufacturers stated that there are several other factors, such as performance and durability, which consumers value more when purchasing residential conventional cooking products. 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.

d. 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 cooking products. 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 cooking products could significantly strain their limited resources if these costs were all incurred in the 3-year time frame from the publication of a final rule to the implementation of the new and amended standards.

K. Emissions Analysis

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

The analysis of power sector emissions uses marginal emissions factors that were derived from data in *AEO 2015,* as described in section IV.M of this SNOPR. The methodology is described in chapter 13 and chapter 15 of the SNOPR TSD.

Combustion emissions of CH_4 and N_2O are estimated using emissions intensity factors published by the EPA, GHG Emissions Factors Hub.[65] The FFC upstream emissions are estimated based on the methodology described in chapter 15 of the SNOPR TSD. The upstream emissions include both emissions from fuel combustion during extraction, processing, and transportation of fuel, and ''fugitive'' emissions (direct leakage to the atmosphere) of CH_4 and CO_2.

The emissions intensity factors are expressed in terms of physical units per MWh or MMBtu of site energy savings. Total emissions reductions are estimated using the energy savings calculated in the national impact analysis.

[65] Available at: *http://www2.epa.gov/climateleadership/center-corporate-climate-leadership-ghg-emission-factors-hub.*

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 each ton of gas 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,[66] DOE used GWP values of 28 for CH_4 and 265 for N_2O.

Because the on-site operation of gas cooking tops requires use of fossil fuels and results in emissions of CO_2, NO_X, and SO_2 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.[67]

The *AEO* incorporates the projected impacts of existing air quality regulations on emissions. *AEO 2015* generally represents current legislation and environmental regulations, including recent government actions, for which implementing regulations were available as of October 31, 2015. DOE's estimation of impacts accounts for the presence of the emissions control programs discussed in the following paragraphs.

SO_2 emissions from affected electric generating units (EGUs) are subject to nationwide and regional emissions cap-and-trade programs. Title IV of the Clean Air Act sets an annual emissions cap on SO_2 for affected EGUs in the 48 contiguous States and the District of Columbia (DC). (42 U.S.C. 7651 *et seq.*) SO_2 emissions from 28 eastern States and DC were also limited under the Clean Air Interstate Rule (CAIR). 70 FR 25162 (May 12, 2005). CAIR created an allowance-based trading program that operates along with the Title IV program. In 2008, CAIR was remanded to EPA by the U.S. Court of Appeals for the District of Columbia Circuit, but it remained in effect.[68] In 2011, EPA issued a replacement for CAIR, the Cross-State Air Pollution Rule (CSAPR). 76 FR 48208 (August 8, 2011). On August 21, 2012, the D.C. Circuit issued a decision to vacate CSAPR,[69] and 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.[70] On October 23, 2014, the D.C. Circuit lifted the stay of CSAPR.[71] Pursuant to this action, CSAPR went into effect (and CAIR ceased to be in effect) as of January 1, 2015.

EIA was not able to incorporate CSAPR into *AEO 2015,* so it assumes implementation of CAIR. Although DOE's analysis used emissions factors that assume that CAIR, not CSAPR, is the regulation in force, 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. Under existing EPA regulations, any excess SO_2 emissions allowances resulting from the lower electricity demand caused by the adoption of an efficiency standard could be used to permit offsetting increases in SO_2 emissions by any regulated EGU. In past rulemakings, DOE recognized that there was uncertainty about the effects of efficiency standards on SO_2 emissions covered by the existing cap-and-trade system, but it concluded that negligible reductions in power sector SO_2 emissions would occur as a result of standards.

Beginning in 2016, however, SO_2 emissions will fall as a result of the Mercury and Air Toxics Standards (MATS) for power plants. 77 FR 9304 (Feb. 16, 2012). In the 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 2015* 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.[72] Therefore, DOE believes that energy conservation standards will generally 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.[73] 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 from other facilities. 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 SNOPR for these States.

The MATS limit mercury emissions from power plants, but they do not include emissions caps and, as such, DOE's energy conservation standards would likely reduce Hg emissions. DOE estimated mercury emissions reduction using emissions factors based on *AEO 2015,* which incorporates the MATS.

EEI commented that DOE's general approach to the long-term assessment of the impacts of energy conservation

[66] 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.

[67] 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*).

[68] 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).

[69] 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).

[70] *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.

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

[72] DOE notes that the Supreme Court remanded EPA's 2012 rule regarding national emission standards for hazardous air pollutants from certain electric utility steam generating units. See *Michigan* v. *EPA* (Case No. 14–46, 2015). DOE has tentatively determined that the remand of the MATS rule does not change the assumptions regarding the impact of energy efficiency standards on SO_2 emissions. Further, while the remand of the MATS rule may have an impact on the overall amount of mercury emitted by power plants, it does not change the impact of the energy efficiency standards on mercury emissions. DOE will continue to monitor developments related to this case and respond to them as appropriate.

[73] 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 emissions is slight.

standards on electricity usage and the related upstream emissions from the power sector is flawed due to their failure to address significant and expected changes in the power sector that will change demand for electricity and the composition of the generating fleet through the period that is covered by the life of a new residential cooking product. EEI also commented that this focus on existing regulations results in predictions about the future composition of the electric generating fleet and the related emissions from that fleet that are unlikely to be borne out by actual experience. (EEI, No. 30 at p. 4)

DOE believes it would be inappropriate to use projections of the power sector that attempt to incorporate regulations that have not been finalized. The final shape of a regulation affects its impacts on the power sector and is not certain until the regulation has become effective.[74]

L. Monetizing Carbon Dioxide and Other Emissions Impacts

As part of the development of this proposed 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 SNOPR.

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.[75] 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.

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

[74] In many cases, newly-issued regulations face challenge in the courts, the outcome of which is uncertain. However, DOE believes that it is reasonable to include the impacts of regulations that have already been issued.

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

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.[76] 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,[77] although preference is given to consideration of the global benefits of reducing CO_2 emissions. Table IV.47 presents the values in the 2010 interagency group report, which is reproduced in appendix 14A of the SNOPR TSD.

TABLE IV.47—ANNUAL SCC VALUES FROM 2010 INTERAGENCY REPORT, 2010–2050

[2007$ 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 for this SNOPR were generated using the most recent versions of the three integrated assessment models that have been published in the peer-reviewed literature.[78] Table IV.48 shows the updated sets of SCC estimates from the 2013 interagency update in 5-year increments from 2010 to 2050. Appendix 14B of the SNOPR 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.

TABLE IV.48—ANNUAL SCC VALUES FROM 2013 INTERAGENCY UPDATE (REVISED JULY 2015), 2010–2050

[2007$ per metric ton CO_2]

Year	Discount rate (%)			
	5	3	2.5	3
	Average	Average	Average	95th Percentile
2010	10	31	50	86
2015	11	36	56	105
2020	12	42	62	123
2025	14	46	68	138
2030	16	50	73	152
2035	18	55	78	168
2040	21	60	84	183
2045	23	64	89	197
2050	26	69	95	212

[76] *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.*).

[77] 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.

[78] *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 July 2015) (Available at: *http://www.whitehouse.gov/sites/default/files/omb/inforeg/scc-tsd-final-july-2015.pdf*).

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. DOE notes that 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 10 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 (revised July 2015), adjusted to 2015$ using the implicit price deflator for gross domestic product (GDP) from the Bureau of Economic Analysis. For each of the four sets of SCC cases specified, the values for emissions in 2015 were $12.4, $40.6, $63.2, and $118 per metric ton avoided (values expressed in 2015$). 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.

The Cato Institute stated that the SCC is not supported by scientific literature, not in accordance with OMB guidelines, fraught with uncertainty, illogical and thus unsuitable and inappropriate for Federal rulemaking. The comment emphasized that the SCC is discordant with the best scientific literature on the equilibrium climate sensitivity and the fertilization effect of carbon dioxide. Further, the estimates should make a clear distinction between global and domestic cost-benefit estimates and delineate the potential positive impact on agriculture. The Cato Institute argued that use of the SCC in cost/benefit analyses in this rulemaking should be suspended. (Cato Institute, No. 24 at pp. 3, 13) NPGA also commented on the issue of a clear distinction between global and domestic cost-benefit estimates. (NPGA, No. 35 at p. 2)

DOE acknowledges the limitations of the SCC estimates, which are discussed in detail in the 2010 Report. Specifically, the 2010 Report discusses and explains the reasons for uncertainties in the assumptions regarding climate sensitivity, as well as other model inputs such as economic growth and emissions trajectories.[79] 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 final rule TSD for discussion). Although uncertainties remain, the revised estimates in the 2013 Report are based on the best available scientific information on the impacts of climate change. The current SCC estimates 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. In July 2015 OMB published a detailed summary and formal response to the many comments that were received.[80] It also stated its intention to seek independent expert advice on opportunities to improve the estimates, including many of the approaches suggested by commenters. 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.

With respect to distinguishing between global and domestic benefits from reducing CO_2 emissions, DOE's analysis estimates both global and domestic benefits of CO_2 emissions reductions. Following the recommendation of the interagency working group, DOE places more focus on a global measure of SCC. As discussed in appendix 14A of the SNOPR TSD, the climate change problem is highly unusual in at least two respects. First, it involves a global externality: Emissions of most greenhouse gases contribute to damages around the world even when they are emitted in the United States. Consequently, to address the global nature of the problem, the SCC must incorporate the full (global) damages caused by GHG emissions. Second, climate change presents a problem that the United States alone cannot solve. Even if the United States were to reduce its greenhouse gas emissions to zero, that step would be far from enough to avoid substantial climate change. Other countries would also need to take action to reduce emissions if significant changes in the global climate are to be avoided. Emphasizing the need for a global solution to a global problem, the United States has been actively involved in seeking international agreements to reduce emissions and in encouraging other nations, including emerging major economies, to take significant steps to reduce emissions. When these considerations are taken as a whole, the interagency group concluded that a global measure of the benefits from reducing U.S. emissions is preferable.

2. Social Cost of Other Air Pollutants

As noted previously, DOE has estimated how the considered energy conservation standards would reduce site NO_X emissions nationwide and decrease power sector NO_X emissions in those 22 States not affected by the CAIR.

DOE estimated the monetized value of NO_X emissions reductions from electricity generation using benefit per ton estimates from the *Regulatory Impact Analysis for the Clean Power*

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

[80] This is available at *https://www.whitehouse.gov/blog/2015/07/02/estimating-benefits-carbon-dioxide-emissions-reductions.*

Plan Final Rule, published in August 2015 by EPA's Office of Air Quality Planning and Standards.[81] The report includes high and low values for NO_X (as $PM_{2.5}$) for 2020, 2025, and 2030 discounted at 3 percent and 7 percent, which are presented in chapter 14 of the SNOPR TSD. DOE primarily relied on the low estimates to be conservative.[82] DOE assigned values for 2021–2024 and 2026–2029 using, respectively, the values for 2020 and 2025. DOE assigned values after 2030 using the value for 2030. DOE developed values specific to the end-use category for cooking products using a method described in appendix 14C of the NOPR TSD.

DOE estimated the monetized value of NO_X emissions reductions from combustion in homes using benefit per ton estimates from the EPA's Technical Support Document *Estimating the Benefit per Ton of Reducing $PM_{2.5}$ Precursors from 17 Sectors.*[83] Although none of the sectors refers specifically to residential and commercial buildings, DOE believes that the sector called ''Area sources'' would be a reasonable proxy for residential and commercial buildings. ''Area sources'' represents all emission sources for which states do not have exact (point) locations in their emissions inventories. Since exact locations would tend to be associated with larger sources, ''area sources'' would be fairly representative of small dispersed sources like homes and businesses. The Technical Support Document provides high and low estimates for 2016, 2020, 2025, and 2030 at 3-percent and 7-percent discount rates. As with the benefit per ton estimates for NO_X emissions reductions from electricity generation, DOE primarily relied on the low estimates to be conservative.

DOE multiplied the emissions reduction (in tons) in each year by the associated $/ton values, and then discounted each series using discount rates of 3 percent and 7 percent as appropriate. DOE will continue to evaluate the monetization of avoided NO_X emissions and will make any appropriate updates of the current analysis for the final rulemaking.

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.

M. Utility Impact Analysis

The utility impact analysis estimates several effects on the electric power industry that would result from the adoption of new or amended energy conservation standards. The utility impact analysis estimates the changes in installed electrical capacity and generation that would result for each TSL. The analysis is based on published output from the NEMS associated with *AEO 2015.* 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 published side cases to estimate the marginal impacts of reduced energy demand on the utility sector. These marginal factors are estimated based on the changes to electricity sector generation, installed capacity, fuel consumption and emissions in the *AEO* Reference case and various side cases. Details of the methodology are provided in the appendices to chapters 13 and 15 of the SNOPR TSD.

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

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 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.[84] There are many reasons for these differences, including wage differences and the fact that the utility sector is more capital-intensive and less labor-intensive than other sectors. Energy conservation standards have the effect of reducing consumer utility bills. Because reduced consumer expenditures for energy likely lead to increased expenditures in other sectors of the economy, the general effect of efficiency standards is to shift economic activity from a less labor-intensive sector (*i.e.,* the utility sector) to more labor-intensive sectors (*e.g.,* the retail and service sectors). Thus, the BLS data suggest that net national employment may increase because of shifts in economic activity resulting from amended standards.

DOE estimated indirect national employment impacts for the standard levels considered in this SNOPR using an input/output model of the U.S. economy called Impact of Sector Energy Technologies, Version 3.1.1 (ImSET).[85]

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[81] Available at *www.epa.gov/cleanpowerplan/clean-power-plan-final-rule-regulatory-impact-analysis.* See Tables 4A–3, 4A–4, and 4A–5 in the report. *The U.S. Supreme Court has stayed the rule implementing the Clean Power Plan until the current litigation against it concludes. Chamber of Commerce, et al.* v. *EPA, et al., Order in Pending Case, 577 U.S. ____ (2016). However, the benefit-per-ton estimates established in the Regulatory Impact Analysis for the Clean Power Plan are based on scientific studies that remain valid irrespective of the legal status of the Clean Power Plan.*

[82] For the monetized NO_X benefits associated with $PM_{2.5}$, the related benefits are primarily based on an estimate of premature mortality derived from the ACS study (Krewski *et al.,* 2009), which is the lower of the two EPA central tendencies. Using the lower value is more conservative when making the policy decision concerning whether a particular standard level is economically justified so using the higher value would also be justified. If the benefit-per-ton estimates were based on the Six Cities study (Lepuele *et al.,* 2012), the values would be nearly two-and-a-half times larger. (See chapter 14 of the SNOPR TSD for further description of the studies mentioned above.)

[83] *http://www.epa.gov/sites/production/files/2014-10/documents/sourceapportionment bpttsd.pdf.*

[84] See U.S. Department of Commerce—Bureau of Economic Analysis. *Regional Multipliers: A User Handbook for the Regional Input-Output Modeling System (RIMS II).* 1997. U.S. Government Printing Office: Washington, DC. Available at *http://www.bea.gov/scb/pdf/regional/perinc/meth/rims2.pdf.*

[85] 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:

Continued

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 SNOPR TSD.

V. Analytical Results

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

A. Trial Standard Levels

DOE analyzed the benefits and burdens of four TSLs for conventional cooking products. These TSLs were developed by combining specific efficiency levels for each of the product classes analyzed by DOE. DOE presents the results for the TSLs in this document, while the results for all efficiency levels that DOE analyzed are in the SNOPR TSD.

Table V.1 through Table V.3 present the TSLs and the corresponding efficiency levels for conventional cooking products.[86] TSL 4 represents the maximum technologically feasible (''max-tech'') improvements in energy efficiency for all product classes. TSL 3 comprises efficiency levels providing maximum NES with positive NPV. TSL 2 includes the prescriptive standards for conventional ovens control design and represents a level between TSL 1 and TSL 3 that does not eliminate commercial-style cooking tops from the market and yields an NPV greater than TSL 1. TSL 1 was configured with a control strategy approach with maximum NES.

TABLE V.1—TRIAL STANDARD LEVELS FOR COOKING TOPS

TSL	Electric open (coil) element cooking tops		Electric smooth element cooking tops		Gas cooking tops	
	Efficiency level	IAEC (kWh/yr)	Efficiency level	IAEC (kWh/yr)	Efficiency level	IAEC (kWh/yr)
1	Baseline	118.1	2	121.2	Baseline	1,104.6
2	1	113.2	2	121.2	1	924.4
3	1	113.2	2	121.2	3	730.4
4	1	113.2	4	102.3	3	730.4

TABLE V.2—TRIAL STANDARD LEVELS FOR OVENS, ELECTRIC

TSL	Electric standard ovens, free-standing		Electric standard ovens, built-in/slide-in		Electric self-cleaning ovens, free-standing		Electric self-cleaning 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	306.3	1	313.3	1	346.0	1	353.0
2	1	306.3	1	313.3	1	346.0	1	353.0
3	4	274.0	4	280.3	1	346.0	1	353.0
4	7	222.2	7	227.2	4	278.5	4	284.1

TABLE V.3—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 (kWh/yr)	Efficiency level	IAEC (kWh/yr)	Efficiency level	IAEC (kWh/yr)	Efficiency level	IAEC (kWh/yr)
1	1	2,052.5	1	2,062.4	1	1,929.0	1	1,939.0
2	2	1,849.9	2	1,858.8	2	1,740.5	2	1,749.4
3	6	1,654.9	6	1,662.9	4	1,658.9	4	1,667.4
4	6	1,654.9	6	1,662.9	4	1,658.9	4	1,667.4

www.pnl.gov/main/publications/external/technical_reports/PNNL–18412.pdf).

[86] For the conventional oven product classes, the efficiency levels are based on an oven with a cavity volume of 4.3 ft^3. As discussed in section IV.C.3 of this notice, DOE developed slopes and intercepts to characterize the relationship between IEAC and cavity volume for each efficiency level.

B. Economic Justification and Energy Savings

1. Economic Impacts on Individual Consumers

DOE analyzed the economic impacts on conventional cooking products 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 SNOPR TSD provides detailed information on the LCC and PBP analyses.

Table V.4 through Table V.25 show the LCC and PBP results for all efficiency levels considered for each conventional cooking 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 no-new-standards case efficiency distribution in the compliance year (see section IV.F.9 of this SNOPR). Because some consumers purchase products with higher efficiency in the no-new-standards case, the average savings are less than the difference between the average LCC of the lowest-efficiency level and the average LCC at each TSL. The savings refer only to consumers who are affected by a standard at a given TSL. Those who already purchase a product with efficiency at or above a given TSL are not affected. Consumers for whom the LCC increases at a given TSL experience a net cost.

TABLE V.4—AVERAGE LCC AND PBP RESULTS BY EFFICIENCY LEVEL FOR PC1 ELECTRIC OPEN (COIL) ELEMENT COOKING TOPS

TSL	Efficiency level	Average costs 2015$				Simple payback years
		Installed cost	First year's operating cost	Lifetime operating cost	LCC	
1	Baseline	$253	$16	$337	$590	
2,3,4	1	256	15	329	585	0.5

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.5—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE EFFICIENCY DISTRIBUTION FOR PC1 ELECTRIC OPEN (COIL) ELEMENT COOKING TOPS

TSL	Efficiency level	Life-cycle cost savings	
		% of Consumers that experience	Average savings*
			Net cost
1	Baseline	0	$0.00
2,3,4	1	19	2.87

* The calculation includes households with zero LCC savings (no impact).

TABLE V.6—AVERAGE LCC AND PBP RESULTS BY EFFICIENCY LEVEL FOR PC2 ELECTRIC SMOOTH ELEMENT COOKING TOPS

TSL	Efficiency level	Average costs 2015$				Simple payback years
		Installed cost	First year's operating cost	Lifetime operating cost	LCC	
1,2,3	2	$483	$16	$343	$825	1.0
4	4	835	14	312	1,146	61.9

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

TABLE V.7—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE EFFICIENCY DISTRIBUTION FOR PC2 ELECTRIC SMOOTH ELEMENT COOKING TOPS

TSL	Efficiency level	Life-cycle cost savings	
		% of Consumers that experience	Average savings*
			Net cost
1,2,3	2	0	$24.37

TABLE V.7—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE EFFICIENCY DISTRIBUTION FOR PC2 ELECTRIC SMOOTH ELEMENT COOKING TOPS—Continued

TSL	Efficiency level	Life-cycle cost savings	
		% of Consumers that experience	Average savings*
			Net cost
4	4	98	(280.82)

* The calculation includes households with zero LCC savings (no impact).

TABLE V.8—AVERAGE LCC AND PBP RESULTS BY EFFICIENCY LEVEL FOR PC3 GAS COOKING TOPS

TSL	Efficiency level	Average costs 2015$				Simple payback years
		Installed cost	First year's operating cost	Lifetime operating cost	LCC	
1	Baseline	$345	$12	$266	$611	—
2	1	361	10	246	607	9.1
3,4	3	361	8	225	586	4.4

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.9—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE EFFICIENCY DISTRIBUTION FOR PC3 GAS COOKING TOPS

TSL	Efficiency level	Life-cycle cost savings	
		% of Consumers that experience	Average savings*
			Net cost
1	Baseline	0	$0.00
2	1	14	1.10
3,4	3	6	15.83

*The calculation includes households with zero LCC savings (no impact).

TABLE V.10—AVERAGE LCC AND PBP RESULTS BY EFFICIENCY LEVEL FOR PC4 ELECTRIC STANDARD OVENS, FREE-STANDING

TSL	Efficiency level	Average costs 2015$				Simple payback years
		Installed cost	First year's operating cost	Lifetime operating cost	LCC	
1,2	1	$557	$17	$386	$942	0.9
3	4	569	16	364	934	4.7
4	7	652	13	332	984	17.1

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.11—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE EFFICIENCY DISTRIBUTION FOR PC4 ELECTRIC STANDARD OVENS, FREE-STANDING

TSL	Efficiency level	Life-cycle cost savings	
		% of Consumers that experience	Average savings*
			Net cost
1,2	1	0	$5.93
3	4	20	10.23
4	7	80	(30.82)

*The calculation includes households with zero LCC savings (no impact).

TABLE V.12—AVERAGE LCC AND PBP RESULTS BY EFFICIENCY LEVEL FOR PC5 ELECTRIC STANDARD OVENS, BUILT-IN/SLIDE-IN

TSL	Efficiency level	Average costs 2015$				Simple payback years
		Installed cost	First year's operating cost	Lifetime operating cost	LCC	
1,2	1	$583	$17	$386	$968	0.9
3	4	596	16	364	960	4.7
4	7	678	13	332	1,010	17.1

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.13—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE EFFICIENCY DISTRIBUTION FOR PC5 ELECTRIC STANDARD OVENS, BUILT-IN/SLIDE-IN

TSL	Efficiency level	Life-cycle cost savings	
		% of Consumers that experience	Average savings*
		Net cost	2015$
1,2	1	0	$5.96
3	4	20	10.23
4	7	80	(30.83)

* The calculation includes households with zero LCC savings (no impact).

TABLE V.14—AVERAGE LCC AND PBP RESULTS BY EFFICIENCY LEVEL FOR PC6 ELECTRIC SELF-CLEAN OVENS, FREE-STANDING

TSL	Efficiency level	Average costs 2015$				Simple payback years
		Installed cost	First year's operating cost	Lifetime operating cost	LCC	
1,2,3	1	$600	$25	$482	$1,083	0.9
4	4	684	21	433	1,117	16.2

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

TABLE V.15—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE EFFICIENCY DISTRIBUTION FOR PC6 ELECTRIC SELF-CLEAN OVENS, FREE-STANDING

TSL	Efficiency level	Life-cycle cost savings	
		% of Consumers that experience	Average savings*
		Net cost	2015$
1,2,3	1	0	$7.04
4	4	72	(17.19)

* The calculation includes households with zero LCC savings (no impact).

TABLE V.16—AVERAGE LCC AND PBP RESULTS BY EFFICIENCY LEVEL FOR PC7 ELECTRIC SELF-CLEAN OVENS, BUILT-IN/SLIDE-IN

TSL	Efficiency level	Average costs 2015$				Simple payback years
		Installed cost	First year's operating cost	Lifetime operating cost	LCC	
1,2,3	1	$626	$25	$484	$1,110	0.9
4	4	710	21	435	1,145	16.2

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

TABLE V.17—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE EFFICIENCY DISTRIBUTION FOR PC7 ELECTRIC SELF-CLEAN OVENS, BUILT-IN/SLIDE-IN

TSL	Efficiency level	Life-cycle cost savings	
		% of Consumers that experience	Average savings*
		Net cost	2015$
1,2,3	1	0	$7.08
4	4	72	$17.21)

* The calculation includes households with zero LCC savings (no impact).

TABLE V.18—AVERAGE LCC AND PBP RESULTS BY EFFICIENCY LEVEL FOR PC8 GAS STANDARD OVENS, FREE-STANDING

TSL	Efficiency level	Average costs 2015$				Simple payback years
		Installed cost	First year's operating cost	Lifetime operating cost	LCC	
1	1	$602	$35	$529	$1,130	0.6
2	2	611	28	452	1,063	1.1
3,4	6	655	28	450	1,105	6.0

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.19—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE EFFICIENCY DISTRIBUTION FOR PC8 GAS STANDARD OVENS, FREE-STANDING

TSL	Efficiency level	Life-cycle cost savings	
		% of Consumers that experience	Average savings*
		Net cost	2015$
1	1	0	$7.60
2	2	0	43.64
3,4	6	61	9.77

* The calculation includes households with zero LCC savings (no impact).

TABLE V.20—AVERAGE LCC AND PBP RESULTS BY EFFICIENCY LEVEL FOR PC9 GAS STANDARD OVENS, BUILT-IN/SLIDE-IN

TSL	Efficiency level	Average costs 2015$				Simple payback years
		Installed cost	First year's operating cost	Lifetime operating cost	LCC	
1	1	$628	$35	$529	$1,156	0.6
2	2	637	28	452	1,089	1.1
3,4	6	681	28	450	1,131	6.0

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.21—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE EFFICIENCY DISTRIBUTION FOR PC9 GAS STANDARD OVENS, BUILT-IN/SLIDE-IN

TSL	Efficiency level	Life-cycle cost savings	
		% of Consumers that experience	Average savings*
		Net cost	2015$
1	1	0	$7.60
2	2	0	43.65

TABLE V.21—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE EFFICIENCY DISTRIBUTION FOR PC9 GAS STANDARD OVENS, BUILT-IN/SLIDE-IN—Continued

TSL	Efficiency level	Life-cycle cost savings	
		% of Con-sumers that experience	Average savings*
		Net cost	2015$
3,4	6	61	9.77

* The calculation includes households with zero LCC savings (no impact).

TABLE V.22—AVERAGE LCC AND PBP RESULTS BY EFFICIENCY LEVEL FOR PC10 GAS SELF-CLEAN OVENS, FREE-STANDING

TSL	Efficiency level	Average costs 2015$				Simple payback years
		Installed cost	First year's operating cost	Lifetime operating cost	LCC	
1	1	$716	$38	$559	$1,275	0.7
2	2	725	31	484	1,209	1.1
3,4	4	760	31	485	1,245	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.23—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE EFFICIENCY DISTRIBUTION FOR PC10 GAS SELF-CLEAN OVENS, FREE-STANDING

TSL	Efficiency level	Life-cycle cost savings	
		% of con-sumers that experience	Average savings*
		Net cost	2015$
1	1	0	$7.73
2	2	0	48.03
3,4	4	49	20.27

* The calculation includes households with zero LCC savings (no impact).

TABLE V.24—AVERAGE LCC AND PBP RESULTS BY EFFICIENCY LEVEL FOR PC11 GAS SELF-CLEAN OVENS, BUILT-IN/SLIDE-IN

TSL	Efficiency level	Average costs 2015$				Simple payback years
		Installed cost	First year's operating cost	Lifetime operating cost	LCC	
1	1	$742	$38	$559	$1,301	0.7
2	2	751	31	484	1,235	1.1
3,4	4	786	31	485	1,271	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.25—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE EFFICIENCY DISTRIBUTION FOR PC11 GAS SELF-CLEAN OVENS, BUILT-IN/SLIDE-IN

TSL	Efficiency level	Life-cycle cost savings	
		% of con-sumers that experience	Average savings*
		Net cost	2015$
1	1	0	$7.73
2	2	0	48.05

TABLE V.25—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE EFFICIENCY DISTRIBUTION FOR PC11 GAS SELF-CLEAN OVENS, BUILT-IN/SLIDE-IN—Continued

TSL	Efficiency level	Life-cycle cost savings	
		% of consumers that experience	Average savings*
		Net cost	2015$
3,4	4	49	20.27

* The calculation includes households with zero LCC savings (no impact).

b. Consumer Subgroup Analysis

As described in section IV.I of this SNOPR, DOE determined the impact of the considered TSLs on low-income households and senior-only households. Table V.26 through Table V.36 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 SNOPR TSD presents the complete LCC and PBP results for the subgroups.

TABLE V.26—COMPARISON OF AVERAGE LCC SAVINGS FOR CONSUMER SUBGROUPS AND ALL HOUSEHOLDS FOR PC1 ELECTRIC OPEN (COIL) ELEMENT COOKING TOPS

TSL	Average life-cycle cost savings (2015$)			Simple payback period (years)		
	Low-income households	Senior-only households	All households	Low-income households	Senior-only households	All households
1	$0.00	$0.00	$0.00			
2,3,4	2.95	2.66	2.60	0.5	0.5	0.5

TABLE V.27—COMPARISON OF AVERAGE LCC SAVINGS FOR CONSUMER SUBGROUPS AND ALL HOUSEHOLDS FOR PC2 ELECTRIC SMOOTH ELEMENT COOKING TOPS

TSL	Average life-cycle cost savings (2015$)			Simple payback period (years)		
	Low-income households	Senior-only households	All households	Low-income households	Senior-only households	All households
1,2,3	$24.36	$24.72	$24.37	1.0	1.0	1.0
4	(280.72)	(282.11)	(282.36)	62.0	62.8	63.4

TABLE V.28—COMPARISON OF AVERAGE LCC SAVINGS FOR CONSUMER SUBGROUPS AND ALL HOUSEHOLDS FOR PC3 GAS COOKING TOPS

TSL	Average life-cycle cost savings (2015$)			Simple payback period (years)		
	Low-income households	Senior-only households	All households	Low-income households	Senior-only households	All households
1	$0.00	$0.00	$0.00			
2	1.94	0.84	0.83	7.6	9.6	9.6
3,4	19.67	15.04	14.82	3.6	4.6	4.6

TABLE V.29—COMPARISON OF AVERAGE LCC SAVINGS FOR CONSUMER SUBGROUPS AND ALL HOUSEHOLDS FOR PC4 ELECTRIC STANDARD OVENS, FREE-STANDING

TSL	Average life-cycle cost savings (2015$)			Simple payback period (years)		
	Low-income households	Senior-only households	All households	Low-income households	Senior-only households	All households
1,2	$5.94	$6.09	$5.71	0.9	0.9	0.9
3	9.77	7.96	11.54	4.7	5.2	4.4
4	(32.05)	(38.77)	(24.65)	17.4	20.0	15.4

TABLE V.30—COMPARISON OF AVERAGE LCC SAVINGS FOR CONSUMER SUBGROUPS AND ALL HOUSEHOLDS FOR PC5 ELECTRIC STANDARD OVENS, BUILT-IN/SLIDE-IN

TSL	Average life-cycle cost savings (2015$)			Simple payback period (years)		
	Low-income households	Senior-only households	All households	Low-income households	Senior-only households	All households
1,2	$5.97	$6.12	$5.73	0.9	0.9	0.9
3	9.77	7.96	11.59	4.7	5.2	4.4
4	(32.06)	(38.78)	(24.58)	17.4	20.0	15.3

TABLE V.31—COMPARISON OF AVERAGE LCC SAVINGS FOR CONSUMER SUBGROUPS AND ALL HOUSEHOLDS PC6 ELECTRIC SELF-CLEANING OVENS, FREE-STANDING

TSL	Average life-cycle cost savings (2015$)			Simple payback period (years)		
	Low-income households	Senior-only households	All households	Low-income households	Senior-only households	All households
1,2,3	$6.68	$7.17	$6.83	0.9	0.8	0.9
4	(10.81)	(23.62)	(12.86)	14.1	18.8	14.9

TABLE V.32—COMPARISON OF AVERAGE LCC SAVINGS FOR CONSUMER SUBGROUPS AND ALL HOUSEHOLDS PC7 ELECTRIC SELF-CLEANING OVENS, BUILT-IN/SLIDE-IN

TSL	Average life-cycle cost savings (2015$)			Simple payback period (years)		
	Low-income households	Senior-only households	All households	Low-income households	Senior-only households	All households
1,2,3	$6.73	$7.20	$6.84	0.9	0.8	0.9
4	(10.83)	(23.64)	(12.86)	14.1	18.8	14.9

TABLE V.33—COMPARISON OF AVERAGE LCC SAVINGS FOR CONSUMER SUBGROUPS AND ALL HOUSEHOLDS PC8 GAS STANDARD OVENS, FREE-STANDING

TSL	Average life-cycle cost savings (2015$)			Simple payback period (years)		
	Low-income households	Senior-only households	All households	Low-income households	Senior-only households	All households
1	$7.18	$7.41	$7.53	0.7	0.6	0.7
2	51.40	38.30	25.11	0.9	1.2	1.8
3,4	17.71	4.24	3.86	5.1	6.6	7.6

TABLE V.34—COMPARISON OF AVERAGE LCC SAVINGS FOR CONSUMER SUBGROUPS AND ALL HOUSEHOLDS FOR PC9 GAS STANDARD OVEN, BUILT-IN/SLIDE-IN

TSL	Average life-cycle cost savings (2015$)			Simple payback period (years)		
	Low-income households	Senior-only households	All households	Low-income households	Senior-only households	All households
1	$7.18	$7.41	$7.53	0.7	0.6	0.7
2	51.41	38.31	25.14	0.9	1.2	1.8
3,4	17.70	4.23	3.87	5.1	6.6	7.6

TABLE V.35—COMPARISON OF AVERAGE LCC SAVINGS FOR CONSUMER SUBGROUPS AND ALL HOUSEHOLDS FOR PC10 GAS SELF-CLEANING OVENS, FREE-STANDING

TSL	Average life-cycle cost savings (2015$)			Simple payback period (years)		
	Low-income households	Senior-only households	All households	Low-income households	Senior-only households	All households
1	$7.50	$7.69	$7.66	0.7	0.7	0.7
2	45.86	42.33	26.80	1.2	1.2	1.8
3,4	18.15	14.67	1.63	5.3	5.6	8.1

TABLE V.36—COMPARISON OF AVERAGE LCC SAVINGS FOR CONSUMER SUBGROUPS AND ALL HOUSEHOLDS FOR PC11 GAS SELF-CLEANING OVEN, BUILT-IN/SLIDE-IN

TSL	Average life-cycle cost savings (2015$)			Simple payback period (years)		
	Low-income households	Senior-only households	All households	Low-income households	Senior-only households	All households
1	$7.50	$7.69	$7.66	0.7	0.7	0.7
2	45.87	42.34	26.85	1.2	1.2	1.8
3,4	18.15	14.67	1.66	5.3	5.6	8.1

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 TSLs, 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. In contrast, the PBPs presented in section V.B.1.a of this SNOPR were calculated using distributions that reflect the range of energy use in the field.

Table V.37 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 rule are economically justified through a more detailed analysis of the economic impacts of those levels pursuant to 42 U.S.C. 6295(o)(2)(B)(i). 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.37—CONVENTIONAL COOKING PRODUCTS: REBUTTABLE PBPS

(years)

Product class	Trial standard level			
	1	2	3	4
PC1: Electric Open (Coil) Element Cooking Tops	....	4.8	4.8	4.8
PC2: Electric Smooth Element Cooking Tops	0.9	0.9	0.9	53.3
PC3: Gas Cooking Tops	....	8.6	4.1	4.1
PC4: Electric Standard Ovens, Free-Standing	0.8	0.8	2.2	6.7
PC5: Electric Standard Ovens, Built-In/Slide-In	0.8	0.8	2.2	6.6
PC6: Electric Self-Clean Ovens, Free-Standing	0.8	0.8	0.8	7.1
PC7: Electric Self-Clean Ovens, Built-In/Slide-In	0.8	0.8	0.8	7.0
PC8: Gas Standard Ovens, Free-Standing	3.7	4.4	12.9	12.9
PC9: Gas Standard Ovens, Built-In/Slide-In	3.7	4.3	12.8	12.8
PC10: Gas Self-Clean Ovens, Free-Standing	3.6	4.5	15.0	15.0
PC11: Gas Self-Clean Ovens, Built-In/Slide-In	3.6	4.5	14.9	14.9

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 cooking products. The following sections describe the expected impacts on residential conventional cooking product manufacturers at each TSL. Chapter 12 of the SNOPR TSD explains the MIA in further detail.

a. Industry Cash-Flow Analysis Results

Table V.38 through Table V.39 depict the financial impacts (represented by changes in INPV) of new and amended energy conservation standards on residential conventional cooking product 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 cooking product 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 no-new-standards case and the standards cases that result from the sum of discounted cash flows from the reference year (2016) through the end of the analysis period. The results also discuss the difference in cash flows between the no-new-standards case and the standards cases 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 cooking product 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 SNOPR.

To assess the upper (less severe) end of the range of potential impacts on residential conventional cooking product manufacturers, DOE modeled a preservation of gross margin markup scenario. This scenario assumes that in the standards cases, 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 no-new-standards case gross margin (as a percentage of revenue) despite the higher production costs in the standards cases. 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 production cost increases.

To assess the lower (more severe) end of the range of potential impacts on the residential conventional cooking product 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 production costs, eroding profit margins as a percentage of total revenue.

Table V.38 and Table V.39 present the projected results for residential conventional cooking products under the preservation of gross margin and preservation of operating profit markup scenarios. DOE examined results for all product classes together since the majority of manufacturers sell products across a variety of the analyzed product classes.

TABLE V.38—MANUFACTURER IMPACT ANALYSIS FOR RESIDENTIAL CONVENTIONAL COOKING PRODUCTS—PRESERVATION OF GROSS MARGIN MARKUP SCENARIO

	Units	No-new-standards case	Trial standard level			
			1	2	3	4
INPV	(2015$ millions)	1,238.1	1,200.1	1,156.7	868.0	511.1
Change in INPV	(2015$ millions)		(38.0)	(81.4)	(370.1)	(727.1)
	(%)		(3.1)	(6.6)	(29.9)	(58.7)
Product conversion costs	(2015$ millions)		19.9	71.3	261.8	525.4
Capital conversion costs	(2015$ millions)		29.9	47.9	248.2	580.2
Total conversion costs	(2015$ millions)		49.8	119.2	510.0	1,105.7

* Numbers in parentheses indicate negative numbers.

TABLE V.39—MANUFACTURER IMPACT ANALYSIS FOR RESIDENTIAL CONVENTIONAL COOKING PRODUCTS—PRESERVATION OF OPERATING PROFIT MARKUP SCENARIO

	Units	No-new-standards case	Trial standard level			
			1	2	3	4
INPV	(2015$ millions)	1,238.1	1,198.3	1,148.5	844.7	314.6
Change in INPV	(2015$ millions)		(39.8)	(89.6)	(393.5)	(923.6)
	(%)		(3.2)	(7.2)	(31.8)	(74.6)
Product conversion costs	(2015$ millions)		19.9	71.3	261.8	525.4
Capital conversion costs	(2015$ millions)		29.9	47.9	248.2	580.2
Total conversion costs	(2015$ millions)		49.8	119.2	510.0	1,105.7

TSL 1 sets the efficiency level at baseline for two product classes, electric open (coil) element cooking tops and gas cooking tops; EL 1 for all electric and gas ovens; and EL 2 for one product class, electric smooth element cooking tops. At TSL 1, DOE estimates impacts on INPV range from −$39.8 million to −$38.0 million, or a change in INPV of −3.2 percent to −3.1 percent. At TSL 1, industry free cash flow (operating cash flow minus capital expenditures) is estimated to decrease to $83.2 million, or a drop of 19.1 percent, compared to the no-new-standards case value of $102.8 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, given the limited conversion costs and number of residential conventional cooking products projected to comply with the analyzed standards at this TSL. DOE projects that in the expected year of compliance (2019), 100 percent of electric open (coil) element cooking top and gas cooking top shipments; 28 percent of electric smooth element cooking top shipments; 60 percent of electric standard free standing oven and electric standard built-in oven shipments; 53 percent of electric self-clean free standing oven and electric self-clean built-in oven shipments; 56 percent of gas standard free standing oven and gas standard built-in oven shipments; and 52 percent of gas self-clean free standing oven and gas self-clean built-in oven shipments would meet or exceed the efficiency levels required 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 cooking product manufacturers would incur $19.9 million in product conversion costs for product redesigns that include converting electric smooth cooking tops and both gas and electric ovens to transition from using linear power supplies to SMPS in order to reduce standby power consumption; as well as implementing automatic power down controls for electric smooth cooking tops. DOE expects $29.9 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 0.2 percent relative to the no-new-standards case MPC. This extremely slight price increase is significantly outweighed by the $49.8 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 no-new-standards case, but manufacturers do not earn additional profit from their investments. The very slight increase in the shipment weighted-average MPC results in a slightly lower average manufacturer markup (slightly smaller than the 1.20 manufacturer markup used in the no-new-standards case). This slightly lower average manufacturer markup and the $49.8 million in conversion costs, results in slightly negative INPV impacts at TSL 1 under the preservation of operating profit.

TSL 2 sets the efficiency level at EL 1 for six product classes, electric open (coil) element cooking tops, gas cooking tops, electric standard free-standing ovens, electric standard built-in ovens, electric self-clean free-standing ovens, and electric self-clean built-in ovens; and EL 2 for five product classes, electric smooth element cooking tops, gas standard free-standing ovens, gas standard built-in ovens, gas self-clean free-standing ovens, and gas self-clean built-in ovens. At TSL 2, DOE estimates impacts on INPV to range from −$89.6 million to −$81.4 million, or a change in INPV of −7.2 percent to −6.6 percent. At TSL 2, industry free cash flow is estimated to decrease to $59.3 million, or a drop of 42.3 percent, compared to the no-new-standards case value of $102.8 million in 2018, the year leading up to new and amended energy conservation standards.

Percentage impacts on INPV are moderately negative at TSL 2. While the $119.2 million in industry conversion costs represent a larger investment for manufacturers than at TSL 1, DOE does not anticipate that manufacturers would lose a significant portion of their INPV at this TSL since the no-new-standards case INPV for manufacturers is more than $1,238.1 million. DOE projects that in 2019, 33 percent of electric open (coil) element cooking top shipments; 28 percent of electric smooth element cooking top shipments; 74 percent of gas cooking top shipments; 60 percent of electric standard free standing oven and electric standards built-in oven shipments; 53 percent of electric self-clean free standing oven and electric self-clean built-in oven shipments; 46 percent of gas standard free standing oven and gas standard built-in oven shipments; and 39 percent of gas self-clean free standing oven and gas self-clean built-in oven shipments would meet or exceed the efficiency levels required at TSL 2.

DOE expects that product conversion costs will rise from $19.9 million at TSL 1 to $71.3 million at TSL 2 for extensive product redesigns and testing. Capital conversion costs will also increase from $29.9 million at TSL 1 to $47.9 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 the need to improve contact conductance for electric open (coil) cooking tops; transition from using linear power supplies to SMPS to reduce standby power consumption while also implementing automatic power down controls for electric smooth cooking tops; improve burner and grate design for gas cooking tops; transition from using linear power supplies to SMPS to reduce standby power consumption for electric ovens; and transition from using linear power supplies to SMPS to improve power consumption in gas ovens.

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 no-new-standards case MPC. In this scenario, INPV impacts are moderately negative because manufacturers incur larger conversion costs, $119.2 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 increase in MPC results in a slightly lower average manufacturer markup (slightly smaller than the 1.20 manufacturer markup used in the no-new-standards case). This slightly lower average manufacturer markup and the $119.2 million in conversion costs result in moderately negative INPV impacts at TSL 2.

TSL 3 sets the efficiency level at EL 1 for three product classes, electric open (coil) cooking tops, electric self-clean free-standing ovens, and electric self-clean built in ovens; EL 2 for one product class, electric smooth element cooking tops; EL 3 for one product class, gas cooking tops; EL 4 for four product classes, electric standard free-standing ovens, electric standard built-in ovens, gas self-clean free-standing ovens, and gas self-clean built-in ovens; and EL 6 for two product classes, gas standard free-standing ovens and gas standard built-in ovens. At TSL 3, DOE estimates impacts on INPV to range from −$393.5 million to −$370.1 million, or a change in INPV of −31.8 percent to −29.9 percent. At this standard level, industry free cash flow is estimated to decrease to −$89.7, or a drop of 187.2 percent, compared to the no-new-standards case value of $102.8 million in 2018, the year leading up to new and amended energy conservation standards.

Percentage impacts on INPV are significantly negative at TSL 3. The $510.0 million in industry conversion costs represent a significant investment for manufacturers, and is the primary cause of the potential drop in INPV of up to 31.8 percent and a negative free cash flow in the year leading up to the new and amended standards. DOE projects that in 2019, 33 percent of electric open (coil) cooking top shipments; 28 percent of electric smooth element cooking top shipments; 13 percent of gas cooking top shipments; 31 percent of electric standard free standing oven and electric standard built-in oven shipments; 53 percent of electric self-clean free standing oven and electric self-clean built-in oven shipments; 9 percent of gas standard free standing oven and gas standard built-in oven shipments; and 13 percent of gas self-cleaning free standing oven and gas self-cleaning built-in oven shipments would meet or exceed the efficiency levels at TSL 3.

DOE expects that product conversion costs will significantly rise from $71.3 million at TSL 2 to $261.8 million at

TSL 3 for extensive product redesigns and testing. Capital conversion costs will also significantly increase from $47.9 million at TSL 2 to $248.2 million at TSL 3 to upgrade production equipment to accommodate for added or redesigned features in each product class. The large conversion costs at TSL 3 are driven by the need to optimize burners and grates for gas cooking tops; improve insulation and door seals for electric standard ovens; electronic spark ignition, improve insulation, increase the efficiency of door seals, forcing convection, and reducing convection losses for gas standard ovens; and forcing convection and reducing convection losses in gas self-clean ovens.

At TSL 3, under the preservation of gross margin markup scenario, the shipment weighted-average MPC increases by 2.5 percent, relative to the no-new-standards case MPC. In this scenario, INPV impacts are negative because manufacturers incur sizable conversion costs ($510.0 million) and are not able to recover much of those conversion costs through the 2.5 percent increase in the shipment weighted-average MPC at TSL 3.

Under the preservation of operating profit markup scenario, the 2.5 percent shipment weighted-average increase in MPC results in a slightly lower average manufacturer markup (1.199, compared to the 1.20 manufacturer markup used in the no-new-standards case). This slightly lower average manufacturer markup and the $510.0 million in conversion costs results in significantly negative INPV impacts at TSL 3.

Commercial-style manufacturers, manufacturers producing gas cooking products that are primarily marketed as commercial-style, would not be able to meet the standards required at TSL 3. As described in sections IV.C.3.b and IV.C.5 of this SNOPR, the features inherent to such gas cooking products would preclude this product configuration from being able to meet the standards required at TSL 3, and would likely force commercial-style manufacturers to exit the gas cooking product market.

TSL 4 sets the efficiency level at EL 1 for one product class, electric open (coil) element cooking tops; EL 3 for one product class, gas cooking tops; EL 4 for five product classes, electric smooth element cooking tops, electric self-clean free-standing ovens, electric self-clean built-in ovens, gas self-clean free-standing ovens, and gas self-clean built-in ovens; EL 6 for two product classes, gas standard free-standing ovens and gas standard built-in ovens; and EL 7 for two product classes, electric standard free-standing ovens and electric standard built-in ovens. This represents max-tech for all product classes. At TSL 4, DOE estimates impacts on INPV to range from −$923.6 million to −$727.1 million, or a change in INPV of −74.6 percent to −58.7 percent. At TSL 4, industry free cash flow is estimated to decrease to −$340.7 million, or a drop of 431.3 percent, compared to the no-new-standards case value of $102.8 million in 2018, the year leading up to new and amended energy conservation standards.

At TSL 4 conversion costs significantly increase, causing free cash flow to become significantly negative, −$340.7 million, in the year leading up to energy conservation standards and causing manufacturers to lose a substantial amount of INPV. Also, the percent change in INPV at TSL 4 is significantly negative due to the extremely large conversion costs, $1,105.7 million. 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 cooking product manufacturers could be seriously jeopardized as several manufacturers would struggle to comply with standards at this TSL, especially the commercial-style manufacturer subgroup. These manufacturers produce gas cooking products that are primarily marketed as commercial-style. As described in sections IV.C.3.b and IV.C.5 of this SNOPR, the features inherent to such gas cooking products would preclude this product configuration from being able to meet the standards required at TSL 4, and would likely force commercial-style manufacturers to exit the gas cooking product market.

A high percentage of total shipments will need to be redesigned to meet the efficiency levels prescribed at TSL 4. DOE projects that in 2019, 33 percent of electric open (coil) element cooking top shipments; 3 percent of electric smooth element cooking top shipments; 13 percent of gas cooking top shipments; 7 percent of electric standard free standing oven and electric standard built-in oven shipments; 12 percent of electric self-clean free standing oven and electric self-clean built-in oven shipments; 9 percent of gas standard free standing oven and gas standard built-in oven shipments; and 13 percent of gas self-clean free standing oven and gas self-clean built-in oven shipments would meet the efficiency levels at TSL 4.

DOE expects significant conversion costs at TSL 4, which represents max-tech. DOE expects product conversion costs to significantly increase from $261.8 million at TSL 3 to $525.4 million at TSL 4. 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 $248.2 million at TSL 3 to $580.2 million at TSL 4. Capital conversion costs are driven by investments in production equipment to accommodate for the addition of induction heating elements for electric smooth cooking tops; improved contact conductance for electric open (coil) element cooking tops; and by optimizing the burner and grate system for residential-style gas cooking tops; reducing vent rate, improving insulation and door seals, forcing convection, developing oven separators, and reducing conduction loses for electric standard ovens; forcing convection, developing oven separators, and reducing conduction loses for electric self-clean ovens; electronic spark ignition, improve insulation, increase the efficiency of door seals, forcing convection, and reducing convection losses for gas standard ovens; and forcing convection and reducing conduction losses in gas self-clean ovens. DOE estimates that most commercial-style manufacturers would not be able to meet the gas cooking product standards prescribed at TSL 4 and would be forced to exit the gas cooking product market.

At TSL 4, under the preservation of gross margin markup scenario, the shipment weighted-average MPC increases by 18.0 percent relative to the no-new-standards case MPC. In this scenario, INPV impacts are severely negative because the $1,105.7 million in conversion costs outweigh the modest increase in shipment weighted-average MPC, resulting in significantly negative INPV impacts at TSL 4.

Under the preservation of operating profit markup scenario, the 18.0 percent shipment weighted-average increase in MPC results in a slightly lower average manufacturer markup of 1.192 (compared to 1.20 used in the no-new-standards case). This lower average manufacturer markup and the $1,105.7 million in conversion costs, results in significantly negative INPV impacts at TSL 4.

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 no-new-standards case and at each TSL from 2019 to 2048. DOE used statistical data from the U.S. Census Bureau's 2014 Annual Survey of Manufactures (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.40 represent the potential domestic 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 DOE's estimate of the total number of U.S. production workers in the industry who could lose their jobs if some or all existing domestic production were moved outside of the United States. While the results present a range of domestic employment impacts following 2019, the following sections also include qualitative discussions of the likelihood of negative employment impacts at the various TSLs. Finally, the direct employment impacts shown are independent of the employment impacts from the broader U.S. economy, documented in chapter 17 of the SNOPR TSD.

Using 2014 ASM data and interviews with manufacturers, DOE estimates that approximately 60 percent of the residential conventional cooking products 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 8,663 domestic production workers involved in manufacturing residential conventional cooking products in 2019. Table V.40 shows the range of the impacts of new and amended energy conservation standards on U.S. production workers in the residential conventional cooking product industry.

TABLE V.40—POTENTIAL CHANGES IN THE TOTAL NUMBER OF DOMESTIC RESIDENTIAL CONVENTIONAL COOKING PRODUCT PRODUCTION WORKERS IN 2019

	No-New-Standards case	Trial standard level			
		1	2	3	4
Total Number of Domestic Production Workers in 2019 (without changes in production locations)	8,663	8,675	8,724	8,832	9,635
Potential Changes in Domestic Production Workers in 2019 *	—	(433) – 12	(866) – 61	(2,166) – 169	(4,332) – 972

* 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 cooking products. 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 cooking products 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 expects any significant changes in domestic employment at TSL 1 to be limited 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 TSL 2, TSL 3, and TSL 4, 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 cooking products, very few units are manufactured and shipped from far distances such as Asia or Europe. The vast majority of residential conventional cooking products 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 cooking products domestically or have recently made significant investments to continue to produce residential conventional cooking products domestically. DOE estimates that, at most, 10 percent of the domestic labor for residential conventional cooking products could move to other countries in response to the standards proposed at TSL 2.

At TSL 3, manufacturers could alter production locations in response to standards since all product classes would be required to meet more stringent standards than at TSL 2. DOE estimated that at most 25 percent of the domestic labor for residential conventional cooking products could move to other countries in response to the standards prescribed at TSL 3.

At TSL 4, 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 cooking products could move to other countries in response to the standards prescribed at TSL 4.

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

c. Impacts on Manufacturer Capacity

Residential conventional cooking product manufacturers stated that they did not anticipate any capacity constraints at the proposed standards, TSL 2. Some manufacturers stated that any standard requiring induction heating technology for all electric smooth element cooking tops would present a very difficult standard to meet since only around 3 percent of the existing electric smooth element cooking tops use induction technology. Manufacturers stated that converting 97 percent of their electric smooth element cooking tops in the 3-year compliance window would present a significant challenge since the production of induction heating cooking tops differs significantly from current cooking top production. However, DOE is not proposing to set efficiency standards that would require manufacturers to use induction technology. Therefore, DOE does not anticipate a manufacturer capacity constraint at TSL 2, the proposed standard.

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

d. Impacts on Subgroups 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 of this SNOPR. DOE also identified the commercial-style manufacturer subgroup as a potential manufacturer subgroup that could be adversely impacted by this rulemaking based on the results of the industry characterization.

The commercial-style manufacturer subgroup consists of cooking product manufacturers that primarily sell gas cooking tops, gas ovens, and electric self-clean ovens marketed as commercial-style, either as a standalone product or as a component of a conventional range. Commercial-style gas cooking tops typically have heavy cast iron grates that act as an additional thermal load and up to six high input rate burners that contribute to reduced cooking top efficiency. No commercial-style manufacturers sell electric coil element cooking tops and the subgroup would be unaffected by any standard required for this product class. However, some, but not all, commercial-style manufacturers produce electric smooth element cooking tops. Of those commercial-style manufacturers that do produce electric smooth element cooking tops, all have products that use induction technology that would be capable of meeting max-tech for this product class. Commercial-style electric and gas ovens typically have cavities with thick gauge cavity walls and heavier racks that result in inherently lower efficiencies as compared to residential-style ovens with comparable cavities sizes, due to the greater thermal mass of the cavity and racks, when measured by the previous DOE test procedure DOE assumes that the commercial-style manufacturer subgroup is primarily impacted by the proposed energy conservation standards required for the gas cooking top, gas oven, and electric self-clean oven product classes and are not significantly impacted by the standards proposed for the electrical cooking top and the electric standard oven product classes.

For the gas cooking top product class, EL 1 represents DOE's estimate of the most efficient cooking top available on the market with cast-iron grates and six burners, at least four of which are high input rate, which are features associated with gas cooking tops marketed as commercial-style. Commercial-style manufacturers would not be able to meet a gas cooking top standard set at EL 2 or EL 3 while retaining the full functionality of a commercial-style product. Therefore, these commercial-style manufacturers would likely be forced to exit the gas cooking top market as a result of gas cooking top standards set at EL 2 or EL 3. TSL 3 and TSL 4 require EL 3 for the gas cooking top product class.

For the gas oven and electric self-clean oven product classes, TSL 2 represents a prescriptive design requirement for the oven control systems that would maintain features associated with ovens marketed as commercial-style, such as thick gauge cavity walls and heavier extension racks. Commercial-style manufacturers would not be able to meet a performance-based standard for ovens set at a TSL higher than TSL 2 while retaining the full functionality of their commercial-style product. Therefore, these commercial-style manufacturers would be likely forced to exit the conventional oven market as a result of conventional oven standards set above TSL 2.

DOE requests comment on the two manufacturer subgroups that DOE identified, the impacts of the proposed standards on those manufacturer subgroups, and any other potential manufacturer subgroups that could be disproportionally impacted by this rulemaking.

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 the 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.

As discussed in section II.B.2 of this SNOPR, DOE published a separate NOPR proposing energy conservation standards for conventional ovens. 80 FR 33030 (June 10, 2015). AHAM and Electrolux commented in response to the June 2015 NOPR that DOE's proposal to bifurcate standards for cooking tops and ovens means that conventional ranges, a single product which makes up over 80 percent of conventional cooking product shipments, could be subject to two different standards on two different timelines. AHAM and Electrolux stated that DOE's proposal to promulgate separate standards for cooking tops and ovens on two separate timelines would likely result in two product redesigns and dual investments for conventional ranges. AHAM added that this would potentially mean unnecessary increased costs for both manufacturers and consumers. AHAM and Electrolux commented that manufacturers will be likely left with stranded investments and unnecessary additional investments. (AHAM, No. 29 at pp. 2, 3, 10; Electrolux, No. 27 at p. 2)

Whirlpool agreed with AHAM's comments and opposed DOE's proposal to pursue energy conservation standards for cooking tops on a different regulatory timeline than standards for ovens. Whirlpool noted that along with potentially imposing dual product redesigns and investments for conventional ranges, manufacturers may also choose to redesign these products together and launch models to the market in advance of the lagging standard compliance date in order to meet both standards; the net effect of this is a shortened lead-in period for the product tied to the lagging standard. Whirlpool urged DOE to reconsider its proposal and align regulatory timelines for ovens and cooking tops to prevent unnecessary and substantial regulatory burden on industry. (Whirlpool, No. 33 at pp. 3, 4, 8)

DOE recognizes that combined cooking products that include both a conventional cooking top and oven (*e.g.,* conventional ranges) may be assembled on a single assembly line in manufacturing production facilities. DOE also notes that some components and parts (*e.g.,* cabinet housing, controls) may be shared between the oven and cooking top portion of the combined cooking product. DOE recognizes that setting standards with different compliance dates for ovens and cooking tops could result in the need for manufacturers to redesign the oven and cooking top portions of combined cooking products (including shared components and assembly lines) separately on different timelines. As discussed in section II.B.2 of this SNOPR, DOE is now combining the rulemaking to consider energy conservation standards for conventional cooking tops and ovens and will align the compliance dates for both product categories.

Manufacturers also commented that conventional electric ranges are facing an additional redesign in the same time period in order to comply with a recent change to UL 858. That change to the voluntary safety standard will require conventional electric ranges, a combined cooking product covered by this rule, to monitor pan bottom temperature and is aimed at reducing the incidences of unattended cooking fires. Manufacturers noted that the change to UL 858 would likely occur just before the compliance date of new and amended residential conventional cooking product standards. Manufacturers added that changes to comply with the requirements in UL 858 to significantly reduce surface temperatures during a prescribed baking operation may also impact the measured efficiency for these products. Manufacturers further explained that the changes in UL 858 will require a major redesign for all electric coil cooking tops by every manufacturer.

DOE acknowledges that most residential conventional cooking product manufacturers also make appliances that are or could be subject to future energy conservation standards implemented by DOE. DOE looks at these regulations that could affect residential conventional cooking product manufacturers that will take effect approximately 3 years before or after the estimated 2019 compliance date of new and amended energy conservation standards for residential conventional cooking products. These energy conservation standards include those for microwave ovens with a compliance date in 2016,[87] commercial refrigeration equipment with a compliance date in 2017,[88] commercial clothes washers with a compliance date in 2018,[89] residential clothes washers with a compliance date in 2018,[90] furnace fans with a compliance date in 2019,[91] dehumidifiers with a compliance date in 2019,[92] and dishwashers with a potential compliance date in 2019.[93]

The compliance years and expected industry conversion costs of relevant new and amended energy conservation standards are indicated in Table V.41.

TABLE V.41—COMPLIANCE DATES AND EXPECTED CONVERSION EXPENSES OF FEDERAL ENERGY CONSERVATION STANDARDS AFFECTING CONVENTIONAL COOKING PRODUCT MANUFACTURERS

Regulation	Number of manufacturers *	Number of manufacturers from today's rule **	Approximate standards year	Industry conversion costs (millions $)	Industry conversion costs/revenue *** (%)
Microwave Ovens, 78 FR 36316 (Jun. 17, 2013)	12	7	2016	43.1(2011$)	<1
Commercial Refrigeration Equipment, 79 FR 17726 (Mar. 28, 2014).	54	3	2017	184 (2012$)	2.0
Residential Clothes Washers, 77 FR 32308 (May 31, 2012).	16	10	2018 (Second Round)	418.5 (2010$)	1.4
Commercial Clothes Washers, 79 FR 74492 (Dec. 15, 2014).	6	4	2018	10.2 (2013$)	2.2
Furnace Fans, 79 FR 38130 (Jul. 3, 2014)	27	1	2019	40.6 (2012$)	1.6
Dehumidifiers, 81 FR 38338 (Jun. 13, 2016)	25	4	2019	52.5 (2014$)	4.5
Dishwashers (NOPR) †, 79 FR 76142 (Dec. 19, 2014).	18	13	2019	316.9 (2013$)	5.6

* This column presents the total number of manufacturers identified in the energy conservation standard rule contributing to cumulative regulatory burden.

** This column presents the number of manufacturers producing residential conventional cooking products that are also listed as manufacturers in the listed energy conservation standard contributing to cumulative regulatory burden.

*** This column presents conversion costs as a percentage of cumulative revenue for the industry during the conversion period. The conversion period is the timeframe over which manufacturers must make conversion costs investments and lasts from the announcement year of the final rule to the standards year of the final rule. This period typically ranges from 3 to 5 years, depending on the energy conservation standard.

[87] Energy conservation standards final rule for microwave ovens. 78 FR 36316 (June 17, 2013).

[88] Energy conservation standards final rule for commercial refrigeration equipment. 79 FR 17726 (March 28, 2014).

[89] Energy conservation standards final rule for commercial clothes washers. 79 FR 74492 (December 15, 2014).

[90] Energy conservation standards direct final rule for residential clothes washers. 77 FR 32308 (May 31, 2012).

[91] Energy conservation standards final rule for furnace fans. 79 FR 38130 (July 3, 2014).

[92] Energy conservation standards final rule for dehumidifiers. 81 FR 38338 (June 13, 2016).

[93] Energy conservation standards NOPR for dishwashers. 79 FR 76142 (December 19, 2014).

† The final rule for this energy conservation standard has not been published. The compliance date and analysis of conversion costs have not been finalized at this time. Values in this row are estimates for the standard level proposed in the NOPR.

DOE discusses these and other requirements and includes the full details of the cumulative regulatory burden analysis in Chapter 12 of the SNOPR TSD. DOE will continue to evaluate its approach to assessing cumulative regulatory burden for use in future rulemakings to ensure that it is effectively capturing the overlapping impacts of its regulations. In particular, DOE will assess whether looking at rules where any portion of the compliance period potentially overlaps with the compliance period for the subject rulemaking would yield a more accurate reflection of cumulative regulatory burden.

DOE seeks comment on the compliance costs of any other regulations residential conventional cooking product manufacturers must follow, especially if compliance with those regulations is required three years before or after the estimated compliance date of this proposed standard (2019). Additionally, DOE welcomes comment on how it analyzes and considers cumulative regulatory burden.

3. National Impact Analysis

a. Significance of Energy Savings

To estimate the energy savings attributable to potential standards for conventional cooking products, DOE compared the energy consumption of those products under the no-new-standards case to their anticipated energy consumption under each TSL. The savings are measured over the entire lifetime of products purchased in the 30-year period that begins in the year of anticipated compliance with amended standards (2019–2048). Table V.42 presents DOE's projections of the national energy savings for each TSL considered for conventional cooking products. The savings were calculated using the approach described in section IV.H of this SNOPR.

TABLE V.42—CONVENTIONAL COOKING PRODUCTS: CUMULATIVE NATIONAL ENERGY SAVINGS FOR PRODUCTS SHIPPED IN 2019–2048

[Quads]

Product type	Energy savings	Trial standard level			
		1	2	3	4
Conventional Cooking Tops	Primary energy	0.22	0.31	0.48	0.70
	FFC energy	0.23	0.33	0.52	0.75
Conventional Ovens	Primary energy	0.17	0.41	0.47	1.05
	FFC energy	0.18	0.43	0.50	1.10
TOTAL (All Products)	Primary energy	0.39	0.72	0.95	1.75
	FFC energy	0.41	0.76	1.01	1.85

OMB Circular A–4 [94] 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 9-year period is a proxy for the timeline in EPCA for the review of certain energy conservation standards and potential revision of and compliance with such revised standards.[95] The review timeframe established in EPCA is generally not synchronized with the product lifetime, product manufacturing cycles, or other factors specific to conventional cooking products. Thus, such results are presented for informational purposes only and are not indicative of any change in DOE's analytical methodology. The NES sensitivity analysis results based on a 9-year analytical period are presented in Table V.43. The impacts are counted over the lifetime of conventional cooking products purchased in 2019–2027.

TABLE V.43—CONVENTIONAL COOKING PRODUCTS: CUMULATIVE NATIONAL ENERGY SAVINGS FOR PRODUCTS SHIPPED IN 2019–2027

[Quads]

Product type	Energy savings	Trial standard level			
		1	2	3	4
Conventional Cooking Tops	Primary energy	0.06	0.08	0.13	0.20
	FFC energy	0.06	0.09	0.14	0.21
Conventional Ovens	Primary energy	0.05	0.12	0.14	0.30
	FFC energy	0.05	0.12	0.14	0.32

[94] 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/*).

[95] Section 325(m) of EPCA requires DOE to review its standards at least once every 6 years, and requires, for certain products, a 3-year period after any new standard is promulgated before compliance is required, except that in no case may any new standards be required within 6 years of the compliance date of the previous standards. While adding a 6-year review to the 3-year compliance period adds up to 9 years, DOE notes that it may undertake reviews at any time within the 6 year period and that the 3-year compliance date may yield to the 6-year backstop. A 9-year analysis period may not be appropriate given the variability that occurs in the timing of standards reviews and the fact that for some consumer products, the compliance period is 5 years rather than 3 years.

TABLE V.43—CONVENTIONAL COOKING PRODUCTS: CUMULATIVE NATIONAL ENERGY SAVINGS FOR PRODUCTS SHIPPED IN 2019–2027—Continued

[Quads]

Product type	Energy savings	Trial standard level			
		1	2	3	4
TOTAL (All Products)	Primary energy	0.11	0.20	0.27	0.50
	FFC energy	0.11	0.21	0.28	0.53

a. 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 cooking products. In accordance with the OMB's guidelines on regulatory analysis (OMB Circular A–4, section E, September 17, 2003),[96] DOE calculated NPV using both a 7-percent and a 3-percent real discount rate. Table V.44 shows the consumer NPV results for each TSL DOE considered for conventional cooking products. The impacts are counted over the lifetime of products purchased in 2019–2048.

TABLE V.44—CONVENTIONAL COOKING PRODUCTS: CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR PRODUCTS SHIPPED IN 2019–2048

Equipment type	Discount rate (%)	Billion 2015$			
		Trial standard level			
		1	2	3	4*
Conventional Cooking Tops	3	1.97	2.39	3.62	(13.00)
	7	0.85	0.99	1.54	(8.22)
Conventional Ovens	3	1.55	3.85	2.66	1.10
	7	0.69	1.73	0.96	(0.72)
TOTAL (All Products)	3	3.52	6.24	6.28	(11.91)
	7	1.53	2.72	2.50	(8.94)

*Parentheses indicate negative (−) values.

The NPV results based on the aforementioned 9-year analytical period are presented in Table V.45. 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.45—CONVENTIONAL COOKING PRODUCTS: CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR PRODUCTS SHIPPED IN 2019–2027

Equipment type	Discount rate	Billion 2015$			
		Trial standard level			
		1	2	3	4*
Conventional Cooking Tops	3	0.66	0.78	1.17	(4.78)
	7	0.40	0.45	0.69	(4.03)
Conventional Ovens	3	0.54	1.35	0.87	0.12
	7	0.33	0.83	0.42	(0.50)
TOTAL (All Products)	3	1.20	2.13	2.04	(4.66)
	7	0.73	1.28	1.12	(4.54)

* Parentheses indicate negative (−) values.

The above results reflect the use of a default trend to estimate the change in price for conventional cooking products over the analysis period (see section IV.F.1 of this SNOPR). 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 SNOPR 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.

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

b. Impacts on Employment

DOE expects energy conservation standards for conventional cooking products 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 SNOPR, 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 SNOPR 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 SNOPR, DOE concluded that the standards proposed in this SNOPR would not reduce the utility or performance of the conventional cooking products 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 SNOPR 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 (costs) of energy production. Reduced electricity demand due to energy conservation standards is also likely to reduce the cost of maintaining the reliability of the electricity system, particularly during peak-load periods. As a measure of this reduced demand, chapter 15 in the SNOPR TSD presents the estimated reduction in generating capacity, relative to the no-new-standards case, for the TSLs that DOE considered in this rulemaking.

Energy conservation resulting from proposed standards for conventional cooking products are expected to yield environmental benefits in the form of reduced emissions of air pollutants and greenhouse gases. Table V.46 provides DOE's estimate of cumulative emissions reductions to result from the TSLs considered in this rulemaking. The table includes site emissions, power sector emissions and upstream emissions. The emissions were calculated using the multipliers discussed in section IV.K of this SNOPR. DOE reports annual emissions reductions for each TSL in chapter 13 of the SNOPR TSD.

TABLE V.46—CONVENTIONAL COOKING PRODUCTS: CUMULATIVE EMISSIONS REDUCTION FOR PRODUCTS SHIPPED IN 2019–2048

	Trial standard level			
	1	2	3	4
Power Sector and Site Emissions				
CO_2 (*million metric tons*)	23.0	42.6	54.7	102.3
SO_2 (*thousand tons*)	13.7	23.2	24.2	52.4
NO_X (*thousand tons*)	25.4	48.1	64.9	117.4
Hg (*tons*)	0.05	0.09	0.09	0.19
CH_4 (*thousand tons*)	2.0	3.4	3.8	7.8
N_2O (thousand tons)	0.28	0.48	0.52	1.09
Upstream Emissions				
CO_2 (*million metric tons*)	1.3	2.7	4.3	7.0
SO_2 (*thousand tons*)	0.2	0.4	0.4	0.9
NO_X (*thousand tons*)	18.6	39.8	65.7	104.2
Hg (*tons*)	0.00	0.00	0.00	0.00
CH_4 (*thousand tons*)	102.5	224.1	378.5	591.1
N_2O (thousand tons)	0.01	0.02	0.02	0.05
Total FFC Emissions				
CO_2 (*million metric tons*)	24.3	45.3	59.1	109.3
SO_2 (*thousand tons*)	13.9	23.6	24.6	53.3
NO_X (*thousand tons*)	43.9	88.0	130.6	221.6
Hg (*tons*)	0.05	0.09	0.09	0.20
CH_4 (*thousand tons*)	104.5	227.5	382.2	598.9
CH_4 (thousand *tons CO_2eq*)*	2,926	6,369	10,703	16,769
N_2O (thousand tons)	0.29	0.50	0.54	1.14

TABLE V.46—CONVENTIONAL COOKING PRODUCTS: CUMULATIVE EMISSIONS REDUCTION FOR PRODUCTS SHIPPED IN 2019–2048—Continued

	Trial standard level			
	1	2	3	4
N_2O (*thousand tons CO_2eq*)*	76.8	132.6	144.3	302.9

* CO_2eq 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 for conventional cooking products. As discussed in section IV.L of this SNOPR, for CO_2, DOE used the most recent values for the SCC developed by an interagency working group. The four sets of SCC values for CO_2 emissions reductions resulting from that process refer to the average value from a distribution that uses a 5-percent discount rate, the average value from a distribution that uses a 3-percent discount rate, the average value from a distribution that uses a 2.5-percent discount rate, and the 95th-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.47 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 SNOPR TSD.

TABLE V.47—CONVENTIONAL COOKING PRODUCTS: ESTIMATES OF GLOBAL PRESENT VALUE OF CO_2 EMISSIONS REDUCTION FOR PRODUCTS SHIPPED IN 2019–2048

TSL	Million 2015$			
	SCC Case			
	5% discount rate, average	3% discount rate, average	2.5% discount rate, average	3% discount rate, 95th percentile
Power Sector and Site Emissions				
1	166	751	1,190	2,289
2	312	1,405	2,222	4,279
3	400	1,805	2,856	5,498
4	742	3,354	5,311	10,219
Upstream Emissions				
1	9.2	41.9	66.6	128
2	19.6	88.9	141	271
3	31.5	142	226	434
4	50.4	229	363	699
Total FFC Emissions				
1	175	793	1,257	2,417
2	331	1,494	2,363	4,550
3	432	1,947	3,081	5,933
4	792	3,584	5,674	10,917

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 cooking products. The dollar-per-ton values that DOE used are discussed in section IV.L of this SNOPR. Table V.48 presents the cumulative present values for each TSL calculated using 7-percent and 3-percent discount rates. This table presents values that use the low dollar-per-ton values, which reflect DOE's primary estimate. Results that reflect the range of NO_X dollar-per-ton values are presented in Table V.50.

TABLE V.48—CONVENTIONAL COOKING PRODUCTS: ESTIMATES OF PRESENT VALUE OF NO_X EMISSIONS REDUCTION FOR PRODUCTS SHIPPED IN 2019–2048

TSL	Million 2015$	
	3% discount rate	7% discount rate
Power Sector and Site Emissions		
1	48.1	20.3
2	109.5	47.0
3	189.7	80.9
4	288.9	122.7
Upstream Emissions		
1	35.3	14.5
2	77.5	32.7
3	128.6	54.7
4	201.4	84.6
Total FFC Emissions		
1	83.4	34.9
2	187.0	79.7
3	318.3	135.6
4	490.4	207.3

7. Other Factors

The Secretary of Energy, in determining whether a standard is economically justified, may consider any other factors that the Secretary deems to be relevant. (42 U.S.C. 6295(o)(2)(B)(i)(VII)) No other factors were considered in this analysis.

8. Summary of National Economic Impacts

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.49 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 2015 values in the four sets of SCC values discussed above.

TABLE V.49—CONVENTIONAL COOKING PRODUCTS: NET PRESENT VALUE OF CONSUMER SAVINGS COMBINED WITH PRESENT VALUE OF MONETIZED BENEFITS FROM CO_2 AND NO_X EMISSIONS REDUCTIONS

[Billion 2015 $]

TSL	Consumer NPV at 3% discount rate added with:			
	SCC case $12.4/t and 3% low NO_X values	SCC case $40.6/t and 3% low NO_X values	SCC case $63.2/t and 3% low NO_X values	SCC case $118/t and 3% low NO_X values
1	3.8	4.4	4.9	6.0
2	6.8	7.9	8.8	11.0
3	7.0	8.5	9.7	12.5
4	(10.6)	(7.8)	(5.7)	(0.5)
TSL	Consumer NPV at 7% discount rate added with:			
	SCC case $12.4/t and 7% low NO_X values	SCC case $40.6/t and 7% low NO_X values	SCC case $63.2/t and 7% low NO_X values	SCC case $118/t and 7% low NO_X values
1	1.7	2.4	2.8	4.0
2	3.1	4.3	5.2	7.3
3	3.1	4.6	5.7	8.6
4	(7.9)	(5.1)	(3.1)	2.2

Note: The SCC case values represent the global SCC in 2015, in 2015$, for each case.

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,[97] the SCC values in future years reflect future climate-related impacts resulting from the emission of CO_2 that continue well beyond 2100.

C. Conclusion

When considering new or amended energy conservation standards that DOE adopts for any type or class of covered product, they 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)) The new or amended standard must also result in a significant conservation of energy. (42 U.S.C. 6295(o)(3)(B))

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

To aid the reader as DOE discusses the benefits and/or burdens of each 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 SNOPR 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 SNOPR 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.[98]

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.[99] 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 Cooking Products

Table V.51 summarize the quantitative impacts estimated for each TSL for conventional cooking products. The national impacts are measured over the lifetime of conventional cooking products purchased in the 30-year period that begins in the anticipated year of compliance with amended standards (2019–2048). The energy savings, emissions reductions, and value of emissions reductions refer to full-fuel-cycle results. The efficiency levels contained in each TSL are described in section V.A of this SNOPR.

[97] 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.

[98] P.C. Reiss and M.W. White. Household Electricity Demand, Revisited. *Review of Economic Studies* (2005) 72, 853–883.

[99] 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.50—CONVENTIONAL COOKING PRODUCTS: SUMMARY OF NATIONAL IMPACTS

Category	TSL 1	TSL 2	TSL 3	TSL 4
Cumulative FFC Energy Savings (quads)				
	0.41	0.76	1.01	1.85
NPV of Consumer Costs and Benefits (2015$ billion)				
3% discount rate	$3.52	$6.24	$6.28	($11.91).
7% discount rate	1.53	2.72	2.50	(8.94).
Cumulative FFC Emissions Reduction				
CO_2 *million metric tons*	24.3	45.3	59.1	109.
SO_2 *thousand tons*	13.9	23.6	24.6	53.3.
NO_X *thousand tons*	43.9	88.0	131	222.
Hg *tons*	0.05	0.09	0.09	0.20.
CH_4 *thousand tons*	104	227	382	599.
CH_4 *thousand tons CO_2eq**	2,926	6,369	10,703	16,769.
N_2O *thousand tons*	0.29	0.50	0.54	1.14.
N_2O *thousand tons CO_2eq**	76.8	133	144	303.
Value of Emissions Reduction				
CO_2 *2015$ million***	175 to 2,417	331 to 4,550	432 to 5,933	792 to 10,917.
NO_X—3% discount rate *2015$ million*	83.4 to 190.2	187.0 to 426.3	318.3 to 725.7	490.4 to 1,118.0.
NO_X—7% discount rate *2015$ million*	34.9 to 78.7	79.7 to 179.7	135.6 to 305.7	207.3 to 467.4.

Parentheses indicate negative (−) values.
* CO_2eq 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.51—CONVENTIONAL COOKING PRODUCTS: SUMMARY OF MANUFACTURER AND CONSUMER IMPACTS

Category	TSL 1	TSL 2	TSL 3	TSL 4
Manufacturer Impacts				
Industry NPV (2015$ million) (*No-New-Standards Case INPV = $1,238.1*)	1,198.3–1,200.1	1,148.5–1,156.7	844.7–868.0	314.6–511.1
Industry NPV *(% change)**	(3.2)–(3.1)	(7.2)–(6.6)	(31.8)–(29.9)	(74.6)–(58.7)
Consumer Average LCC Savings (2015$)				
PC1: Electric Open (Coil) Element Cooking Tops	$0.00	$2.87	$2.87	$2.87
PC2: Electric Smooth Element Cooking Tops *	24.37	24.37	24.37	(280.82)
PC3: Gas Cooking Tops	0.00	1.10	15.83	15.83
PC4: Electric Standard Ovens, Free-Standing *	5.93	5.93	10.23	(30.82)
PC5: Electric Standard Ovens, Built-in/Slide-in *	5.96	5.96	10.23	(30.83)
PC6: Electric Self-Clean Ovens, Free-Standing *	7.04	7.04	7.04	(17.19)
PC7: Electric Self-Clean Ovens, Built-in/Slide-in *	7.08	7.08	7.08	(17.21)
PC8: Gas Standard Ovens, Free-Standing	7.60	43.64	9.77	9.77
PC9: Gas Standard Ovens, Built-In/Slide-In	7.60	43.65	9.77	9.77
PC10: Gas Self-Cleaning Ovens, Free-Standing	7.73	48.03	20.27	20.27
PC11: Gas Self-Cleaning Ovens, Built-In/Slide-In	7.73	48.05	20.27	20.27
Consumer Simple PBP (years)				
PC1: Electric Open (Coil) Element Cooking Tops	....	0.5	0.5	0.5
PC2: Electric Smooth Element Cooking Tops	1.0	1.0	1.0	61.9
PC3: Gas Cooking Tops	....	9.1	4.4	4.4
PC4: Electric Standard Ovens, Free-Standing	0.9	0.9	4.7	17.1
PC5: Electric Standard Ovens, Built-in/Slide-in	0.9	0.9	4.7	17.1
PC6: Electric Self-Clean Ovens, Free-Standing	0.9	0.9	0.9	16.2
PC7: Electric Self-Clean Ovens, Built-in/Slide-in	0.9	0.9	0.9	16.2
PC8: Gas Standard Ovens, Free-Standing	0.6	1.1	6.0	6.0
PC9: Gas Standard Ovens, Built-In/Slide-In	0.6	1.1	6.0	6.0
Built-In/Slide-In				
PC10: Gas Self-Cleaning Ovens, Free-Standing	0.7	1.1	5.3	5.3
PC11: Gas Self-Cleaning Ovens, Built-In/Slide-In	0.7	1.1	5.3	5.3

TABLE V.51—CONVENTIONAL COOKING PRODUCTS: SUMMARY OF MANUFACTURER AND CONSUMER IMPACTS—Continued

Category	TSL 1	TSL 2	TSL 3	TSL 4
% of Consumers That Experience Net Cost				
PC1: Electric Open (Coil) Element Cooking Tops	0	19	19	19
PC2: Electric Smooth Element Cooking Tops	0	0	0	98
PC3: Gas Cooking Tops	0	14	6	6
PC4: Electric Standard Ovens, Free-Standing	0	0	20	80
PC5: Electric Standard Ovens, Built-in/Slide-in	0	0	20	80
PC6: Electric Self-Clean Ovens, Free-Standing	0	0	0	72
PC7: Electric Self-Clean Ovens, Built-in/Slide-in	0	0	0	72
PC8: Gas Standard Ovens, Free-Standing	0	0	61	61
PC9: Gas Standard Ovens, Built-In/Slide-In	0	0	61	61
PC10: Gas Self-Cleaning Ovens, Free-Standing	0	0	49	49
PC11: Gas Self-Cleaning Ovens, Built-In/Slide-In	0	0	49	49

* Parentheses indicate negative (−) values.

DOE first considered TSL 4, which represents the max-tech efficiency levels. TSL 4 would save 1.85 quads of energy, an amount DOE considers significant. Under TSL 4, the NPV of consumer benefit would be negative 8.94 billion using a discount rate of 7 percent, and negative 11.91billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 4 are 109 Mt of CO_2, 222 thousand tons of NO_X, 53.3 thousand tons of SO_2, 0.20 ton of Hg, 599 thousand tons of CH_4, and 1.14 thousand tons of N_2O. The estimated monetary value of the CO_2 emissions reduction at TSL 4 ranges from $792 million to $10,917 million.

At TSL 4, the average LCC impact ranges from a loss of $280.82 for PC2 (Electric Smooth Element Cooking Tops) to a savings of $15.83 for PC3 (Gas Cooking Tops). The simple payback period ranges from 0.5 years for PC1 (Electric Open Element Cooking Tops) to 61.9 years for PC2 (Electric Smooth Element Cooking Tops). The fraction of consumers experiencing an LCC net cost ranges from 6 percent for PC3 (Gas Cooking Tops) to 98 percent for PC2 (Electric Smooth Element Cooking Tops).

DOE notes that the reduction in IAEC at TSL 4 could result in the unavailability of certain product types, specifically commercial-style cooking tops that incorporate certain features that may be expected by purchasers of such products, *e.g.,* heavier cast iron grates to support larger loads and high input rate burners to provide faster cooking times for larger loads. Because it is uncertain how greatly consumers value these product types, DOE is concerned that TSL 4 may result in the unavailability of certain product types for PC3 (Gas Cooking Tops). In addition, as discussed in section III.B, DOE recognizes that there may be uncertainty in conducting the standards analysis and analyzing energy savings from performance standards for conventional ovens based on efficiency levels using the oven test procedure adopted in the July 2015 TP Final Rule, which DOE is now proposing to repeal due to concerns whether the test procedure accurately reflects the energy use of all product types.

At TSL 4, the projected change in INPV ranges from a decrease of $923.6 million to a decrease of $727.1 million, equivalent to a loss of 74.6 percent and a loss of 58.7 percent, respectively.

Products that meet the efficiency standards specified by TSL 4 are forecast to represent 13 percent of shipments in the year leading up to new and amended standards. As such, manufacturers would have to redesign nearly all products by the 2019 compliance date to meet demand. Redesigning all units to meet max-tech would require considerable capital and product conversion expenditures. At TSL 4, DOE estimates capital conversion costs would total $580.2 million and product conversion costs would total $525.4 million. Total capital and product conversion costs associated with the changes in products and manufacturing facilities required at TSL 4 would require significant use of manufacturers' financial reserves and would significantly reduce manufacturer INPV. Additionally, manufacturers are more likely to reduce their margins to maintain a price-competitive product at higher TSLs, so DOE expects that TSL 4 would yield impacts closer to the most severe range of INPV impacts. If the most severe range of impacts is reached, as DOE expects could happen, TSL 4 could result in a net loss of 74.6 percent in INPV to residential conventional cooking product manufacturers. As a result, at TSL 4, DOE expects that some companies could be forced to exit the residential conventional cooking product market or shift production abroad, both of which would negatively impact domestic manufacturing capacity and employment. The commercial-style manufacturer subgroup, which primarily produces gas cooking products that are marketed as commercial-style, would not be able to meet the gas cooking product standards required at this TSL and would likely be forced to exit the gas cooking product market, which could negatively impact domestic employment.

In view of the foregoing, DOE has tentatively concluded that, at TSL 4 for conventional cooking products, the benefits of energy savings, positive NPV of total customer benefits, customer LCC savings for six of the eleven product classes, emission reductions and the estimated monetary value of the emissions reductions would be outweighed by the negative customer impacts for product classes 2, 4, 5, 6 and 7 (Electric Smooth Element Cooking Tops and all Electric Ovens), the potential burden on consumers from the unavailability of certain product types for PC3 (Gas Cooking Tops), the uncertainty of performance-based standards for PC4 through PC11 (Conventional Ovens) since DOE is proposing to repeal its conventional oven test procedure, the significant reduction in industry value at TSL 4, as well as the potential for loss of domestic manufacturing. Consequently, DOE has tentatively concluded that TSL 4 is not economically justified.

DOE then considered TSL 3, which comprises efficiency levels providing maximum NES with positive NPV. TSL 3 would save 1.01 quads of energy, an amount DOE considers significant. Under TSL 3, the NPV of consumer benefit would be $2.50 billion using a discount rate of 7 percent, and $6.28 billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 3 are 59.1 Mt of CO_2, 131 thousand tons of NO_X, 24.6 thousand tons of SO_2, 0.09 ton of Hg, 382 thousand tons of CH_4, and 0.54 thousand tons of N_2O. The estimated monetary value of the CO_2 emissions reduction at TSL 3 ranges from $432 million to $5,933 million.

At TSL 3, the average LCC impact is a savings ranging from $2.87 for PC1 (Electric Coil Cooking Tops) to $24.37 for PC2 (Electric Smooth Element Cooking Tops). The simple payback period ranges from 0.5 years for PC1 (Electric Open Element Cooking Tops) to 6.0 years for Gas Standard Ovens. The fraction of consumers experiencing an LCC net cost ranges from zero percent for PC2, PC6, and PC7 (Electric Smooth Element Cooking Tops, and all Electric Self-Clean Ovens) to 61 percent for all Gas Standard Ovens.

As described for TSL 4, the reduction in IAEC at TSL 3 could also result in a lack in the availability of commercial-style cooking tops that incorporate certain features that may be expected by purchasers of such products, *e.g.,* heavier cast iron grates to support larger loads and high input rate burners to provide faster cooking times for larger loads. DOE is concerned that TSL 3 may also result in the unavailability of certain product types for PC3 (Gas Cooking Tops). In addition, as discussed in section III.B, DOE recognizes that there may be uncertainty in conducting the standards analysis and analyzing energy savings from performance standards for conventional ovens based on efficiency levels using the oven test procedure adopted in the July 2015 TP Final Rule, which DOE is now proposing to repeal due to concerns whether the test procedure accurately reflects the energy use of all product types.

At TSL 3, the projected change in INPV ranges from a decrease of $393.5 million to a decrease of $370.1 million, equivalent to a loss of 31.8 percent and a loss of 29.9 percent, respectively.

Products that meet the efficiency standards specified by TSL 3 are forecast to represent 30 percent of shipments in the year leading up to new and amended standards. As such, manufacturers would have to redesign a large portion of products by the 2019 compliance date to meet demand. Redesigning the majority of units to meet efficiency requirements at TSL 3 would require considerable capital and product conversion expenditures. At TSL 3, DOE estimates capital conversion costs would total $248.2 million and product conversion costs would total $261.8 million. 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 and would significantly reduce manufacturer INPV. As a result, at TSL 3, DOE expects that some companies could be forced to exit the residential conventional cooking product market or shift production abroad, both of which would negatively impact domestic manufacturing capacity and employment. The commercial-style manufacturer subgroup, which primarily produces gas cooking products that are marketed as commercial-style, would not be able to meet the gas cooking product standards required at this TSL and would likely be forced to exit the gas cooking product market, which could negatively impact domestic employment.

In view of the foregoing, DOE has tentatively concluded that, at TSL 3 for conventional cooking products, the benefits of energy savings, positive NPV of total customer benefits, customer LCC savings for all the product classes, emission reductions and the estimated monetary value of the emissions reductions would be outweighed by the negative customer impacts for product classes 8 through 11 (all Gas Ovens), the potential burden on consumers from the unavailability of certain product types for PC3 (Gas Cooking Tops), the uncertainty of performance-based standards for PC4 through PC11 (Conventional Ovens) since DOE has proposed to repeal its conventional oven test procedure, the significant reduction in industry value at TSL 3, as well as the potential for loss of domestic manufacturing. Consequently, DOE has tentatively concluded that TSL 3 is not economically justified.

DOE then considered TSL 2. TSL 2 includes the prescriptive standards for conventional ovens and represents a level between TSL 1 and TSL 3 that does not eliminate commercial-style cooking tops from the market and yields an NPV greater than TSL 1. TSL 2 would save 0.76 quads of energy, an amount DOE considers significant. Under TSL 2, the NPV of consumer benefit is $2.72 billion using a discount rate of 7 percent, and $6.24 billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 2 are 45.3 Mt of CO_2, 88.0 thousand tons of NO_X, 23.6 thousand tons of SO_2, 0.09 tons of Hg, 227 thousand tons of CH_4, and 0.50 thousand tons of N_2O. The estimated monetary value of the CO_2 emissions reduction at TSL 3 ranges from $331 million to $4,550 million.

At TSL 2, the average LCC impact is a savings ranging from $1.10 for PC3 (Gas Cooking Tops) to $48.05 for PC11 (Gas Self-Cleaning Ovens, Built-in/Slide-in). The simple payback period ranges from 0.5 years for PC1 (Electric Open Element Cooking Tops) to 9.1 years for PC3 (Gas Cooking Tops). The fraction of consumers experiencing a LCC net cost ranges from zero percent for PC2 and PC4 through PC11 (Electric Smooth Element Cooking Tops, and all Electric and Gas Ovens) to 19 percent for PC1 (Electric Open Element Cooking Tops).

At TSL 2, the projected change in INPV ranges from a decrease of $89.6 million to a decrease of $81.4 million, equivalent to a loss of 7.2 percent and a loss of 6.6 percent, respectively. Products that meet the efficiency standards specified by this TSL are forecast to represent 49 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 $47.9 million in capital conversion costs and would require manufacturers to make an estimated $71.3 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. The substantial reduction in conversion costs corresponding to compliance with TSL 2, compared to compliance with TSL 3 and TSL 4, greatly mitigates the operational risk and impact on manufacturer INPV.

DOE estimates that the reduction in IAEC due to a performance standard under TSL 2 for PC3 (Gas Cooking Tops) would not result in the unavailability of certain product types and features. Specifically, the commercial-style gas cooking tops that may be lost under TSL 3 would be retained at TSL 2. Based on DOE's testing, as presented in section IV.C.2 of this SNOPR, commercial-style gas cooking tops are available on the market that meet the proposed efficiency level under TSL 2.

Additionally, because TSL 2 is composed of prescriptive requirements for conventional ovens, the industry would not face the costs associated with complying with performance requirements for these product classes. TSL 2 would require conventional gas ovens to be equipped with a control system that uses intermittent/interrupted ignition or intermittent pilot ignition and does not use a linear power supply. For conventional electric ovens, TSL 2 would require that conventional electric ovens not be equipped with a control system that uses a linear power supply. Current prescriptive standards for conventional gas cooking products require that gas cooking products with or without an electrical supply cord not be equipped with a constant burning pilot. As a result, conventional cooking product manufacturers are not currently subject to the costs of testing the rated performance of their products to label and comply with performance-based energy conservation standards. By maintaining prescriptive standards at TSL 2, DOE avoids burdening manufacturers of conventional ovens with testing, labeling, and compliance costs that they currently do not bear. As discussed in section III.B of this SNOPR, the prescriptive standards for conventional ovens that are proposed under TSL 2 would also avoid the issues with uncertainty in measured energy use values for different oven product types, particularly since DOE is proposing to repeal the oven test procedure.

After considering the analysis and weighing the benefits and burdens, the Secretary tentatively concludes that at TSL 2 for residential conventional cooking products, 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. Although TSL 2 could result in a reduction in INPV for manufacturers, DOE has concluded that it would not place a significant burden on manufacturers to comply with the standards in terms of changes to existing manufacturing processes and certification testing. Accordingly, the Secretary has tentatively concluded that TSL 2 would offer the maximum improvement in efficiency that is technologically feasible and economically justified, and would result in significant conservation of energy.

Therefore, based on the above considerations, DOE proposes TSL 2 for conventional cooking products. The proposed energy conservation standards for conventional cooking tops are shown in Table V.52. As discussed in section IV.C.3 in this SNOPR, the efficiency levels analyzed in this SNOPR are based, in part, on DOE's testing of products in its test sample. DOE recognizes that manufacturers implement different heating element or burner designs and welcomes additional test data regarding the proposed standard levels.

TABLE V.52—PROPOSED AMENDED ENERGY CONSERVATION STANDARDS FOR CONVENTIONAL COOKING TOPS

[Compliance date: January 1, 2019]

Product class	Integrated annual energy consumption (IAEC) (kWh/year)
Electric Open (Coil) Element Cooking Tops	113.2
Electric Smooth Element Cooking Tops	121.2
Gas Cooking Tops	924.4

For conventional ovens, the proposed standards at TSL 2 correspond to a prescriptive design requirement for the control system of the oven. DOE is proposing to require that conventional electric ovens not be equipped with a control system that uses a linear power supply. DOE is also proposing that conventional gas ovens be equipped with a control system that uses an intermittent/interrupted ignition or intermittent pilot ignition and does not use a linear power supply. DOE also notes that the current prescriptive standards for conventional gas ovens prohibiting constant burning pilot lights would continue to be applicable. (10 CFR 430.32(j)).

2. Summary of Annualized Benefits and Costs of the Proposed Standards

The benefits and costs of the proposed standards can also be expressed in terms of annualized values. The annualized net benefit is the sum of (1) the annualized national economic value (expressed in 2015$) of the benefits from operating products that meet the proposed standards (consisting primarily of operating cost savings from using less energy, minus increases in product purchase costs, which is another way of representing consumer NPV), and (2) the monetary value of the benefits of CO_2 and NO_X emission reductions.[100]

Table V.53 shows the annualized values for conventional cooking products under TSL 2, expressed in 2015$. 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 $40.6/ton in 2015 (in 2015$), the cost of the standards for conventional cooking products in today's rule is $42.6 million per year in increased equipment costs, while the annualized benefits are $293 million per year in reduced equipment operating costs, $80.8 million in CO_2 reductions, and $7.4 million in reduced NO_X emissions. In this case, the net benefit amounts to $339 million per year. Using a 3-percent discount rate for all benefits and costs and the SCC series corresponding to a value of $40.6/ton in 2015 (in 2015$), the cost of the standards for conventional cooking products in today's rule is $42.3 million per year in increased equipment costs, while the benefits are $380 million per year in reduced operating costs, $80.8 million in CO_2 reductions, and $10.1 million in reduced NO_X emissions. In this case, the net benefit amounts to $429 million per year.

[100] To convert the time-series of costs and benefits into annualized values, DOE calculated a present value in 2015, 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 2015. 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.

TABLE V.53—ANNUALIZED BENEFITS AND COSTS OF PROPOSED AMENDED STANDARDS (TSL 2) FOR CONVENTIONAL COOKING PRODUCTS SOLD IN 2019–2048

	Discount rate	Primary estimate*	Low net benefits estimate*	High net benefits estimate*
Benefits				
Consumer Operating Cost Savings	7%	293	262	332.
	3%	380	336	439.
CO_2 Reduction at $12.4/t **	5%	23.8	21.7	26.5.
CO_2 Reduction at $40.6/t **	3%	80.8	73.6	90.5.
CO_2 Reduction at $63.2/t **	2.5%	118.6	107.9	132.8.
CO_2 Reduction at $118/t **	3%	246.3	224.1	275.6.
NO_X Reduction Value †	7%	7.4	6.8	18.2.
	3%	10.1	9.2	25.6.
Total Benefits ††	7% plus CO_2 range	325 to 547	290 to 493	377 to 626.
	7%	382	342	441.
	3% plus CO_2 range	414 to 637	367 to 569	491 to 740.
	3%	471	418	555.
Costs				
Consumer Incremental Product Costs	7%	42.6	41.6	45.3.
	3%	42.3	41.3	45.2.
Total †	7% plus CO_2 range	282 to 504	249 to 451	332 to 581.
	7%	339	301	396.
	3% plus CO_2 range	372 to 594	325 to 528	446 to 695.
	3%	429	377	510.

* This table presents the annualized costs and benefits associated with cooking products shipped in 2019–2048. Note that the benefits and costs may not exactly sum to the net benefits due to rounding. These results include benefits 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 the 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* Reference case, Low Economic Growth case, and High Economic Growth case, 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 in the High Benefits Estimate. The methods used to derive projected price trends are explained in section IV.F.1 of this SNOPR.

** The CO_2 values represent global monetized values of the SCC, in 2015$, 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 95th percentile of the SCC distribution calculated using a 3% discount rate. The SCC time series incorporate an escalation factor.

† DOE estimated the monetized value of NO_X emissions reductions associated with electricity savings using benefit per ton estimates from the *Regulatory Impact Analysis for the Clean Power Plan Final Rule,* published in August 2015 by EPA's Office of Air Quality Planning and Standards. (Available at: *http://www.epa.gov/cleanpowerplan/clean-power-plan-final-rule-regulatory-impact-analysis.)* See section IV.L.2 of this SNOPR for further discussion. For DOE's Primary Estimate and Low Net Benefits Estimate, the agency used a national benefit-per-ton estimate for NO_X emitted from the Electric Generating Unit sector based on an estimate of premature mortality derived from the ACS study (Krewski *et al.,* 2009). For DOE's High Net Benefits Estimate, the benefit-per-ton estimates were based on the Six Cities study (Lepuele *et al.,* 2011), which are nearly two-and-a-half times larger than those from the ACS study.

†† Total Benefits for both the 3% and 7% cases are derived using the series corresponding to the average SCC with a 3-percent discount rate ($40.6/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.

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 products. 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.

The Administrator of the Office of Information and Regulatory Affairs (OIRA) in the OMB has determined that the proposed regulatory action is a significant regulatory action under section (3)(f) of Executive Order 12866. Accordingly, pursuant to section 6(a)(3)(B) of the Order, DOE has provided to OIRA: (i) The text of the draft regulatory action, together with a reasonably detailed description of the need for the regulatory action and an explanation of how the regulatory action will meet that need; and (ii) An assessment of the potential costs and benefits of the regulatory action, including an explanation of the manner in which the regulatory action is consistent with a statutory mandate. DOE has included these documents in the rulemaking record.

In addition, DOE has determined that this regulatory action is an ''economically significant regulatory action'' under Executive Order 12866. Accordingly, pursuant to section 6(a)(3)(C) of the Order, DOE has provided to OIRA an assessment, including the underlying analysis, of benefits and costs anticipated from the regulatory action, together with, to the extent feasible, a quantification of those costs; and an assessment, including the underlying analysis, of costs and benefits of potentially effective and reasonably feasible alternatives to the planned regulation, and an explanation why the planned regulatory action is preferable to the identified potential alternatives. These assessments 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, OIRA has emphasized that such techniques may include identifying changing future compliance costs that might result from technological innovation or anticipated behavioral changes. For the reasons stated in the preamble, DOE believes that this SNOPR 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 Web site (*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 cooking products, the SBA has set a size threshold, which defines those entities classified as ''small businesses'' for the purposes of the statute. DOE used the small business size standards published by SBA to determine whether any small entities would be required to comply with this rule. *The* size standards are 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 cooking products manufacturing is classified under NAICS 335221, ''Household Cooking Appliance Manufacturing.'' The SBA sets a threshold of 1,500 employees or fewer for an entity to be considered a small business for this category.

DOE reviewed the potential standard levels considered in this SNOPR 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 businesses of products covered by this rulemaking. During its market survey, DOE used available public information to identify potential small businesses. DOE's research involved industry trade association membership directories (*e.g.,* AHAM), information from previous rulemakings, individual company Web sites, and market research tools (*e.g.,* Hoover's reports) to create a list of companies that manufacture or sell residential conventional cooking products covered by this rulemaking.

TABLE VI.1—SOURCES USED TO IDENTIFY RESIDENTIAL CONVENTIONAL COOKING PRODUCT BUSINESSES

Source	Number of large businesses identified	Number of small businesses identified
AHAM Trade Association Directory	9	2
Previous Rulemaking	2	4
Market Research	0	4
Total	11	10

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

DOE identified 21 companies that either manufacture or sell residential conventional cooking products that would be affected by this proposal. Of these 21 companies, DOE identified 10 that met the SBA's definition of a small business. However, DOE believes that only eight of these 10 small businesses actually manufacture the products they sell. The other two are rebranders and do not manufacture the products they sell.

b. Manufacturer Participation

DOE contacted identified businesses to invite them to take part in a manufacturer impact analysis interview. DOE contacted all 10 potential small businesses to participate in manufacturer interviews. DOE was able to reach and discuss potential standards with two small businesses. DOE also obtained information about small businesses and potential impacts on small businesses while interviewing large manufacturers.

c. Residential Conventional Cooking Product Industry Structure and Nature of Competition

Three major manufacturers supply approximately 85 percent of the market for residential conventional cooking products. None of the three major manufacturers of residential conventional cooking products affected by this rulemaking is a small business. DOE estimates that the remaining 15 percent of the market is served by a combination of 10 small businesses and eight large businesses, not counting the three major manufacturers.

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 compared to large manufacturers.

2. Description and Estimate of Compliance Requirements

DOE discovered that small businesses can be divided into two groups; (1) small manufacturers, that manufacture their products; and (2) rebranders, that label already-manufactured products under their company name. Even though small businesses that re-label already-manufactured products may experience slightly higher unit costs, DOE does not anticipate this rulemaking having a significant effect on these businesses, since these rebranders are not responsible for the conversion costs associated with the proposed standards.

There are two types of small businesses responsible for manufacturing the products they sell; niche small manufacturers and premium small manufacturers. Niche small manufacturers typically produce inexpensive cooking products in non-conventional sizes for unique applications. They typically do not compete with large manufacturers due to the lower sales volumes associated with these non-conventional sizes and unique applications. In order to comply with the proposed oven standards, several niche small manufacturers would need to purchase SMPS for their ovens. However, since this is a purchased part, DOE does not anticipate a significant impact to these manufacturers due to the proposed standards for ovens. For cooking tops, most niche small manufacturers use lighter metal grates in their cooking tops that are more efficient and would already meet the proposed standards for cooking tops.

Premium small manufacturers sell premium cooking products that typically do not compete in the market place on price. These products can be significantly more expensive than the mass volume cooking products that large manufacturers typically sell. Most premium small manufacturers already use switch mode power supplies in their ovens and would not be significantly impacted by the proposed standards for ovens. While some premium manufacturers would have to redesign their cooking tops to meet the proposed standards, there are premium cooking tops on the market that are able to meet these standards while still retaining their premium quality.

At TSL 2, the level proposed in this SNOPR, DOE estimates capital conversion costs of $1.5 million and product conversion costs of $4.0 million for an average small manufacturer. This brings the total conversion costs to approximately $5.5 million for an average small manufacturer. Based on publicly available information from online sources such as Hoovers,[101] Cortera,[102] and Glassdoor,[103] DOE estimates the average annual revenue of a small manufacturer to be approximately $161.5 million. Table VI.2 presents the estimated conversion costs as a percentage of annual revenue for an average small manufacturer.

[101] See: *http://www.hoovers.com/.*

[102] See: *https://www.cortera.com/.*

[103] See: *https://www.glassdoor.com/.*

TABLE VI.2—CONVERSION COSTS AS A PERCENTAGE OF ANNUAL REVENUE FOR AN AVERAGE SMALL MANUFACTURER OF RESIDENTIAL CONVENTIONAL COOKING PRODUCTS

	Annual revenue (millions 2014$)	Conversion costs (millions 2014$)	Conversion costs as a percentage of annual revenue
Average Small Manufacturer	$161.5	$5.5	3.4

Since the proposed standards could impact up to eight small manufacturers' level of investment and profitability, 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, including small rebranders and small manufacturers.

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 the proposed standards. In reviewing alternatives to the proposed rule, DOE examined energy conservation standards set at higher and lower efficiency levels, TSL 4, TSL 3, and TSL 1. DOE estimates that for an average small manufacturer, conversion costs would be 86.8 percent lower at TSL 2 ($5.5 million) compared to the conversion costs at TSL 4 ($41.8 million) and would be 75.5 percent lower at TSL 2 ($5.5 million) compared to the conversion costs at TSL 3 ($22.6 million). The substantial reduction in small manufacturer conversion costs corresponding to TSL 2 compared to TSL 4 and TSL 3 greatly mitigates the operational risk and the impact of the standards on small manufacturer's profitability.

While TSL 1 would reduce the impacts on small businesses, it would come at the expense of a significant reduction in energy savings and NPV benefits to consumers, achieving 29 percent lower energy savings and 36 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 products manufacturers, including small businesses. Accordingly, DOE is declining to adopt one of the other TSLs, or the other policy alternatives detailed as part of the regulatory impacts analysis included in chapter 17 of the SNOPR TSD.

Additional compliance flexibilities may be available through other means. For example EPCA provides that a manufacturer whose annual gross revenue from all of its operations does not exceed $8 million may apply for an exemption from all or part of an energy conservation standard for a period not longer than 24 months after the effective date of a final rule establishing the standards. (42 U.S.C. 6295(t)) DOE estimates that three of the nine 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.B of this SNOPR 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. DOE requested OMB approval of an extension of this information collection for 3 years, specifically including the collection of information proposed in the present rulemaking, and estimated that the annual number of burden hours under this extension is 30 hours per company. In response to DOE's request, OMB approved DOE's information collection requirements covered under OMB control number 1910–1400 through November 30, 2017. 80 FR 5099 (Jan. 30, 2015).

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 App. 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; (3) provide a clear legal standard for affected conduct rather than a general standard; and (4) promote simplification and burden reduction. 61 FR 4729 (Feb. 7, 1996). Regarding the review required by section 3(a), section 3(b) of 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. Public Law 104–4, sec. 201 (codified at 2 U.S.C. 1531). For a proposed regulatory action likely to result in a rule that may cause the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector of $100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish a written statement that estimates the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a), (b)) The UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal governments on a proposed ''significant intergovernmental mandate,'' and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect 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 in any one year by the private sector. 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.

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 this SNOPR 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. As required by 42 U.S.C. 6295(d), (f), and (o), 6313(e), and 6316(a), this proposed rule would establish new and amended 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

Pursuant to Executive Order 12630, ''Governmental Actions and Interference with Constitutionally Protected Property Rights'' 53 FR 8859 (Mar. 18, 1988), DOE has determined 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 information quality guidelines established by each agency pursuant to general guidelines issued by OMB. OMB's guidelines were published at 67 FR 8452 (Feb. 22, 2002), and DOE's guidelines were published at 67 FR 62446 (Oct. 7, 2002). DOE has reviewed the SNOPR 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. Submission of Comments

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

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

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

Do not submit to *www.regulations.gov* information for which disclosure is restricted by statute, such as trade secrets and commercial or financial information (hereinafter referred to as Confidential Business Information (CBI)). Comments submitted through *www.regulations.gov* cannot be claimed as CBI. Comments received through the Web site 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 *www.regulations.gov* before posting. Normally, comments will be posted within a few days of being submitted. However, if large volumes of comments are being processed simultaneously, your comment may not be viewable for up to several weeks. Please keep the comment tracking number that *www.regulations.gov* provides after you have successfully uploaded your comment.

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

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

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

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

Confidential Business Information. Pursuant to 10 CFR 1004.11, any person submitting information that he or she believes to be confidential and exempt by law from public disclosure should submit via email, 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 that 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).

B. 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 welcomes comments on whether there are products currently available on the market that would meet DOE's definition of a conventional oven, but that could not be tested according to the DOE test procedures adopted in adopted in the July 2015 TP Final Rule (see section III.A of this SNOPR).

2. DOE requests comment on the proposed product classes for residential conventional cooking products. DOE welcomes comment and data on the determination that conventional gas cooking products with higher input rates (*i.e.,* ''commercial-style'' products) do not warrant establishing a separate product class. DOE also requests comment on its conclusion that cooking efficiency for gas cooking tops is more closely related to burner and grate design rather than input rate *per se* (see section IV.A.2.a of this SNOPR).

3. DOE seeks comment the proposed determination to consider induction heating as a technology option for electric smooth cooking tops rather than as a separate product class. DOE noted that induction heating provides the same basic function of cooking or heating food as heating by gas flame or electric resistance and that the installation options available to consumers are also the same for both cooking products with induction and electric resistance heating. DOE also noted that the utility of speed of cooking, ease of cleaning, and requirements for specific cookware for induction cooking tops do not appear to be uniquely associated with higher energy use compared to other smooth cooking tops with electric resistance heating elements (see section IV.A.2.a of this SNOPR).

4. DOE requests comment on its determination to consider self-clean ovens as a separate product class and 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. DOE welcomes data on the effectiveness and frequency of consumer use of pyrolytic versus non-pyrolytic self-cleaning technologies (see section IV.A.2.b of this SNOPR).

5. DOE welcomes comment on whether improved contact conductance should be considered as a technology option, in particular information and data substantiating the claims that radiation acts like conduction at very short distances and the degree to which the heating element or cookware may deform and impact the heat transfer between the two surfaces (see section IV.A.3.a of this SNOPR).

6. DOE requests comment on the proposed definitions of the terms ''intermittent/interrupted ignition'' and ''intermittent pilot ignition'' (see section IV.A.3.b of this SNOPR).

7. DOE requests comment on whether a reduced vent rate should be considered a design option and whether a reduction in vent rate could be used to reduce the energy consumption of conventional electric standard ovens (see section IV.A.3.b of this SNOPR).

8. 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 tops, including design options that may not yet be found in the market (see section IV.B.2 of this SNOPR).

9. DOE requests comment on the proposed baseline and incremental efficiency levels. DOE specifically requests inputs and test data on the baseline efficiency levels and 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 SNOPR (see section IV.C.3 of this SNOPR).

10. 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 SNOPR (see section IV.C.4 of this SNOPR).

11. DOE seeks comment on the tentative determination that the proposed efficiency levels and design options would not impact the consumer utility of conventional cooking products (see section IV.C.5 of this SNOPR).

12. DOE requests comments on its repair cost estimation for gas ovens, as well as on its decision not to include changes in repair and maintenance costs for products more efficient than baseline products for electric cooking products (see section IV.F.5 of this SNOPR).

13. DOE requests comments on the use of a consumer choice model to establish the no-new standards case and standards case efficiency distribution for both electric and gas cooking products (see section of this IV.F.9 SNOPR)

14. DOE requests comments on it approach to developing the shipments forecast and the use of relevant data in the shipments analysis (see section IV.G of this SNOPR).

15. DOE requests comment on extending data it received from AHAM on the average lifetime for ovens to cooktop products as well, resulting in an average lifetime estimate for all gas ovens and cooktops of 13 years and all electric ovens and cooktops of 16 years (See section IV.F. 6).

16. 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 SNOPR).

17. To estimate the impact on shipments of the price increase for the considered efficiency levels, DOE determined that the new construction market will be inelastic to price changes and will not impact shipments, and any impact of the price increase would be on the replacement market. DOE welcomes input on the effect of new and amended standards on impacts across products within the same fuel class and equipment (see section IV.G of this SNOPR).

18. 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 document).

19. DOE requests comment on DOE's approach for estimating monetary benefits associated with emissions reductions (see section IV.L of this SNOPR).

20. DOE seeks comment on the use of 1.20 as a manufacturer markup for all residential conventional cooking products (see section IV.J.2 of this SNOPR).

21. DOE seeks comment on the potential domestic employment impacts to residential conventional cooking product manufacturers at the proposed efficiency levels (see section V.B.2 of this SNOPR).

22. DOE requests comment on any potential manufacturer capacity constraints caused by the proposed standards in this SNOPR, TSL 2 (see section V.B.2 of this SNOPR).

23. DOE requests comment on the two manufacturer subgroups that DOE identified, the impacts of the proposed standards on those manufacturer subgroups, and any other potential manufacturer subgroups that could be disproportionally impacted by this rulemaking (see section V.B.2 of this SNOPR).

24. DOE seeks comment on the compliance costs of any other regulations that residential conventional cooking product manufacturers may incur, especially if compliance with those regulations is required 3 years before or after the estimated compliance date of this proposed standard (2019) (see section V.B.2 of this SNOPR).

25. DOE requests comments on the number of small businesses identified and on the impacts of new and amended energy conservation standards on small businesses, including small rebranders and small manufacturers (see section VI.B of this SNOPR).

VIII. Approval of the Office of the Secretary

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

List of Subjects

10 CFR Part 429

Confidential business information, Energy conservation, Household appliances, Imports, Reporting and recordkeeping requirements.

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 August 16, 2016.

David Friedman,

Acting Assistant Secretary, Energy Efficiency and Renewable Energy.

For the reasons set forth in the preamble, DOE proposes to amend parts 429 and 430 of chapter II, subchapter D, of title 10 of the Code of Federal Regulations, as set forth below:

PART 429—CERTIFICATION, COMPLIANCE, AND ENFORCEMENT FOR CONSUMER PRODUCTS AND COMMERCIAL AND INDUSTRIAL EQUIPMENT

■ 1. The authority citation for part 429 continues to read as follows:

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

■ 2. Section 429.23 is revised to read as follows:

§ 429.23 Cooking products.

(a) *Sampling plan for selection of units for testing.* (1) The requirements of § 429.11 are applicable to cooking products; and

(2) For each basic model of cooking products a sample of sufficient size shall be randomly selected and tested to ensure that any represented value of estimated annual operating cost, standby mode power consumption, off mode power consumption, annual energy consumption, integrated annual energy consumption, or other measure of energy consumption of a basic model for which consumers would favor lower values shall be greater than or equal to the higher of:

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$$

and $\bar{x}$ is the sample mean; n is the number of samples; and x_i is the i^{th} sample;

Or,

(ii) The upper 97½ percent confidence limit (UCL) of the true mean divided by 1.05,

where:

$$UCL = \bar{x} + t_{.975}\left(\frac{s}{\sqrt{n}}\right)$$

And $\bar{x}$ is the sample mean; s is the sample standard deviation; n is the number of samples; and $t_{0.975}$ is the t statistic for a 97.5% one-tailed confidence interval with n-1 degrees of freedom (from Appendix A).

(b) *Certification reports.* (1) The requirements of § 429.12 are applicable to cooking products; and

(2) Pursuant to § 429.12(b)(13), a certification report shall include the following public product-specific information:

(i) Conventional gas cooking tops: The integrated annual energy consumption in thousand British thermal units per year (kBtu/yr);

(ii) Conventional electric cooking tops: The integrated annual energy consumption in thousand watt-hours per year (kWh/yr);

(iii) Conventional gas ovens: The type of gas ignition and power supply with a declaration that the manufacturer has incorporated the applicable design requirements;

(iv) Conventional electric ovens: The type of power supply with a declaration that the manufacturer has incorporated the applicable design requirements; and

(v) Microwave ovens: The average standby power in watts (W).

PART 430—ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS

■ 3. The authority citation for part 430 continues to read as follows:

Authority: 42 U.S.C. 6291–6309; 28 U.S.C. 2461 note.

■ 4. Section 430.2 is amended by adding definitions for ''intermittent/interrupted ignition'' and ''intermittent pilot ignition'' in alphabetical order to read as follows:

§ 430.2 Definitions.

* * * * *

Intermittent/interrupted ignition is an ignition source which is ignited or energized upon initiation of each main burner operational cycle and which is extinguished or no longer energized after the main burner is ignited.

Intermittent pilot ignition is an ignition source which, upon initiation of each main burner operational cycle, ignites a pilot that remains lit continuously during the main burner operational cycle and is extinguished when the main burner operational cycle is completed.

* * * * *

■ 5. 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) The control system of a conventional oven shall:

(i) Not be equipped with a constant burning pilot light for gas ovens manufactured on or after April 9, 2012;

(ii) Be equipped with an intermittent/interrupted ignition or intermittent pilot ignition for gas ovens manufactured on or after [*DATE 3 years after final rule* ***Federal Register*** *publication*]; and

(iii) Not be equipped with a linear power supply for electric and gas ovens manufactured on or after [*DATE 3 years after final rule* ***Federal Register*** *publication*].

(2) Conventional cooking tops manufactured on or after [*Date 3 years after final rule* ***Federal Register*** *publication*] shall have an integrated annual energy consumption no greater than:

Product class	Maximum Integrated Annual Energy Consumption (IAEC) (kWh/yr)
Electric Open (Coil) Element Cooking Tops	113.2
Electric Smooth Element Cooking Tops	121.2
Gas Cooking Tops	924.4

(3) 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.

* * * * *

[FR Doc. 2016–20721 Filed 9–1–16; 8:45 am]

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