[6450-01-P]

DEPARTMENT OF ENERGY

10 CFR Part 430

EERE–2014–BT–STD–0005

RIN 1904–AD15

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

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

ACTION: Notification of proposed determination and request for comment.

SUMMARY: The Energy Policy and Conservation Act, as amended ("EPCA"), prescribes energy conservation standards for various consumer products and certain commercial and industrial equipment, including consumer conventional cooking products. EPCA also requires the U.S. Department of Energy ("DOE") to periodically determine whether more-stringent standards would be technologically feasible and economically justified, and would result in significant energy savings. In this notification of proposed determination ("NOPD"), DOE has initially determined that amended energy conservation standards for consumer conventional cooking products would not be economically justified and would not result in a significant conservation of energy. DOE requests comment on this proposed determination and the associated analyses and results.

DATES: *Meeting*: DOE will hold a webinar on Thursday, January 28, 2021, from 11:00 a.m. to 4:00 p.m. See section V, "Public Participation," for webinar registration information, participant instructions, and information about the capabilities available to webinar participants.

Comments: Written comments and information are requested and will be accepted on or before **[INSERT DATE 75 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]**.

ADDRESSES: Interested persons are encouraged to submit comments using the Federal eRulemaking Portal at *http://www.regulations.gov*. Follow the instructions for submitting comments. Alternatively, interested persons may submit comments, identified by docket number EERE-2014-BT-STD-0005, by any of the following methods:

1) *Federal eRulemaking Portal*: *http://www.regulations.gov*. Follow the instructions for submitting comments.
2) *Email*: *ApplianceStandardsQuestions@ee.doe.gov*. Include the docket number EERE-2014-BT-STD-0005 in the subject line of the message.
3) *Postal Mail*: Appliance and Equipment Standards Program, U.S. Department of Energy, Building Technologies Office, Mailstop EE-5B, 1000 Independence Avenue, SW., Washington, DC, 20585-0121. Telephone: (202) 287-1445. If possible, please submit all items on a compact disc ("CD"), in which case it is not necessary to include printed copies.

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

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

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

The docket web page can be found at *http://www.regulations.gov/#!docketDetail;D=EERE-2014-BT-STD-0005*. The docket web page contains instructions on how to access all documents, including public comments, in the docket. See section VII, "Public Participation," for information on how to submit comments through *http://www.regulations.gov*.

FOR FURTHER INFORMATION CONTACT:

Dr. Stephanie Johnson, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Office, EE-5B, 1000 Independence Avenue, SW., Washington, DC, 20585-0121. Telephone: (202) 287-1943. E-mail: *ApplianceStandardsQuestions@ee.doe.gov*.

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

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

SUPPLEMENTARY INFORMATION:

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I. Synopsis of the Proposed Determination

Title III, Part B[1] of EPCA[2], established the Energy Conservation Program for Consumer Products Other Than Automobiles. (42 U.S.C. 6291–6309) These products include consumer conventional cooking products, and specifically conventional cooking tops[3] and conventional ovens,[4] the subject of this NOPD. (42 U.S.C. 6292(a)(10))

DOE is issuing this NOPD pursuant to the EPCA requirement that not later than 6 years after issuance of any final rule establishing or amending a standard, DOE must publish either a notification of determination that standards for the product do not need to be amended, or a notice of proposed rulemaking ("NOPR") including new proposed energy conservation standards (proceeding to a final rule, as appropriate). (42 U.S.C. 6295(m)) Pursuant to the 6-year look-back provision, DOE proposed energy conservation standards for conventional cooking tops. 80 FR 33030 (June 10, 2015); 81 FR 60784 (Sep. 2, 2016). Based on additional analysis and review of comments received, DOE is publishing this proposed determination that establishing new and amended standards for conventional cooking products, including conventional cooking

[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 America's Water Infrastructure Act of 2018, Public Law 115-270 (Oct. 23, 2018).
[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. This includes any conventional cooking top component of a combined cooking product. (10 CFR 430.2)
[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. This includes any conventional oven(s) component of a combined cooking product. (10 CFR 430.2)

tops, is not needed because standards would not be economically justified and would not result in a significant conservation of energy.

For this proposed determination, DOE analyzed consumer conventional cooking products, including those subject to standards specified in 10 CFR 430.32(j)(1)–(2).

DOE first analyzed the technological feasibility of more energy efficient consumer conventional cooking products. For those consumer conventional cooking products for which DOE determined higher standards to be technologically feasible, DOE estimated energy savings that would result from potential energy conservation standards by conducting a national impacts analysis ("NIA"). DOE then evaluated whether higher standards would be economically justified pursuant to the seven factors specified in EPCA.

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

II. Introduction

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

A. Authority

EPCA authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment. Title III, Part B of EPCA established the Energy Conservation Program for Consumer Products Other Than Automobiles. These products include consumer conventional cooking products, and specifically consumer conventional cooking tops and conventional ovens, the subject of this document. (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 future rulemakings to determine whether to amend these standards. (42 U.S.C. 6295(h)(2))

The energy conservation program under EPCA consists essentially of four parts: (1) testing, (2) labeling, (3) the establishment of Federal energy conservation standards, and (4) certification and enforcement procedures. Relevant provisions of EPCA specifically include definitions (42 U.S.C. 6291), test procedures (42 U.S.C. 6293), labeling provisions (42 U.S.C. 6294), energy conservation standards (42 U.S.C. 6295), and the authority to require information and reports from manufacturers (42 U.S.C. 6296).

Subject to certain criteria and conditions, DOE is required to develop test procedures to measure the energy efficiency, energy use, or estimated annual operating cost of each covered product. (42 U.S.C. 6295(o)(3)(A) and 42 U.S.C. 6295(r)) Manufacturers of covered products must use the prescribed DOE test procedure as the basis for certifying to DOE that their products comply with the applicable energy conservation standards adopted under EPCA and when making representations to the public regarding the energy use or efficiency of those products. (42 U.S.C. 6293(c) and 42 U.S.C. 6295(s)) Similarly, DOE must use these test procedures to determine whether the products comply with standards adopted pursuant to EPCA. (42 U.S.C. 6295(s)) The DOE test procedures for consumer conventional cooking products were established in title 10 of the Code of Federal Regulations ("CFR") part 430, subpart B, appendix I ("Appendix I"). However, as discussed further in section III.B of this document, the test procedures for the conventional cooking products that are the subject of this proposed determination have been withdrawn.

Federal energy conservation standards for covered products 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 in 42 U.S.C. 6297(d).

DOE must follow specific statutory criteria for prescribing new or amended standards for covered products, including consumer conventional cooking products. In prescribing new or amended standards for covered products DOE must consider, among other things, the opportunity for energy savings, as well as the potential costs to consumers, and impacts on consumer choice. 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 if DOE determines by rule that the standard is not technologically feasible or economically justified. (42 U.S.C. 6295(o)(3)(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 standard;
3) The total projected amount of energy (or as applicable, water) savings likely to result directly from imposition of the standard;
4) Any lessening of the utility or the performance of the covered products likely to result from 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 establishes a rebuttable presumption that a standard is economically justified if the Secretary finds that the additional cost to the consumer of purchasing a product complying with an energy conservation standard level will be less than three times the value of the energy savings during the first year that the consumer will receive as a result of the standard, as calculated under the applicable test procedure. (42 U.S.C. 6295(o)(2)(B)(iii))

EPCA 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 in any covered product type (or class) of performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially the same as those generally available in the United States. (42 U.S.C. 6295(o)(4))

EPCA specifies requirements when promulgating an energy conservation standard for 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 such a feature and other factors DOE deems appropriate. *Id*. Any rule prescribing such a standard must include an explanation of the basis on which such higher or lower level was established. (42 U.S.C. 6295(q)(2))

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 a single standard, or, if that is not feasible, adopt a separate standard for such energy use for that product. (42 U.S.C. 6295(gg)(3)(A)–(B)) Although DOE currently does not have test procedures for consumer conventional cooking products,[5] previous versions of Appendix I addressed standby mode and off mode energy use. In the absence of a test procedure, in this analysis DOE considers energy use as measured under the previous test procedure Appendix I in its determination of whether energy conservation standards need to be amended.

DOE must periodically review its already established energy conservation standards for a covered product no later than 6 years from the issuance of a final rule establishing or amending a standard for a covered product. (42 U.S.C. 6295(m)) This 6-year look-back provision requires that DOE publish either a determination that standards do not need to be amended or a NOPR, including new proposed standards (proceeding to

[5] *See* 85 FR 50757 (August 18, 2020).

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

A determination that amended standards are not needed must be based on consideration of whether amended standards will result in significant conservation of energy, are technologically feasible, and are cost effective. (42 U.S.C. 6295(m)(1)(A) and 42 U.S.C. 6295(n)(2)) Additionally, as discussed above, any new or amended energy conservation standard prescribed by the Secretary for any type (or class) of covered product shall be designed to achieve the maximum improvement in energy efficiency which the Secretary determines is technologically feasible and economically justified. 42 U.S.C. 6295(o)(2(A) Among the factors DOE considers in evaluating whether a proposed level is economically justified includes whether the proposed standard at that level is cost effective, as defined under 42 U.S.C. 6295(o)(2)(B)(i)(II). Under 42 U.S.C. 6295(o)(2)(B)(i)(II), an evaluation of cost-effectiveness requires DOE to consider savings in operating costs throughout the estimated average life of the covered products in the type (or class) compared to any increase in the price, initial charges, or maintenance expenses for the covered products that are likely to result from the standard. (42 U.S.C. 6295(n)(2) and 42 U.S.C. 6295(o)(2)(B)(i)(II))

DOE is publishing this NOPD in satisfaction of the requirements under EPCA.

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 consumer 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. 74 FR 16040. DOE's regulations, codified at 10 CFR 430.2, define conventional cooking tops and conventional ovens as categories of cooking products. As noted in the April 2009 Final Rule, DOE specified conventional cooking tops and conventional ovens as separate categories of cooking products, 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 Consumer 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. (42 U.S.C. 6295(h)(1)) 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)(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. 63 FR 48038. In addition, partially due to the difficulty of conclusively demonstrating at that time 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, 48039–48040. For the second cycle of rulemakings, DOE published the April 2009 Final Rule amending the energy conservation standards for consumer 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, 16085.[6]

As noted, EPCA requires that, not later than 6 years after the issuance of a final rule establishing or amending a standard, DOE publish a NOPR proposing new standards or a notification of determination that the existing standards do not need to be amended. (42 U.S.C. 6295(m)(1)) 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. 79 FR 8337. As part of the RFI, DOE sought input from the public to assist with its determination on whether new or amended standards pertaining to

[6] 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.

consumer conventional cooking products are warranted. 79 FR 8337, 8339. 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(m)(1)(B) and 42 U.S.C. 6295(o)(3)(B))

On June 10, 2015, DOE published a NOPR (the "June 2015 NOPR") proposing new and amended energy conservation standards for consumer 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, D.C. 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. 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.

Prior to the June 2015 NOPR, DOE issued two notices requesting comment on the test procedures for cooking products. In both the test procedure NOPR published on January 30, 2013 (78 FR 6232, the "January 2013 TP NOPR") and the supplemental test procedure NOPR 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) ("July 2015 TP Final Rule"). Test procedures for cooking tops were again proposed, as discussed in section III.B of this document, in an SNOPR on August 22, 2016. (81 FR 57374, the "August 2016 TP SNOPR"). Subsequently a final rule was published on December 16, 2016 (the "December 2016 TP Final Rule") adopting amended test procedures for conventional cooking tops that include, among other things, test methods for induction cooking tops and gas cooking tops with high burner input rates. 81 FR 91418. This rule was subsequently withdrawn on August 18, 2020 as a result of a petition from the Association of Home Appliance Manufacturers ("AHAM"). As discussed in more detail in section III.B of this document, DOE withdrew the December 2016 TP Final Rule because it could not be certain that the results of the conventional cooking tops test procedure were accurate.

On September 2, 2016, prior to the now withdrawn test procedure amendments being adopted in the December 2016 TP Final Rule, DOE published in the *Federal Register* an SNOPR (the "September 2016 SNOPR") proposing new and amended energy conservation standards for conventional cooking tops based on the amendments to the test procedure as proposed in the August 2016 TP SNOPR. 81 FR 60784. In the September 2016 SNOPR, DOE also revised its proposal from the June 2015 NOPR for conventional ovens from a performance-based standard to a prescriptive standard given that DOE had proposed to repeal the test procedure for conventional ovens in the August 2016 TP SNOPR. 81 FR 60784, 60793–60794. (The repeal of the test procedure for conventional ovens is discussed in greater detail in section III.B of this document.) In response to the September 2016 SNOPR, DOE received a number of comments from interested parties and considered these comments in preparing this NOPD. The commenters are summarized in Table II-1. Relevant comments, and DOE's responses, are provided in the appropriate sections of this document.

Table II-1 Interested Parties Providing Comments on the September 2016 SNOPR

Name	Acronyms	Commenter Type*
Appliance Standards Awareness Project, Alliance to Save Energy, Consumer Federation of America, Natural Resources Defense Council ("NRDC"), Northwest Energy Efficiency Alliance, and Northwest Power and Conservation Council	The Joint Commenters	EA
American Gas Association, American Public Gas Association	AGA, AGPA	UR
Association of Home Appliance Manufacturers	AHAM	TA
Environmental Defense Fund; Union of Concerned Scientists; Jayni Hein**; Peter H. Howard**; NRDC; Richard L. Revesz**; Jason A. Schwartz**	The Joint Advocates	EA
Felix Storch, Inc.	Felix Storch	M
GE Appliances, a Haier Company†	GE	M
Miele, Inc.	Miele	M
Pacific Gas and Electric, San Diego Gas and Electric, Southern California Edison	CA IOUs	U
Southern California Gas Company, San Diego Gas and Electric, Southern California Edison	SoCal IOUs	U
Spire, Inc.	Spire	U
Sub-Zero Group, Inc.†	Sub-Zero	M
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, Association of Home Appliance Manufacturers, Brick Industry Association, Council of Industrial Boiler Owners, National Association of Home Builders, National Association of	The Associations	TA

Name	Acronyms	Commenter Type*
Manufacturers, National Lime Association, National Mining Association, National Oilseed Processors Association, Portland Cement Association		
Whirlpool Corporation†	Whirlpool	M

* EA: Efficiency Advocate; M: Manufacturer; TA: Trade Association; U: Utility; UR: Utility Representative.
** Institute for Policy Integrity, NYU School of Law; listed for identification purposes only and does not purport to present New York University School of Law's views, if any.
† GE, Sub-Zero, and Whirlpool supported the comments made by AHAM.

A parenthetical reference at the end of a comment quotation or paraphrase provides the location of the item in the public record.[7]

III. General Discussion

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

A. Product Classes and Scope of Coverage

When evaluating and establishing energy conservation standards, DOE divides covered products into product classes by the type of energy used or by capacity or other performance-related features that justify differing standards. In making a determination whether a performance-related feature justifies a different standard, DOE must consider

[7] The parenthetical reference provides a reference for information located in the docket of DOE's rulemaking to consider energy conservation standards for consumer conventional cooking products. (Docket No. EERE-2014-BT-STD-0005, which is maintained at *www.regulations.gov/#!docketDetail;D=EERE-2014-BT-STD-0005*). The references are arranged as follows: (commenter name, comment docket ID number, page of that document).

such factors as the utility of the feature to the consumer and other factors DOE determines are appropriate. (42 U.S.C. 6295(q))

As discussed in section II.A of this document, 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[8] and/or one or more heating compartments. 10 CFR 430.2.

DOE defines 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. (10 CFR part 430, subpart B, appendix I) In this analysis, DOE is not treating combined cooking products as a distinct product category and is not basing its product classes on such a category. Instead, DOE is evaluating 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, the cooking top and oven standards would continue to apply to the individual components of the combined cooking product.

As part of the 2009 standards rulemaking for consumer conventional cooking products, DOE did not consider energy conservation standards for consumer

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

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 per hour ("Btu/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 consumer 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.B of this document, DOE amended 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 91418 (Dec. 16, 2016). However, on August 18, 2020, as a result of a petition from AHAM and data received in response to that petition, DOE withdrew the conventional cooking top test procedure in Appendix I after determining that it was not representative of energy use or efficiency during an average use cycle and was overly burdensome to conduct. 85 FR 50757 ("August 2020 TP Final Rule"). DOE also repealed the conventional oven test procedure in the December 2016 TP Final Rule. See 81 FR 91418 (Dec. 16, 2016). In the absence of Federal test procedures to measure the energy use or energy efficiency of conventional cooking tops and conventional ovens, DOE is evaluating prescriptive design requirements for the control system of conventional electric smooth element cooking tops and conventional ovens, including commercial-style ovens with higher burner input rates. DOE would maintain the existing prescriptive design requirements for all conventional gas cooking products, noting 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 discussed in section IV.A.1 of this document, DOE is not proposing 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.

B. Test Procedure

EPCA sets forth generally applicable criteria and procedures for DOE's adoption and amendment of test procedures. (42 U.S.C. 6293) Manufacturers of covered products must use these test procedures to certify to DOE that their product complies with energy conservation standards and to quantify the efficiency of their product. (42 U.S.C. 6295(s) and 42 U.S.C. 6293(c)) DOE will finalize a test procedure establishing methodologies used to evaluate proposed energy conservation standards at least 180 days prior to publication of a NOPR proposing new or amended energy conservation standards. Section 8(d) of appendix A to 10 CFR part 430 subpart C ("Process Rule").

DOE established 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 consumer conventional cooking products established 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 consumer conventional cooking products were not used for compliance with any energy conservation standards because the standards to date have been design requirements; in addition, there is no EnergyGuide[9] 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 consumer 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 satisfied the EPCA requirement that DOE include measures

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

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))

The January 2013 TP NOPR proposed 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 specified at that time 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 the December 2014 TP SNOPR, DOE modified its proposal from the January 2013 TP NOPR in response to comments from interested parties 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.

As discussed in the June 2015 NOPR for conventional ovens, DOE received a significant number of comments raising issues with the repeatability and reproducibility of the proposed hybrid test block test method for cooking tops in response to the December 2014 TP SNOPR and in separate interviews conducted with consumer conventional cooking product manufacturers in February and March of 2015. 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 IEC Standard 60350-2 Edition 2, "Household electric appliances – Part 2: Hobs – Method for measuring performance"[10] ("IEC Standard 60350-2") for measuring the energy consumption of electric cooking tops. These manufacturers stated that the test methods in IEC Standard 60350-2 are compatible with all electric cooking top types, specify additional cookware diameters 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–

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

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).

DOE published the August 2016 TP SNOPR that proposed amendments to 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 proposed 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"[11] ("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 also proposed to extend the test methods provided in EN 60530-2:2013 to measure the energy consumption of gas cooking tops by correlating test equipment diameter to burner input rate, including input rates that exceed 14,000 Btu/h. 81 FR

[11] The test methods in EN 60350–2:2013 are based on the same test methods in the draft version of IEC 60350–2 available at the time of the December 2016 TP Final Rule. As noted in that final rule, based on the few comments received during the development of the draft, DOE expected that the IEC procedure, once finalized, would retain the same basic test method as contained in EN 60350–2:2013. 81 FR 91418, 91421 (Dec. 16, 2016).

57374, 57385–57386. In addition, DOE also proposed in the August 2016 TP SNOPR to include methods for both electric and gas cooking tops to calculate the annual energy consumption ("AEC") and integrated annual energy consumption ("IAEC") to account for the proposed water-heating test method. 81 FR 57374, 57387–57388.

In the August 2016 TP SNOPR, DOE proposed to repeal the conventional oven test procedure. DOE determined that the conventional oven test procedure may not accurately represent consumer use as it favors conventional ovens with low thermal mass and does not capture cooking performance-related benefits due to increased thermal mass of the oven cavity. 81 FR 57374, 57378–57379.

For the September 2016 SNOPR, DOE evaluated its proposed energy conservation standards for conventional cooking tops based on the proposed cooking top test procedure discussed above. 81 FR 60784, 60797 (Sept. 2, 2016). For conventional ovens, due to the uncertainties in analyzing a performance-based standard using oven testing provisions that DOE proposed to remove from the test procedure, as discussed above, DOE proposed in the September 2016 SNOPR prescriptive design requirements for the control system of conventional ovens. 81 FR 60784, 60794.

AHAM, AGA and APGA opposed consideration of proposed standards in the absence of a final test procedure, stating that the technological feasibility and economic justification of proposed standards can only be evaluated with a finalized test procedure. (AHAM, No. 53 at pp. 1–2; AHAM, No. 64 at p. 3; AGA and APGA, No. 68 at p. 2) AHAM, AGA and APGA asserted that 42 U.S.C. 6295(r) requires that test procedures are finalized in a sufficient period of time before energy conservation standards are proposed. (AHAM, No. 53 at pp. 1–2; AHAM, No. 64 at p. 3; AGA and APGA, No. 68 at p. 2) AHAM, AGA and APGA also argued that DOE has not followed section 7 of the then-current Process Improvement Rule, which stated that needed modifications to test procedures will be identified in consultation with experts and interested parties early in the screening stage of the standards development process and any necessary modifications will be proposed before issuance of an advanced notice of proposed rulemaking ("ANOPR") in the standards process. In addition, these commenters stated that the then-current Process Improvement Rule specified that final modified test procedures will be issued prior to the NOPR on proposed standards. (AHAM, No. 53 at pp. 2–3; AGA and APGA, No. 68 at p. 2)

AHAM, AGA and APGA asserted that, even with the 30-day extension, the comment period for the September 2016 SNOPR was inadequate for industry to analyze and provide meaningful comment on the impacts of the proposed standards given the uncertainty in the test procedure. AHAM added that it was particularly difficult to comment on the proposed standards because manufacturers do not regularly conduct energy tests because there is not a standard that requires them to do so. (AHAM, No. 52 at pp. 3–4; AHAM, No. 64 at p. 3; AGA and APGA, No. 68 at pp. 1–2)

AHAM reiterated the list of issues with the test procedure presented in its comments on the August 2016 TP SNOPR[12] concerning the repeatability and reproducibility of tests results. AHAM urged DOE to issue a notice of data availability and/or supplemental proposed test procedure with a 30- to 60-day comment period to

[12] AHAM's comment on the August 2016 TP SNOPR is available at: *https://www.regulations.gov/document?D=EERE-2012-BT-TP-0013-0030*.

address AHAM's comments on the test procedure. AHAM added that DOE should finalize the test procedure before proposing standards, and provide 180 days after finalizing the test procedure before closing the comment period on a proposed standard to provide sufficient time for manufacturers to test enough models to evaluate the potential impact of proposed standards. AHAM stated that if DOE does not, however, issue an additional SNOPR on the proposed standard, DOE should at minimum explain how any additional changes to the test procedure impact the proposed standards and provide interested parties with an additional 60 days to comment on the proposed standards. (AHAM, No. 53 at pp. 5–6; AHAM, No. 64 at pp. 1, 3–4) AHAM also commented that if DOE proceeds with standards for cooking tops using the test procedure proposed in the August 2016 TP SNOPR, DOE should adjust the tolerance for enforcement from 5 percent to 20 percent, consistent with the variation in test results observed in AHAM's round robin test program. (AHAM, No 64 at p. 21)

Sub-Zero similarly commented that the proposed test procedure produces significant variation in test results and, thus, it is not feasible to adopt standards for conventional cooking tops. Sub-Zero commented that DOE should work with industry to develop a test procedure that produces repeatable and reproducible results. (Sub-Zero, No. 66 at p. 1) AGA and APGA also commented that adding what it stated is a complicated and unproven test procedure for gas cooking tops does not appear to be warranted for the testing and verification burden that would be placed on the industry, as well as the consumers that will pay for the added cost of testing and compliance. (AGA and APGA, No. 68 at p. 3)

On December 16, 2016, DOE published a final rule repealing the test procedures for conventional ovens for the reasons discussed above, and adopting the test procedure amendments for conventional cooking tops proposed in the August 2016 TP SNOPR, with the following modifications:

- Aligning the test methods for electric surface units with flexible concentric cooking zones (also referred to as multi-ring surface units) with the provisions in EN 60350-2:2013;[13]
- Clarifying the simmering temperature requirements, temperature sensor requirements, and surface unit diameter measurement; and
- Maintaining the existing installation requirements in Appendix I.

81 FR 91418.

The Administrative Procedure Act ("APA"), 5 U.S.C. 551 *et seq.*, provides among other things, that "[e]ach agency shall give an interested person the right to petition for the issuance, amendment, or repeal of a rule." (5 U.S.C. 553(e)) DOE received a petition from AHAM requesting that DOE reconsider its December 2016 TP Final Rule. In its petition, AHAM requested that DOE undertake a rulemaking to withdraw the test procedure for conventional cooking tops, while maintaining the repeal of the oven test procedure that was part of the Final Rule. In the interim, AHAM sought an immediate stay of the effectiveness of the December 2016 TP Final Rule, including the requirement that manufacturers use the final test procedure to make energy-related claims. In its petition, AHAM claimed that its analyses showed that the test procedure is

[13] EN 60350-2:2013 requires testing of the largest measured diameter of multi-ring surface units only, unless an additional test vessel category is needed to meet the test vessel selection requirements in EN 60350-2:2013. In that case, one of the smaller-diameter settings of the multi-ring surface unit may be tested if it fulfills the test vessel category requirement.

not representative for gas cooking tops and, for gas and electric cooking tops, has such a high level of variation it will not produce accurate results for certification and enforcement purposes and will not assist consumers in making purchasing decisions based on energy efficiency. DOE published AHAM's petition on April 25, 2018, and requested comments and information on whether DOE should undertake a rulemaking to consider the proposal contained in the petition. 80 FR 17944.

On August 9, 2019, DOE published a NOPR ("the August 2019 TP NOPR") proposing to withdraw the test procedure for conventional cooking tops after evaluating new information and data produced by AHAM and other interested parties that suggested that the test procedure yields inconsistent results that are indicative of the test not being representative of energy use or efficiency during an average use cycle. As such, DOE determined that it would be unduly burdensome to subject those manufacturers seeking to make representations as to the efficiency of their products to the requirement to conduct such tests while DOE investigated the issues presented. 84 FR 39211.

On August 18, 2020, DOE published the August 2020 TP Final Rule withdrawing the test procedure for conventional cooking tops. 85 FR 50757. Testing conducted by DOE and outside parties using the test procedure yielded inconsistent results. 85 FR 50757, 50763. DOE had not identified the cause of the inconsistencies, and noted that its data to date is limited. *Id.* DOE concluded, therefore, that the test procedure was not representative of energy use or efficiency during an average use cycle. *Id.* DOE also determined that it would be unduly burdensome to leave the test procedure in place and require cooking top tests to be conducted using that test method without further study to resolve those inconsistencies. *Id.*

Under EPCA, any new or amended energy conservation standard must include, where applicable, test procedures prescribed in accordance with the test procedure provisions of the Act. (42 U.S.C. 6295(r)) As discussed previously, DOE repealed the conventional cooking top and conventional oven test procedures and is evaluating new prescriptive design requirements for the control system of conventional ovens and conventional electric smooth cooking tops, while proposing to maintain the existing prescriptive design requirements for conventional gas ovens and conventional gas cooking tops. As a result, the prescriptive design requirements would not require manufacturers to test using the DOE test procedure for conventional cooking tops and conventional ovens to certify products.

C. Technological Feasibility

1. General

In evaluating potential amendments to energy conservation standards, DOE conducts a screening analysis based on information gathered on all current technology options and prototype designs that could improve the efficiency of the products or equipment that are the subject of the determination. As the first step in such an analysis, DOE develops a list of technology options for consideration in consultation with manufacturers, design engineers, and other interested parties. DOE then determines which of those means for improving efficiency are technologically feasible. DOE considers technologies incorporated in commercially available products or in working prototypes to be technologically feasible. Sections 6(c)(3)(i) and 7(b)(1) of the Process Rule.

After DOE has determined that particular technology options are technologically feasible, it further evaluates each technology option in light of the following additional screening criteria: (1) practicability to manufacture, install, and service; (2) adverse impacts on product utility or availability; (3) adverse impacts on health or safety; and (4) unique-pathway proprietary technologies. Sections 6(c)(3)(ii)–(iv) and 7(b)(2)–(5) of the Process Rule. Section IV.B of this document discusses the results of the screening analysis for consumer conventional cooking products, particularly the designs DOE considered, those it screened out, and those that are the basis for the standards considered in this proposed determination. For further details on the screening analysis for this proposed determination, see chapter 4 of the technical support document ("TSD")[14] for this NOPD.

2. Maximum Technologically Feasible Levels

As when DOE proposes to adopt an amended standard for a type or class of covered product, in this analysis it must determine the maximum improvement in energy efficiency or maximum reduction in energy use that is technologically feasible for such 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 consumer conventional cooking products, using the design parameters for the most efficient products available on the market or in working prototypes. The max-

[14] The TSD is available in the docket for this rulemaking at *http://www.regulations.gov/#!docketDetail;D=EERE-2014-BT-STD-0005*.

tech levels that DOE determined for this analysis are described in section IV.C of this proposed determination and in chapter 5 of the TSD for this NOPD.

D. Energy Savings

1. Determination of Savings

For each trial standard level ("TSL"), DOE projected energy savings from application of the TSL to consumer conventional cooking products purchased in the 30-year period that begins in the year of compliance with the potential standards (2023–2052).[15] The savings are measured over the entire lifetime of products purchased in the previous 30-year 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 that reflects how the market for a product would likely evolve in the absence of new or amended energy conservation standards.

DOE used its NIA spreadsheet models to estimate national energy savings ("NES") from potential new or amended standards for consumer conventional cooking products. The NIA spreadsheet model (described in section IV.H of this document) calculates energy savings in terms of site energy, which is the energy directly consumed by products at the locations where they are used. For electricity, DOE reports NES in terms of primary energy savings, which is the savings in the energy that is used to

[15] Each TSL is composed of specific efficiency levels for each product class. The TSLs considered for this NOPD are described in section V.A of this document. DOE also presents a sensitivity analysis that considers impacts for products shipped in a 9-year period.

generate and transmit the site electricity. For natural gas, the primary energy savings are considered to be equal to the site energy savings. DOE also calculates NES in terms of 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.[16] DOE's approach is based on the calculation of an FFC multiplier for each of the energy types used by covered products or equipment. For more information on FFC energy savings, see section IV.H.2 of this document.

2. Significance of Savings

In determining whether amended standards are needed, DOE must consider whether such standards will result in significant conservation of energy. (42 U.S.C. 6295(m)(1)(A)) The term "significant" is not defined in EPCA. DOE has established a significance threshold for energy savings. Section 6(b) of the now-current Process Rule. In evaluating the significance of energy savings, DOE conducts a two-step approach that considers both an absolute site energy savings threshold and a threshold that is a percent reduction in the covered product energy use. *Id.* DOE first evaluates the projected energy savings from a max-tech standard over a 30-year period against a 0.3 quadrillion British thermal units ("quads") of site energy threshold. Section 6(b)(2) of the now-current Process Rule. If the 0.3 quads-threshold is not met, DOE then compares the max-tech savings to the total energy usage of the covered equipment to calculate a percentage reduction in energy usage. Section 6(b)(3) of the Process Rule. If this comparison does

[16] 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).

not yield a reduction in site energy use of at least 10 percent over a 30-year period, DOE proposes that no significant energy savings would likely result from setting new or amended standards. Section 6(b)(4) of the now-current Process Rule. The two-step approach allows DOE to ascertain whether a potential standard satisfies EPCA's significant energy savings requirements in 42 U.S.C. 6295(o)(3)(B) to ensure that DOE avoids setting a standard that "will not result in significant conservation of energy."

EPCA defines "energy efficiency" as the ratio of the useful output of services from a consumer product to the *energy use* of such product, measured according to the Federal test procedures. (42 U.S.C. 6291(5), *emphasis added*) EPCA defines "energy use" as the quantity of energy directly consumed by a consumer product at point of use, as measured by the Federal test procedures. (42 U.S.C. 6291(4)) Further, EPCA uses a household energy consumption metric as a threshold for setting standards for new covered products. (42 U.S.C. 6295(l)(1)) Given this context, DOE relies on site energy as the appropriate metric for evaluating the significance of energy savings.

E. 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)(I)–(VII)) The following sections discuss how DOE has addressed each of those seven factors in this proposed determination.

a. Economic Impact on Manufacturers and Consumers

In determining the impacts of potential new or amended standards on manufacturers, DOE conducts a manufacturer impact analysis ("MIA"), as discussed in section IV.I of this document. DOE first uses an annual cash-flow approach to determine the quantitative impacts. This step includes both a short-term assessment—based on the cost and capital requirements during the period between when a regulation is issued and when entities must comply with the regulation—and a long-term assessment over a 30-year period. The industry-wide impacts analyzed include (1) the industry net present value ("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 life-cycle cost ("LCC") and simple payback period ("PBP") associated with new or amended standards. These measures are discussed further in the following section. For consumers in the aggregate, DOE also calculates the national net present value ("NPV") of the consumer costs and benefits expected to result from particular standards.

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

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

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

c. Energy Savings

Although significant conservation of energy is a separate statutory requirement for adopting an energy conservation standard, EPCA requires DOE, in determining the economic justification of a standard, to consider the total projected energy savings that are expected to result directly from the standard. (42 U.S.C. 6295(o)(2)(B)(i)(III)) As discussed in section IV.H of this document, 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 considered in this document would not reduce the utility or performance of consumer conventional cooking products.

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)) In the event DOE were to propose amended standards, DOE would transmit a copy of the proposed rule to the Attorney General with a request that the Department of Justice ("DOJ") provide its determination on this issue. DOE would then publish and respond to the Attorney General's determination in the final rule. Currently, DOE is not proposing to amend the energy conservation standards for consumer conventional cooking products so there is no proposed rule to submit to the Attorney General for review.

f. Need for National Energy Conservation

In evaluating the need for national energy conservation, DOE expects that energy savings from amended standards would likely 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. Energy savings from amended standards also would likely result in environmental benefits in the form of reduced emissions of air pollutants and greenhouse gases primarily associated with fossil-fuel based energy production. Consistent with its past approach,[17] because DOE has initially concluded amended standards for consumer conventional cooking products would not result in significant energy savings and would not be economically justified, DOE did not conduct a utility impact analysis or emissions analysis for this document.

g. Other Factors

[17] See 81 FR 71325 (Oct. 17, 2016); see also 84 FR 17626 (Dec. 27, 2019).

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

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 effect 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 of this document.

F. Other Issues

In response to the September 2016 SNOPR, the SoCal IOUs and the Joint Commenters supported performance-based standards for conventional cooking tops, stating that the August 2016 TP SNOPR proposed test methods to fully capture energy consumption for these products. (SoCal IOUs, No. 67 at p. 2; Joint Commenters, No. 70 at p. 1) Due to the repeal of the testing requirements for conventional cooking tops in the August 2020 TP Final Rule, DOE did not evaluate performance-based standards in this document.

The Joint Commenters opposed prescriptive standards for the power supply of conventional cooking tops. The Joint Commenters stated that while switch-mode power supplies ("SMPS") are generally more efficient than linear power supplies, the standby power consumption of cooking tops with SMPS is not necessarily lower than that of cooking tops with linear power supplies based on DOE's test sample. The Joint Commenters also commented that a prescriptive standard that only required cooking tops to be equipped with a SMPS would eliminate significant energy savings from the proposed performance-based standard level that included energy savings from the automatic power-down design option for electric smooth cooking tops. (Joint Commenters, No. 70 at p. 2)

GE commented that for the proposed standard for electric smooth cooking tops, which corresponds to the automatic power-down technology option, the estimated standby power of 0.25 Watts ("W") is unrepresentative of products available on the market and that none of its models would meet this level. AHAM and GE commented that DOE based the reduction in standby power consumption on a stand-alone cooking top, not a combined cooking product such as a range. AHAM and GE added that, according to the test procedure proposed in the August 2016 TP SNOPR, combined cooking products must include standby energy from the other components. According to AHAM and GE, the energy savings estimated by DOE are not achievable when accounting for the standby power consumption of a combined cooking product and would result in a loss of consumer utility because manufacturers would have to remove the clock function to meet the low standby power consumption levels. (AHAM, No. 64 at p. 10; GE, No. 72 at p. 2)

As discussed in chapter 5 of the TSD for this NOPD, DOE observed in its testing that the standby power for electric smooth cooking tops without an automatic power-down feature was similar among the units in its test sample, which included both stand-alone cooking tops and cooking tops in combined cooking products. Furthermore, DOE observed an electric smooth cooking top that implements an automatic power-down feature. The automatic power-down design option achieves very low standby power levels (approximately 0.25 W) by turning off most of the power-consuming components on the control board once a period of user inactivity has elapsed. DOE determined through product teardowns that the power supply requirements for all of the electric smooth cooking tops in its test sample are similar, including those in the unit that implements the automatic power-down feature. As a result, DOE identified no technical barrier to implementing this design option to power down most of the power-consuming components on the control board in any of its sample units and, therefore, concludes that similar levels of energy savings due to standby power improvements can be achieved for all electric smooth cooking tops. However, DOE also recognizes that a standby power level associated with the automatic power-down technology option may not be achievable while powering the continuous clock display typically used in combined cooking products, such as ranges. Therefore, as discussed in section V.A of this document, DOE evaluated prescriptive design standards in this NOPD for electric smooth cooking tops that would allow for a continuous clock display, and accordingly, would not require the elimination of clocks from products.

AGA and APGA commented that the proposed standards in the September 2016 SNOPR for conventional gas cooking tops and ovens would produce little real energy savings. In particular, AGA and APGA opposed DOE's proposal for gas cooking tops to eliminate the current prescriptive standard prohibiting constant burning pilot lights and replace it with a performance standard because the test procedure had not yet been finalized or vetted by industry. AGA and APGA asserted that the limited testing conducted by DOE was not adequate given the concerns about the test procedure. (AGA and APGA, No. 68 at pp. 3, 4)

The SoCal IOUs supported DOE's analysis and proposed standards, with the exception of those for gas cooking tops. The SoCal IOUs stated that under TSL 2, 26.1 percent of gas cooking top consumers would be adversely impacted and have an average payback period of 19.7 years. The SoCal IOUs recommended adopting TSL 2, with the exception of specifying standards at the baseline efficiency level for gas cooking tops. According to the SoCal IOUs, this approach would result in a fractional reduction in national energy savings of 0.06 quads. (SoCal IOUs, No. 67 at p. 3)

As discussed in section III.B of this document, DOE withdrew the testing provisions for conventional cooking tops in the August 2020 TP Final Rule and, therefore, is not evaluating performance standards for conventional cooking tops, including gas cooking tops, in this NOPD.

Spire commented that the higher efficiency of induction cooking tops, being technologically feasible and economically justified, obligates DOE to mandate their use for electric cooking products. (Spire, No. 61 at p. 4) As discussed in section V.C.3 of this document, DOE has initially determined that the electric smooth cooking top efficiency level associated with induction heating is not economically justified.

AHAM stated that, based on its comments regarding improved contact conductance (discussed in section IV.A.2.a of this document), the additional testing conducted by AHAM members (discussed in section IV.C.1.a of this document), and the estimated 19 percent of consumers that would experience a net cost at DOE's proposed standard level, DOE's proposed standard for electric coil cooking tops would not achieve actual energy savings in the field and could eliminate these products from the market. AHAM opposed standards for electric coil cooking tops and recommended that DOE maintain the "no standard" standard for this product class. (AHAM, No. 64 at p. 20) As discussed in section IV.A.2.a of this document, DOE is no longer considering improved contact conductance as a technology option. In addition, as discussed in section IV.C.2 of this document, DOE updated its efficiency levels to account for the additional data submitted by AHAM. Based on these revisions to the analysis for this NOPD, DOE is not evaluating standards for electric coil cooking tops, as discussed in section IV.C.2.b of this document.

The CA IOUs submitted a test report from their testing of gas and electric ovens. The CA IOUs noted that their test sample included a range of manufacturers, cavity sizes, and cooking modes. The CA IOUs conducted testing to evaluate pre-heating, steady-state (temperature) operation, broiling, and self-cleaning. In addition, the CA IOUs conducted testing according to the previous version of the test procedure. The CA IOUs asserted, based on their test results, that energy consumption was correlated to a number of factors, including: cavity size, insulation, oven input rate, and whether the product was commercial-style. The CA IOUs noted that convection mode did not have a clear correlation to cooking efficiency, but most ovens had a higher efficiency in convection mode. The CA IOUs also noted that their test results did not show a correlation between energy consumption and retail price. (CA IOUs, No. 59) DOE appreciates the test data submitted by the CA IOUs. As discussed in section IV.C.2.c of this document, DOE similarly determined that conventional oven energy consumption was related to the oven cavity volume and developed relationships between IAEC and oven cavity volume. As discussed in section III.B of this document, DOE repealed the test procedures for conventional ovens. DOE, therefore, evaluated potential standards based on prescriptive design options for conventional ovens for this NOPD, as discussed in section IV.C.2 of this document.

Spire stated that a number of DOE’s assumptions disadvantage cooking products that use natural gas. (Spire, No. 61 at p. 7) Spire identified DOE’s assumptions with regard to the discount rate, marginal energy costs, appliance lifetimes, installation costs, and incremental maintenance costs, as resulting in the bias. DOE notes generally that it based its analysis on all available data for both gas and electric conventional cooking products, much of which was submitted by appliance manufacturers. DOE conducts its analysis to accurately represent, to the extent possible, the manufacture and consumer usage in the United States of both gas and electric conventional cooking products.

IV. Methodology and Discussion of Related Comments

This section addresses the analyses DOE has performed for this proposed determination with regard to consumer conventional cooking products. Separate subsections address each component of DOE's analyses.

DOE used several analytical tools to estimate the impact of potential energy conservation standards. The first tool is a spreadsheet that calculates the LCC savings and PBP of potential energy conservation standards. The NIA uses a second spreadsheet tool that provides shipments projections and calculates NES and NPV of total consumer costs and savings expected to result from potential energy conservation standards. DOE uses the third spreadsheet tool, the Government Regulatory Impact Model ("GRIM"), to assess manufacturer impacts of potential standards. These three spreadsheet tools are available on the DOE website for this rulemaking: *http://www.regulations.gov/#!docketDetail;D=EERE-2014-BT-STD-0005*.

A. Market and Technology Assessment

DOE develops information in the market and technology assessment that provides an overall picture of the market for the products concerned, including the purpose of the products, the industry structure, manufacturers, market characteristics, and technologies used in the products. This activity includes both quantitative and qualitative assessments, based primarily on publicly-available information. The subjects addressed in the market and technology assessment for this proposed determination include (1) a determination of the scope of the rulemaking and product classes, (2) manufacturers and industry structure, (3) existing efficiency programs, (4) shipments information, (5) market and industry trends, and (6) technologies or design options that could improve the energy efficiency of consumer conventional cooking products. The key findings of DOE's market assessment are summarized in the following sections. See chapter 3 of the TSD for this NOPD for further discussion of the market and technology assessment.

1. 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 for consumer conventional cooking tops in the April 2009 Final Rule TSD ("2009 TSD"):[18]

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

Induction Heating

In the September 2016 SNOPR, DOE proposed to maintain the product classes for conventional cooking tops from the previous standards rulemaking, as presented above. DOE also proposed 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 with 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 noted in the September 2016 SNOPR that the utility of speed of cooking, ease of cleaning, and requirements for specific cookware for induction cooking tops do not

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

appear to be uniquely associated with higher energy use compared to other smooth cooking tops with electric resistance heating elements. 81 FR 60784, 60800–60801 (Sept. 2, 2016).

The SoCal IOUs supported DOE's analysis conducted for induction cooking tops and DOE's decision to consider induction heating as a technology option for electric smooth cooking tops rather than a separate product class because induction heating provides the same utility for electric smooth cooking tops as does electric resistance heating. (SoCal IOUs, No. 67 at pp. 3–4) AHAM agreed with DOE's determination that the ease of cleaning smooth elements is a consumer utility that justifies a separate product class from electric coil cooking tops. However, AHAM stated that it does not currently have enough information to support or oppose DOE's proposal to consider induction heating as a technology option for electric smooth cooking tops rather than as a separate product class. AHAM expressed concern whether the test procedure proposed in the August 2016 TP SNOPR for cooking tops would accurately measure the differences in energy use between induction and other smooth element cooking tops. (AHAM, No. 64 at p. 5)

As discussed in section III.B of this document, DOE withdrew the test procedure for conventional cooking tops in the August 2020 TP Final Rule. However, as discussed in section IV.C.2.b of this document, DOE determined that its testing using the water-heating method previously adopted in the December 2016 TP Final Rule provided measures of energy consumption that represent the energy use of both smooth–electric resistance and smooth–induction cooking tops with relative accuracy. For the reasons presented in the September 2016 SNOPR and discussed above, DOE is maintaining consideration of induction cooking tops as a technology option for electric smooth cooking tops and not as a separate product class.

Commercial-Style Cooking Tops

Based on DOE's review of conventional gas cooking tops available on the market, DOE determined for the September 2016 SNOPR 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.

As part of the September 2016 SNOPR, 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. For the September 2016 SNOPR analysis, DOE conducted testing of gas surface units in a sample of twelve gas cooking tops, which included six products marketed as commercial-style, and determined that there was no statistically significant correlation between burner input rate and the ratio of surface unit energy consumption to test load mass[19] for cooking tops marketed as either residential-style or commercial-style. DOE noted that its testing showed that this efficiency ratio for

[19] 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 test load mass, the less efficient the surface unit.

gas cooking tops is more closely related to burner and grate design rather than input rate. 81 FR 60784, 60801–60802 (Sept. 2, 2016).

DOE recognized in the September 2016 SNOPR 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 stated that it was 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. 81 FR 60784, 60803 (Sept. 2, 2016). Although DOE's testing indicated 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 stated that is not aware of an industry test standard that evaluates cooking performance and that would quantify the utility provided by these products. *Id*.

For these reasons, DOE did not propose in the September 2016 SNOPR to establish a separate product class for gas cooking tops marketed as commercial-style or conventional gas cooking tops with higher burner input rates. 81 FR 60784, 60803 (Sept. 2, 2016).

AHAM stated that, due to the length of the comment period and the limited resources that could be dedicated to testing, it did not have enough information to support or oppose DOE's proposal to not define a separate product class for commercial-style cooking tops. Moreover, AHAM commented that because of its concerns that the test procedure does not produce repeatable and reproducible results and concerns with using a test procedure designed for electric cooking tops to measure gas cooking top energy use, it could not determine whether test results are accurate or assess whether separate product classes are warranted. (AHAM, No. 64 at p. 6)

Sub-Zero and Felix Storch both urged DOE to establish separate product classes for commercial-style cooking tops. (Sub-Zero, No. 66 at p. 2; Felix Storch, No. 62 at p. 1) Sub-Zero stated that high-performance[20] gas cooking tops include design features that enhance cooking performance (rapid boiling, precision simmering, and even heat distribution) while adhering to safety requirements, but that negatively impact efficiency as compared to conventional residential-style cooking tops. According to Sub-Zero, gas burner design attributes such as safety, performance, and efficiency are systematic, and that a change to one attribute significantly affects the others. (Sub-Zero, No. 66 at pp. 2, 4–5) The design features associated with high-performance gas cooking tops and the utility that Sub-Zero and Miele claimed these features provide include:

- High input rate burners with large diameters provide faster heat up times and allow consumers to use larger professional cooking vessels while maintaining even heat distribution (Sub-Zero, No. 66 at p. 5);

- High input rate burners with high levels of flame controllability, specifically high turndown ratios, allow for both simmering of foods such

[20] Sub-Zero stated that "high performance" cooking is a better descriptor of this segment than "commercial-style" or "professional-style."

as chocolates and sauces and faster heat up times (Sub-Zero, No. 66 at p. 5);

- Greater spacing between the gas flame, grate, and cooking vessel is required for high input rate burners than for low input rate burners to meet performance and safety requirements, specifically even heat distribution and reduction of carbon monoxide ("CO"). 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 CO emissions and combustion by-products. Designing high performance products with safe combustion gases provides an inherent constraint to the efficiency level that can be attained (Sub-Zero, No. 66 at pp. 5–6);

- 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. 66 at p. 6) Heavier cast iron grates also retain more heat once the burner is turned down during simmer or shut off. (Miele, No. 60 at p. 2; Sub-Zero, No. 66 at pp. 5–6)

Sub-Zero commented that the features listed above deliver superior performance by allowing consumers to use a wider range of cooking methods that differ significantly from how the average consumer uses a consumer conventional cooking product. (Sub-Zero, No. 66 at p. 2) Sub-Zero also commented that high performance cooking tops typically employ a range of burner inputs to allow consumers the ability to cook foods that require searing on one burner and foods that require melting temperatures on another burner. (Sub-Zero, No. 66 at p. 4) Miele provided similar comments as Sub-Zero regarding the features that distinguish cooking methods used with commercial-style cooking tops compared to residential-style cooking tops, such as the added mass and heat retention of the grates for improved temperature controllability. (Miele, No. 60 at pp. 1–2) Both Sub-Zero and Miele stated that their consumers often sauté at very high burner outputs, manipulate the pans to mix the ingredients like professional chefs, flame the contents, and keep most, if not all, the burners in the cooking top firing together when cooking. (Miele, No. 60 at p. 2; Sub-Zero, No. 66 at p. 2) Miele added that commercial-style models may be equipped with specialty burners such as a grill or griddle, not covered in the proposed standards, that are used by consumers together with the adjoining regular burners. Miele stated that the heat generated by specialty burners is not captured in the test procedure but could potentially provide a significant amount of heat energy to the adjoining grates prior to the ignition and use of the adjoining burners. Furthermore, Miele claimed that the vigorous actions of professional-style cooking require the support structure of the heavy grates typical of commercial-style cooking tops. (Miele, No. 60 at p. 1)

Sub-Zero suggested that DOE establish a separate product class for residential gas cooking tops that have an average burner input rate of at least 14,000 Btu/h and a grate mass of at least 4 pounds per burner. Sub-Zero claimed that its suggested product class definition was based on its research of product marketing, utility, and performance of residential gas cooking products. (Sub-Zero, No. 66 at p. 3)

Based on DOE's testing, including the additional testing conducted for this NOPD and discussed in section IV.C.1 of this document, DOE did not identify a correlation between measured energy consumption of conventional gas cooking products and any specific utility provided to consumers. While DOE recognizes the presence of certain commercial-style features described by manufacturers may allow consumers to cook with a wide variety of cooking methods, manufacturers have not provided consumer usage data demonstrating that consumers of commercial-style cooking tops and residential-style cooking tops employ significantly different cooking methods during a typical cooking cycle. Moreover, manufacturers have not provided evidence that consumers of commercial-style cooking tops would use more burners on a cooking top during a single cooking cycle than consumers of residential-style cooking tops. DOE notes that there are many residential-style cooking tops with one to two high input rate burners and continuous cast iron grates that provide consumers with the ability to sear food at high temperatures and simmer at low temperatures.

For these reasons, DOE is not evaluating 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 section IV.C.3.a of this document, DOE conducted its engineering analysis consistent with products currently available on the market and is not evaluating amendments to the current prescriptive standards for gas cooking tops; this will 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 considered in this proposed determination are the same as those currently in effect and thus would not alter the safety of existing commercial-style gas cooking tops 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, in the April 2009 Final Rule analysis described in the 2009 TSD, DOE defined the following product classes 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.

Self-Cleaning Technology

Based on DOE's review of conventional gas ovens available on the U.S. market, and 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 a self-clean oven may employ methods other than a high-temperature pyrolytic cycle to perform the cleaning action.[21] 80 FR 33030, 33043 (June 10, 2015). 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*. As part of the September 2016 SNOPR, DOE stated that it 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. As a result, DOE did not consider establishing separate product classes based on the type of self-cleaning technology. 81 FR 60784, 60804 (Sept. 2, 2016). DOE did not receive any comments on the September 2016 SNOPR regarding product classes for different self-cleaning technologies. As a result, for the reasons discussed previously, DOE is not considering separate product classes based on the type of self-cleaning technology.

Commercial-Style Ovens

With regard to gas oven burner input rates, DOE noted in the June 2015 NOPR that based on its review of the consumer conventional gas ovens available on the market,

[21] 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-cleaning mode that is user-selectable.

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.[22] 80 FR 33030, 33043 (June 10, 2015). 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 (June 10, 2015). 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. DOE

[22] 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.

also noted that the conventional gas ovens with higher burner input rates in its 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 degrees Fahrenheit ("°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 (June 10, 2015).

As part of the September 2016 SNOPR, 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 stated that it is not aware of an industry test standard that evaluates cooking performance and that would quantify the utility provided by these products. DOE also noted 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. 81 FR 60784, 60805–60806 (Sept. 2, 2016).

DOE also observed as part of the September 2016 SNOPR that 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, are also found in residential-style products. DOE noted 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 stated in the September 2016 SNOPR that it was 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 did not propose in the September 2016 SNOPR to establish a separate product class for commercial-style ovens. 81 FR 60784, 60806 (Sept. 2, 2016).

Sub-Zero supported a differentiation based on utility between high-performance ovens and residential-style ovens. (Sub-Zero, No. 66 at p. 2) However, Sub-Zero asserted there could potentially be confusion if DOE defines a high-performance product class for ovens in a future rulemaking but does not do so for gas cooking tops as part of the current rulemaking. Sub-Zero stated that since both components are incorporated in combined cooking products such as ranges, different product classes for different components could lead to significant market uncertainty. Sub-Zero stated that the only accurate and equitable solution is to define separate product classes for high-performance ovens and gas cooking tops and set appropriate standards based on utility and performance considerations. (Sub-Zero, No. 66 at p. 6)

Based on DOE's analysis discussed previously, DOE is not evaluating a separate product class for commercial-style ovens.

Installation Configuration

As discussed in section III.B of this document, in the October 2012 TP Final Rule, DOE amended Appendix I to include methods for measuring fan-only mode.[23] 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 kilowatt-hours per year ("kWh/yr"). Based on DOE's reverse engineering analyses, DOE noted that built-in and slide-in products incorporate an additional exhaust fan and vent assembly that is 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 and September 2016 SNOPR to include separate product classes for freestanding and built-in/slide-in ovens. 80 FR 33030, 33045 (June 10, 2015); 81 FR 60784, 60806 (Sept. 2, 2016).

DOE did not receive comment on its proposal in the September 2016 SNOPR to include separate product classes for built-in/slide-in ovens. For the reasons discussed above, DOE analyzed separate product classes for freestanding and built-in/slide-in ovens for this NOPD.

[23] 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.

In summary, DOE analyzed the product classes listed in Table IV-1 for this NOPD.

Table IV-1 Evaluated Product Classes for Consumer 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 without a catalytic line	Freestanding
5			Built-in/Slide-in
6		Self-clean	Freestanding
7			Built-in/Slide-in
8	Gas oven	Standard with or without a catalytic line	Freestanding
9			Built-in/Slide-in
10		Self-clean	Freestanding
11			Built-in/Slide-in

2. 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 TSD for this NOPD includes the detailed list and descriptions of all technology options identified for this equipment.

a. Conventional Cooking Tops

In the September 2016 SNOPR, DOE proposed to consider the technology options for conventional cooking tops listed in Table IV-2. 81 FR 60784, 60808 (Sept. 2, 2016).

Table IV-2 September 2016 SNOPR 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
9. Catalytic burners[24]

In response to the September 2016 SNOPR, DOE received comments regarding the potential energy savings and applicability of the improved contact conductance and low-standby-loss electronic control technology options for conventional cooking tops. These specific technology options are discussed in the following sections.[25]

Improved Contact Conductance

AHAM opposed improved contact conductance as a technology option for electric coil cooking tops. AHAM commented that the test procedure specifies narrow tolerances on the flatness of the test vessel, which AHAM feels are appropriate to reduce variability

[24] Catalytic burners were included in the September 2016 SNOPR screening analysis, but not included in the table of technology options.
[25] Previous comments and DOE's responses on the various cooking top technology options listed in Table IV-2 are discussed in the September 2016 SNOPR. 81 FR 60784, 60807–60808 (Sept. 2, 2016).

in test results. AHAM stated that if a consumer does not use pots with comparable flatness, any reduction in energy consumption due to greater flatness of the heating element that would be measured using the test procedure will not be realized in the field. AHAM supplied data from testing of different pan diameters and materials showing that all pan materials warp after the first use, and the warping continues as the cookware is used.[26] Based on this testing, AHAM asserted that consumers are using warped pans and that improving the flatness of the heating element will not achieve improved contact conductance. AHAM stated, therefore, that the energy savings associated with the improved contact conductance technology option measured under the test procedure is not representative of what consumer will experience in the field and, as a result, this should not be considered as a technology option. (AHAM, No. 64 at pp. 7–10)

DOE agrees that, based on the test data provided by AHAM, improving the flatness of the electric coil heating element may not result in energy savings due to the warping of pots and pans used by consumers. As a result, DOE did not consider improved contact conductance as a technology option for electric coil cooking tops for this NOPD.

Low-Standby-Loss Electronic Controls

AHAM commented that most baseline products on the market are already using a low-standby-loss SMPS and, as a result, this should not be considered a viable technology option to improve efficiency for electric smooth cooking tops. (AHAM, No.

[26] AHAM test data showed that the average pan warpage ranged from -0.02 inches for aluminum pans to -0.08 inches for stainless steel pans.

64 at p. 10) Among the six electric smooth cooking tops that DOE tore down, DOE observed units that incorporated a baseline efficiency linear power supply. As a result, DOE maintained SMPS as a technology option for reducing the standby power consumption of electric smooth cooking tops for this NOPD.

Table IV-3 lists the technology options for cooking tops that DOE considered for this NOPD.

Table IV-3 Evaluated Technology Options for Conventional Cooking Tops

Open (coil) element electric cooking tops
1. None
Smooth element electric cooking tops
1. Halogen elements
2. Induction elements
3. Low-standby-loss electronic controls
Gas Cooking Tops
1. Radiant gas burners
2. Catalytic burners
3. Reduced excess air at burner
4. Reflective surfaces
5. Optimized burner and grate design

b. Conventional Ovens

In the September 2016 SNOPR, DOE proposed to consider the technology options for conventional ovens listed in Table IV-4. 81 FR 60784, 60808–60810 (Sept. 2, 2016).

Table IV-4 September 2016 SNOPR Technology Options for Conventional Ovens

1. Bi-radiant oven (electric only)
2. Intermittent/interrupted ignition or intermittent pilot ignition system
3. Forced convection
4. Halogen lamp oven (electric only)
5. Improved and added insulation
6. Improved door seals
7. No oven-door window
8. Oven separator (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 response to the September 2016 SNOPR, DOE received a number of comments regarding the potential energy savings and applicability of intermittent/interrupted ignition or intermittent pilot ignition systems, forced convection, improved insulation, improved door seals, oven separator, reduced conduction losses, and reduced vent rate, as technology options for conventional ovens. These specific technology options are discussed in the following sections.[27]

Intermittent/Interrupted Ignition or Intermittent Pilot Ignition System

As part of the September 2016 SNOPR, 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

[27] Prevoius comments and DOE's responses on the various oven technology options listed in Table IV-4 are discussed in the June 2015 NOPR and September 2016 SNOPR. 80 FR 33030, 33046–33047 (June 10, 2015); 81 FR 60784, 60808–60810 (Sept. 2, 2016).

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 three categories: (1) intermittent ignition, (2) intermittent/interrupted ignition, and (3) intermittent pilot ignition.[28] 81 FR 60784, 60809 (Sept. 2, 2016).

DOE noted in the September 2016 SNOPR that its testing 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 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 expanded the gas ignition system technology option to account for both of these options. 81 FR 60784, 60809–60810 (Sept. 2, 2016). Because DOE proposed in the September 2016 SNOPR to adopt a prescriptive standard for the control system of conventional gas ovens to require the use of an intermittent/interrupted ignition or intermittent pilot ignition, DOE also proposed to define "intermittent/interrupted ignition" and "intermittent pilot ignition" in 10 CFR 430.2. 81 FR 60784, 60810.

In response to the September 2016 SNOPR, Spire reiterated its April 14, 2014 comments[29] that its test data indicate that glo-bar ignition systems consume only 0.16

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[28] Continuous ignition systems (*e.g.*, constant-burning or "standing" pilot), defined in ANSI Z21.1, were eliminated for all gas cooking products by the current standards as of April 9, 2012.
[29] Spire, formerly the Laclede Group, Inc., April 14, 2014 comments are available at *https://www.regulations.gov/document?D=EERE-2014-BT-STD-0005-0008*.

kWh per cycle. Spire claimed that this is equivalent to 160 W, which is no more than half of DOE's estimates. (Spire, No. 61 at pp. 5–6) DOE responded to these comments in the June 2015 NOPR by presenting test data on the glo-bar power and energy consumption from its test sample. DOE noted that while the power consumption of the glo-bar ignition systems was measured as 330 W to 450 W, the per-cycle energy consumption was similar to that reported by Spire, ranging from 0.141 to 0.261 kWh, because the glo-bar ignition systems do not stay on for the entire cooking cycle and instead cycle on and off as the main burner cycles on and off. 80 FR 33030, 33051 (June 10, 2015). DOE analyzed standards for conventional ovens using the IAEC metric, which includes the energy use from the glo-bar ignition system.

AHAM and GE questioned whether DOE's proposal to require gas ovens to be equipped with an intermittent/interrupted ignition or intermittent pilot ignition would achieve energy savings. AHAM and GE noted that a glo-bar ignition system, which stays on when the main burner is on, contributes heat to the cavity and the food load. (AHAM, No. 64 at p. 28; GE, No. 72 at p. 3) AHAM stated that unlike DOE's testing that compared two different models, one with a glo-bar ignition and one with an intermittent/interrupted or intermittent pilot system, AHAM members conducted testing by comparing the same model with two different ignition systems. AHAM member testing, presented in Table IV-5, showed that the units equipped with the glo-bar ignition system consumed less energy than the same models equipped with the intermittent pilot (*i.e.*, spark ignition) system. (AHAM, No. 64 at pp. 28–29)

Table IV-5 AHAM Test Data Comparing Ignition Systems

	Change in energy consumption between glo-bar and intermittent pilot ignition systems, solid door (*kBtu/yr)**	**Change in energy consumption between glo-bar and intermittent pilot ignition systems, window door (*kBtu/yr)***
Model A	10	41
Model B	35	36
Model C	106	139
Model D	9	1

* kilo-British thermal units per year.
Note: Positive values indicate that the unit consumed additional energy with the intermittent pilot ignition system as compared to the identical model with the glo-bar ignition system.

In addition, AHAM and GE presented data from testing of a single oven that was configured to switch between the glo-bar ignition system and the intermittent pilot ignition system. AHAM and GE noted that the testing, conducted according to the DOE test procedure adopted in the July 2015 TP Final Rule, showed that when replacing the glo-bar ignition system with spark ignition, the electrical energy consumed by the glo-bar is replaced by additional gas usage when using the intermittent pilot ignition system, and the overall energy use of both systems is essentially the same. Based on this, AHAM and GE asserted that replacing the glo-bar ignition system with an intermittent/interrupted ignition or intermittent pilot ignition does not achieve energy savings. (AHAM, No. 64 at pp. 29–30; GE, No. 72 at p. 3)

Based on review of the additional test data provided by AHAM, DOE agrees that replacing the intermittent glo-bar ignition system with an intermittent/interrupted ignition or intermittent pilot ignition may not achieve energy savings due to the elimination of heat input that the glo-bar contributes to the cavity and food load, which must be offset by additional gas consumption. As a result, DOE is no longer considering intermittent/interrupted or intermittent pilot ignition systems as a technology option. Because DOE is no longer considering these ignition systems as technology options, DOE is not considering prescriptive standards to require that conventional gas ovens be equipped with a control system that uses intermittent/interrupted ignition or intermittent pilot ignition in this NOPD.

Instead, DOE is evaluating prescriptive standards requiring that conventional ovens not be equipped with a control system that uses a linear power supply. 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, DC output. However, there are other 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 DC 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.2.b of this document, 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 offers 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. DOE seeks comment on both its initial decision to no longer consider intermittent/interrupted or intermittent pilot ignition systems as a technology option, and its initial decision to only evaluate prescriptive standards requiring that conventional ovens not be equipped with a control system that uses a linear power supply (see section VII.B of this document).

Forced Convection

AHAM commented that, depending on the total energy consumption of the unit, the convection motor wattage could negate any potential energy savings of forced convection. AHAM also asserted that convection is not appropriate for cooking all food types, such as covered food loads. AHAM commented that because DOE proposed to repeal the oven test procedure in the August 2016 TP SNOPR, there was no way to determine whether there are efficiency gains from this technology option. (AHAM, No. 64 at p. 11)

As discussed in chapter 3 of the TSD for this NOPD, DOE conducted testing on ovens equipped with forced convection, comparing the measured energy consumption of each oven in bake mode to the average energy consumption of bake mode and convection mode, including energy consumption due to the fan motor, as specified in the test procedure adopted in the July 2015 TP Final Rule. Based on this testing, DOE determined that forced convection provides a 4 to 6-percent increase in cooking efficiency. In addition, DOE notes that because the test procedure specified that the bake mode and convection mode energy consumption be averaged when calculating cooking efficiency, the test procedure did not assume that forced convection would be used for cooking all food loads. For these reasons, DOE retained forced convection as a technology option for this NOPD. However, as discussed in section III.B of this document, DOE repealed the test procedures for conventional ovens. DOE will reevaluate the energy savings associated with this technology option if it considers performance standards in a future rulemaking.

Improved Insulation

AHAM commented that DOE's estimate of the efficiency increase associated with improved insulation is based on data from the 1996 TSD.[30] AHAM also noted that added insulation would decrease the overall cavity size and reduce consumer utility. AHAM commented that DOE must conduct testing on products currently on the market using an active test procedure to determine the energy savings associated with these technology options. (AHAM, No. 64 at p. 13) As discussed in chapter 3 of the TSD for this NOPD, DOE noted that using denser insulation can increase cooking efficiency, and that self-clean ovens typically have a more effective insulation package to meet surface temperature safety requirements due to the higher temperatures during the self-cleaning operation. DOE observed from teardowns of products in its test sample that standard and

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

self-clean ovens may use different density insulations. As a result, DOE believes that the efficiency of standard ovens can be increased by using improved insulation. For these reasons, DOE maintained improved insulation as a technology option for standard ovens for this NOPD, although as discussed in section IV.B.1.b of this document, DOE screened out added insulation from further analysis. DOE recognizes that the estimates for the energy savings may vary depending on the test procedure. DOE will reevaluate the energy savings associated with this technology option if it considers performance standards in a future rulemaking.

Improved Door Seals

AHAM commented that further improving door seals will lead to a loss of performance due to a loss of sufficient airflow. According to AHAM, door seals are already optimized to retain heat while offering enough airflow for cooking performance. AHAM stated that if the door is sealed further, increased airflow would be required by means of implementing an additional motor that would likely consume more energy, and the 1-percent energy gain DOE estimated would be eliminated. For these reasons, AHAM opposed considering improved door seals as a technology option. (AHAM, No. 64 at p. 11)

As discussed in chapter 3 of the TSD for this NOPD, DOE noted that because some venting is required for proper cooking performance, a complete seal on the oven is undesirable. However, the oven door seals can be improved further without sealing the oven completely. As discussed in chapter 5 of the TSD for this NOPD, the estimated efficiency improvement for improving the door seals was based on replacing the baseline silicone rubber door seal that DOE observed in its test sample with the fiberglass door seals with metallic mesh typically found in self-clean ovens and that DOE also observed in its test sample. As a result, DOE initially concludes that efficiency can be increased by improving the door seals and retained this technology option for this NOPD.

Oven Separator

AHAM opposed considering oven separators as a technology option. AHAM commented that oven separators are not a widely available feature and that DOE does not have data to show the frequency with which consumers actually use the oven separator. AHAM stated that without knowing whether consumers use the oven separator, it is not possible to determine the energy savings that would be realized in the field. (AHAM, No. 64 at p. 11) DOE notes that the test procedure adopted in the July 2015 TP Final Rule specified that the total AEC of an oven equipped with an oven separator be calculated as the average energy. As discussed in the September 2016 SNOPR, DOE's testing showed that oven separators can reduce energy use by reducing the cavity volume that must be heated. 81 FR 60784, 60818. Because oven separators have the potential to reduce energy use for conventional electric ovens, DOE retained this technology option for this NOPD.

Reduced Conduction Losses

AHAM commented that DOE's data on reduced conduction losses are based on products that are more than 10 years old. AHAM noted that testing at the time indicated an extremely small absolute percentage point increase in efficiency of 0.05 percent, and that DOE does not have any current data to evaluate the efficiency improvement for products currently on the market. (AHAM, No. 64 at p. 12) Based on DOE's testing and reverse engineering for this proposed determination, DOE did not observe variation in the interface between the door and the oven cavity that would demonstrate an opportunity for improving efficiency. As a result, DOE did not consider reduced conduction losses as a technology option in this NOPD.

Reduced Vent Rate

AHAM opposed considering reduced vent rate as a technology option. AHAM commented that DOE's estimates of energy savings rely on old testing and product designs, and that the negligible energy savings are based on a test procedure that DOE proposed to repeal in the August 2016 TP SNOPR. According to AHAM, any future energy savings may not be captured if the test procedure is changed. AHAM also commented that oven vent rates are part of a complex air flow design that affects preheat times, cooking performance, and fire and explosion safety performance. AHAM asserted that forcing manufacturers to implement this technology option would reduce energy use by a negligible amount while forcing a significant redesign effort. AHAM added that this could also lead to the elimination of self-clean ovens or cause poor cooking performance because it would result in low air flow and the development of hots spots in the cavity. (AHAM, No. 64 at p. 12)

DOE notes that it proposed to consider reduced vent rate as a technology option for only electric standard ovens, and that no further increase in efficiency can be achieved for gas and electric self-clean ovens and gas standard ovens with this technology option.

In addition, because DOE did not consider reduced vent rate for gas ovens, DOE does not believe that fire and explosion safety performance from gas combustion would be an issue. As noted in the September 2016 SNOPR, DOE observed from its testing that reduced vent rate could be considered for improving the cooking efficiency for electric standard ovens. 81 FR 60784, 60810 (Sept. 2, 2016). As a result, DOE retained reduced vent rate as a technology option for electric standard ovens in this NOPD.

Table IV-6 lists the technology options for ovens that DOE considered for this NOPD.

Table IV-6 Evaluated Technology Options for Conventional Ovens

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

B. Screening Analysis

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

1) *Technological feasibility*. Technologies that are not incorporated in commercial products or in 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 projected 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.

5) *Unique-Pathway Proprietary Technologies*. If a design option uses proprietary technology that represents a unique pathway to achieving a given efficiency level, that technology will not be considered further.

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

In summary, if DOE determines that a technology, or a combination of technologies, fails to meet one or more of the listed 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, in the September 2016 SNOPR, DOE screened out radiant gas burners, catalytic burners, reduced excess air at burner, and reflective surfaces. 81 FR 60784, 60810–60811 (Sept. 2, 2016). DOE did not receive any comments opposing the technology options screened out in the September 2016 SNOPR. For the same reasons discussed in the September 2016 SNOPR, DOE is continuing to screen out radiant gas burners, catalytic burners, reduced excess air at burner, and reflective surfaces from further analysis in this NOPD.

In addition, AHAM commented that halogen heating elements are not being used in any commercially available products or working prototypes. AHAM also noted that

DOE's estimated energy savings using the previous version of the test procedure are no longer relevant. AHAM asserted that halogen heating elements should be screened out from the analysis. (AHAM, No. 64 at p. 10) Based on DOE's review of products available on the market and its product teardowns, DOE is not aware of any cooking tops that incorporate halogen heating elements. Because this technology is currently not being used commercially or in working prototypes, DOE does not believe that it would be practicable to produce this technology in commercial products on the scale necessary to serve the market by the potential compliance date of the proposed standards. As a result, DOE is screening out halogen elements from further analysis in this NOPD.

AHAM commented that the optimized burner and grate design technology option for gas cooking tops should be screened out from the analysis. AHAM stated that designs of the burner system components are interdependent and must consider safety as well. According to AHAM, gas cooking top burner and grate designs are already optimized to meet consumer utility and to stay within combustion safety requirements. AHAM also asserted that the additional heat retention of heavier grates contributes to the efficiency of longer cooking cycles that are not measured under the test procedure. (AHAM, No. 64 at p. 6)

As discussed in the September 2016 SNOPR, DOE considered different efficiency levels associated with the optimized burner and grate design technology option that it observed in products available on the market, including a range of commercial-style gas cooking tops that maintain the utilities discussed previously in section IV.A.1.a of this document. 81 FR 60784, 60187 (Sept. 2, 2016). DOE characterized the optimized burner and grate design incremental efficiency levels based on different observed features (*e.g.*, high input rate burners, grate types and material). DOE further notes that all gas cooking tops on the market, including those with an optimized burner and grate design, have been certified to applicable safety standards. However, DOE recognizes that the estimates for the energy savings associated with optimized burner and grate design may vary depending on the test procedure, and thus screened out this technology option from further analysis of gas cooking tops. DOE will reevaluate the energy savings associated with this technology option if it considers performance standards in a future rulemaking.

b. Conventional Ovens

For conventional ovens, in the September 2016 SNOPR, DOE screened out added insulation, bi-radiant oven, halogen lamp oven, no oven door window, reflective surfaces, and optimized burner and cavity design. 81 FR 60784, 60811 (Sept. 2, 2016).

AHAM supported DOE's proposal to screen out optimized burner and cavity design as well as no oven door window from the analysis. (AHAM, No. 64 at pp. 12, 13) Because DOE did not receive any comments opposing the technology options screened out in the September 2016 SNOPR, for the same reasons discussed in the September 2016 SNOPR, DOE screened out added insulation, bi-radiant oven, halogen lamp oven, no oven door window, reflective surfaces, and optimized burner and cavity design from further analysis in this NOPD.

2. Remaining Technologies

Based on the screening analysis, DOE considered the design options listed in Table IV-7 for conventional cooking tops and Table IV-8 for conventional ovens.

Table IV-7 Remaining Conventional Cooking Top Technology Options

Open (coil) element electric cooking tops
1. None
Smooth element electric cooking tops
1. Induction elements
2. Low-standby-loss electronic controls
Gas Cooking Tops
1. None

Table IV-8 Remaining Conventional Oven Technology Options

1. Forced convection
2. Improved insulation
3. Improved door seals (standard ovens only)
4. Oven separator (electric only)
5. Reduced vent rate (electric standard ovens only)
6. Low-standby-loss electronic controls

DOE determined that these technology options are technologically feasible because they are being used or have previously been used in commercially available products or working prototypes. DOE also finds that all of the remaining technology options meet the other screening criteria (*i.e.*, practicable to manufacture, install, and service and do not result in adverse impacts on consumer utility, product availability, health, or safety, nor require unique-pathway proprietary technologies). For additional details, see chapter 4 of the TSD for this NOPD.

C. Engineering Analysis

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

1. Efficiency analysis

DOE typically uses one of two approaches to develop energy efficiency levels for the engineering analysis: (1) relying on observed efficiency levels in the market (*i.e.*, the efficiency-level approach), or (2) determining the incremental efficiency improvements associated with incorporating specific design options to a baseline model (*i.e.*, the design-option approach). Using the efficiency-level approach, the efficiency levels established for the analysis are determined based on the market distribution of existing products (in other words, based on the range of efficiencies and efficiency level "clusters" that already exist on the market). Using the design option approach, the efficiency levels established for the analysis are determined through detailed engineering calculations and/or computer simulations of the efficiency improvements from implementing specific design options that have been identified in the technology assessment. DOE may also rely on a combination of these two approaches. For example, the efficiency-level approach (based on actual products on the market) may be extended using the design option approach to interpolate to define "gap fill" levels (to bridge large gaps between other identified efficiency levels) and/or to extrapolate to the "max-tech" level (particularly in cases where the "max-tech" level exceeds the maximum efficiency level currently available on the market).

In this rulemaking, DOE is adopting 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 data from the previous rulemaking analysis provided in the 2009 TSD. DOE also conducted interviews with manufacturers of consumer 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.

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 consumer conventional cooking products, DOE selected test units based on performance-related features and technologies advertised in product literature.

a. Conventional Cooking Tops

As noted in the September 2016 SNOPR, DOE's test sample for conventional cooking tops included four gas cooking tops, eight gas ranges, six electric cooking tops, and two electric ranges for a total of 20 conventional cooking tops covering all of the considered product classes. 81 FR 60784, 60811–60812 (Sept. 2, 2016). DOE conducted testing on each cooking top in its test sample. DOE notes that it originally conducted testing using the withdrawn hybrid test block method proposed in the December 2014 TP SNOPR. DOE also tested nine of the twenty units in its test sample using the water heating test method adopted in the December 2016 TP Final Rule, which as discussed in section III.B of this document has since been withdrawn. To maintain its full test sample to be representative of products on the market, 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.

DOE 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.2 and section IV.C.3 of this document.

In response to the September 2016 SNOPR, AHAM requested information on which of the IAECs for units in DOE's test sample were measured using the methods proposed in the August 2016 TP SNOPR and which IAECs were calculated using scaling factors derived from the results of testing using the hybrid test block method proposed in the December 2014 TP SNOPR. AHAM also requested that DOE provide the scaling factors for each scaled unit in the test sample. (AHAM, No. 57 at p. 2) On October 24, 2016, DOE added to the rulemaking docket the information requested by AHAM, which included: (1) the IAECs for the units tested according to the August 2016 TP SNOPR, (2) the IAECs for the units tested according to the withdrawn hybrid test block method, and (3) the scaling factor used to scale results obtained with the hybrid test block method.[31]

AHAM did not agree with DOE's method to scale results using the difference between products tested with both the hybrid block and water-heating test procedures. AHAM did not believe that DOE had enough data to understand how different cooking top configurations affect the scaling factor, and as such asserted that DOE should not develop a scaling factor. (AHAM, No. 64 at pp. 14–15) AHAM noted that the hybrid test block method specified three different test load diameters, while the test procedure proposed in the August 2016 TP SNOPR specified eight different test load diameters. Additionally, AHAM claimed that due to the variety of cooking top configurations and surface unit diameters that were available on the U.S. market, a single scaling factor for any cooking top product class would not be meaningful. (AHAM, No. 64 at p. 14)

AHAM specifically noted that the scaling factors used for the smooth–electric resistance cooking tops were calculated using units that contained multi-ring elements. AHAM also stated that because "zone-less" smooth–induction cooking tops (*i.e.*, those with full-surface induction) were tested differently than "zoned" smooth–induction cooking tops (*i.e.*, those with individual surface units)—the test load sizes were based on the number of controls rather than the diameter of each of the surface units—it was inappropriate to use a scaling factor developed using zoned cooking tops for zone-less

[31] Available at *https://www.regulations.gov/document?D=EERE-2014-BT-STD-0005-0058*.

cooking tops. (AHAM, No. 64 at pp. 14–15) Furthermore, for gas cooking tops, AHAM stated that because DOE's test sample contained cooking tops with unique burner/grate designs that had an impact on the efficiency of the product, it was inappropriate to apply the same scaling factor to all of the gas models in the DOE test sample. (AHAM, No. 64 at p. 16)

AHAM noted that DOE tested less than half of the cooking tops in its test sample according to the test procedure proposed in the August 2016 TP SNOPR, and as a result, based the standards for conventional cooking tops proposed in the September 2016 SNOPR on test data for only nine products. (AHAM, No. 64 at p. 14) Moreover, AHAM stated that because the rulemaking started 3 years prior to the September 2016 SNOPR, DOE relied on old samples for its analysis and that it was possible that products on the market at the time of AHAM's comments differed from the products on the market at the time DOE started its analysis. (AHAM, No. 64 at p. 14) AHAM also commented that the number of different product types in DOE's test sample was disproportionate to the percentage of shipments for each product type. AHAM noted that DOE tested only two smooth–electric resistance cooking tops and three electric coil cooking tops even though these product types represented a significant portion of the market. (AHAM, No. 64 at pp. 14, 16)

AHAM submitted test data for 8 electric coil cooking tops, 15 electric smooth cooking tops (11 electric resistance and 4 induction), and 10 gas cooking tops. AHAM's test results are presented in Table IV-9 to Table IV-11. The coefficient of variation in AHAM's test data ranges from 7.1 to 9.2 percent, depending on the product class. According to AHAM, this variation introduced uncertainty about whether or not a data point would meet the proposed standard level and made it difficult to evaluate the potential impact of the proposed standard. (AHAM, No. 64 at pp. 18, 20)

Table IV-9 AHAM Electric Coil Cooking Top Test Data

Test Unit #	Configuration	Product Class	IAEC (*kWh/yr*)
1	Range	Electric Coil	120.1
2	Range	Electric Coil	120.3
3	Range	Electric Coil	130.7
4	Range	Electric Coil	143.6
5	Stand-alone Cooking Top	Electric Coil	129.0
6	Stand-alone Cooking Top	Electric Coil	115.6
7	Stand-alone Cooking Top	Electric Coil	121.4
8	Range	Electric Coil	118.0

Table IV-10 AHAM Electric Smooth Cooking Top Test Data

Test Unit #	Configuration	Product Class	IAEC (*kWh/yr*)
1	Stand-alone Cooking Top	Smooth–Induction	133.5
2	Range	Smooth–Induction	164.4
3	Range	Smooth–Induction	201.2
4	Stand-alone Cooking Top	Smooth–Induction	126.7
5	Range	Smooth–Electric Resistance	122.3
6	Stand-alone Cooking Top	Smooth–Electric Resistance	140.2
7	Range	Smooth–Electric Resistance	128.7
8	Range	Smooth–Electric Resistance	154.9
9	Range	Smooth–Electric Resistance	150.1
10	Range	Smooth–Electric Resistance	146.2
11	Range	Smooth–Electric Resistance	126.3
12	Range	Smooth–Electric Resistance	118.7
13	Range	Smooth–Electric Resistance	116.6
14	Range	Smooth–Electric Resistance	125.4
15	Range	Smooth–Electric Resistance	126.6

Table IV-11 AHAM Gas Cooking Top Test Data

Test Unit #	Configuration	Product Description	IAEC (*kBtu/yr*)
1	Range	4 burners (1 high input rate burner)	712.6
2	Range	4 burners (1 high input rate burner)	928.5
3	Range	4 burners (1 high input rate burner)	961.8
4	Range	4 burners (1 high input rate burner)	970.1
5	Stand-alone Cooking Top	4 burners (1 high input rate burner)	850.4
6	Range	4 burners (2 high input rate burners)	1039.5
7	Range	4 burners (2 high input rate burners)	1060.0
8	Range	5 burners (2 high input rate burners)	1062.6
9	Range	5 burners (3 high input rate burners)	1443.3
10	Range	6 burners (6 high input rate burners)	1324.1

DOE notes that for each of the electric cooking top product classes, it did not base the scaling factor on simply the overall AEC calculated according to each test method, because the difference in the overall AECs that were measured for each electric cooking top subject to the two test methods varied by more than 2 percentage points for some product classes. Instead, DOE scaled the measured results for each individual surface unit of each cooking top based on the heating technology of the surface unit (coil, smooth–electric resistance, and smooth–induction) and the surface unit diameter, accounting for any difference in the diameter of the test loads for each respective test method used to test the surface unit. The scaling factors presented in DOE's October 24, 2016 response to AHAM's data request thus are an average obtained from individually scaling four or more surface units per cooking top, and represent the aggregate difference between the overall AEC determined using each test method.

This scaling method for electric cooking tops allowed DOE to account for configuration differences among units in its test sample, including the presence of multi-ring surface units, and the effects of the test cookware selection process specified in the December 2016 TP Final Rule. Regarding the latter, for a given surface unit, the test vessel with a diameter that most closely matched the surface unit diameter was selected for the test. The number of test vessels and test vessel size categories[32] needed to assess the energy consumption of the cooking top was based on the number of controls that could be independently but simultaneously operated on the cooking top. If the number of independent controls/surface units for the cooking top exceeded two, the cooking top was required to be tested with test vessels from at least two cookware categories. As a result, the test vessel selected for testing an individual surface unit was based on the diameter of that surface unit as well as the configuration of diameters of all the surface units on the cooking top to ensure that the test vessel size category requirements were also met. Scaling test results for each individual surface unit ensured that DOE factored in this test procedure requirement.

In contrast, for the gas cooking top test data that were scaled from the results using the hybrid test block method, DOE used the average difference in overall AEC between the two test methods to scale the test results because the test load selection process for gas cooking tops depended only on the input rate of each individual burner and did not depend on the configuration of all the burners on the cooking top. Thus, scaling by the percent difference in overall AEC instead of surface unit energy consumption was appropriate for gas cooking tops, as evidenced by the results for the three gas units in the DOE test sample that were tested according both test methods. For

[32] Test vessels are grouped into categories based on ranges of test vessel diameters to represent different cookware types.

these three gas cooking tops, the percent difference in overall AEC varied less than 1 percentage point.

For these reasons, in this NOPD DOE maintained the same approach to scale test results measured with the hybrid test block method and updated the scaling factors to reflect the test procedure adopted in the December 2016 TP Final Rule.

DOE's test sample of 20 consumer conventional cooking products that were used for the September 2016 SNOPR analysis, as well as being subjected to additional testing for this NOPD, comprised units purchased in 2014 and 2015. To supplement its analysis for this NOPD, DOE also purchased and tested two additional commercial-style gas cooking tops and one additional smooth–electric resistance cooking top. DOE has periodically reviewed the market throughout the course of the rulemaking and has determined that this test sample captures the range of features currently available on the market for each product class. The key characteristics and test results for all cooking top units in DOE's test sample are listed in Table IV-12 and Table IV-13.

Table IV-12 Updated DOE Conventional Gas Cooking Top Test Results

Test Unit #	Burner Type	Burner Input Rating (*Btu/h*)	Average Burner Input Rate (*Btu/h*)	Grate Material	Grate Weight per Burner (*pounds* (*lbs*))*	IAEC (*kBtu/yr*)
1	Open	4×9,000	9,000	Steel	0.5	655.2
2	Open	4×9,100	9,100	Steel	1.1	758.9
3	Open	4×9,100	9,100	Steel	1.1	832.6
4	Sealed	5,000; 9,500; 10,000; 15,000; 17,000	11,300	Cast Iron	2.2	958.4
5	Sealed	2×7,000; 2×8,000	7,500	Cast Iron	2.1	745.5
6	Sealed	2×15,000; 9,500; 5,000	11,125	Cast Iron	3.7	837.9
7	Sealed	4×18,000	18,000	Cast Iron	6.1	974.6
8	Sealed	5,000; 2×9,100; 11,000; 20,000	10,540	Cast Iron	4.2	1031.4
9	Sealed	4×18,000	18,000	Cast Iron	4.8	928.6
10	Sealed	2×9,500; 2×15,000; 2×18,500	14,333	Cast Iron	5.4	922.4
11	Open	4×23,000	23,000	Cast Iron	8.6	907.1
12	Open	12,000; 2×18,000; 3×25,000	20,500	Cast Iron	6.3	1102.5
13	Sealed	5×15,000; 9,200	14,033	Cast Iron	5.8	922.0
14	Sealed	18,500; 5×15,000	15,583	Cast Iron	7.0	895.3

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

Table IV-13 Updated DOE Conventional Electric Cooking Top Test Results

Test Unit #	Cooking Top Product Class	Surface Unit Input Rating (*W*)	IAEC (*kWh/yr*)
1	Smooth–Induction	1,900; 2,600; 3,200; 3,400	119.9
2	Smooth–Induction	Max 3,600	105.7
3	Smooth–Induction	1,800; 2×2,500; 3,700	121.0
4	Smooth–Electric Resistance	2×1,200; 2,400; 3,000	127.4
5	Smooth–Electric Resistance	2×1,200; 2×3,000	120.2
6	Open (Coil)	3×1,300; 1×2,100	111.4
7	Open (Coil)	2×1,300; 2×2,400	115.0
8	Open (Coil)	3×1,250; 2,100	113.8
9	Smooth–Electric Resistance	2×1,200; 1,800; 2,500	106.6

For completeness, DOE supplemented its dataset by incorporating AHAM's test data, and considered this combined dataset in evaluating the efficiency levels, as discussed in section IV.C.2 of this document. The combined dataset significantly expands the number of models included in the engineering analysis and further ensures that the full range of energy consumption for products on the market is captured.

b. Conventional Ovens

As noted in the September 2016 SNOPR, 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. 81 FR 60784, 60812 (Sept. 2, 2016). As discussed in section III.B of this document, although DOE has since repealed the conventional oven test procedure in Appendix I, DOE based its analyses on the data measured using that test procedure. Table IV-14 and Table IV-15 present the testing results maintained from the September 2016 SNOPR 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.2 and section IV.C.3 of this document.

Table IV-14 DOE Conventional Gas Oven Test Results

Test Unit #	Oven Product Class	Burner Input Rate (*Btu/h*)	Cavity Volume (*ft*^{3})	Ignition Type	Convection (Y/N)	IAEC (*kBtu/yr*)
1	Gas Standard – Freestanding	18,000	4.8	Spark	N	1341.4
2	Gas Standard – Freestanding	18,000	4.8	Glo-bar	N	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

Table IV-15 DOE Conventional Electric Oven Test Results

Test Unit #	Oven Product Class	Heating Element Wattage (*W*)	Cavity Volume (*ft*^{3})	Convection (Y/N)	IAEC (*kWh/yr*)
1	Electric Self-Clean – Freestanding	3,000	5.9*	Y	266.2
2	Electric Standard – Freestanding	2,000	2.4	N	213.6
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.

2. 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 NOPD 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 September 2016 SNOPR, DOE developed baseline efficiency levels by considering both data from the previous standards rulemaking and the energy use for the test units based on the water heating test procedure that was later adopted in the December 2016 TP Final Rule. 81 FR 60784, 60813–60814 (Sept. 2, 2016). DOE conducted testing for units in its test sample to measure IAEC, which included energy use in active mode and standby mode. DOE also requested energy use data as part of the manufacturer interviews. However, because manufacturers were not required at the time of the September 2016 SNOPR to conduct testing according to the DOE test procedure, very little energy use information was available. DOE noted in the September 2016 SNOPR that the highest measured IAEC in DOE's test sample 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. 81 FR 60784, 60814.

As part of the September 2016 SNOPR, because DOE observed that baseline electric coil cooking tops and gas cooking tops have only electromechanical controls, DOE calculated the baseline IAEC for these product classes 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. For the September 2016 SNOPR, DOE determined the baseline IAEC for electric smooth cooking tops by setting the 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. 81 FR 60784, 60814 (Sept. 2, 2016).

The baseline efficiency levels for conventional cooking tops proposed in the September 2016 SNOPR are presented in Table IV-16. *Id.*

Table IV-16 September 2016 SNOPR Proposed 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

AHAM commented that all electric coil cooking tops will require a significant redesign to comply with a change to the voluntary safety standard, UL 858, which took effect on June 15, 2018. The updated UL 858 requires manufacturers to monitor and limit pan bottom temperature for coil elements to reduce the incidence of unattended cooking fires. AHAM stated that, at the time of the comment, manufacturers were developing products to comply with the UL 858 requirements and did not yet know how the changes would impact energy consumption. AHAM asserted that DOE's data and efficiency level analysis may not be representative because they do not reflect products that will enter the market before the compliance date of DOE's proposed standards. (AHAM, No. 64 at pp. 19–20)

DOE notes that AHAM did not provide data showing how the redesigns necessary to comply with changes to UL 858 impact the measured energy use for electric coil cooking tops. AHAM did, however, provide data in its petition requesting the withdrawal of the test procedure for conventional cooking tops, showing that the time to boil did not significantly increase using temperature limiting controls on electric coil cooking tops that meet UL 858's recently updated requirements.[33] As a result, DOE did not revise its efficiency level analysis for this NOPD based on the requirements in UL 858.

With respect to the standby energy consumption for baseline electric coil and gas cooking tops, GE commented that the test procedure proposed in the August 2016 TP SNOPR, which proposed to apportion standby power to the cooking top on a combined cooking product, negatively impacts the cooking top IAEC. GE noted that on a majority of combined cooking products, while the entire product may consume standby power, the controls for the cooking top component consist of electromechanical switches that consume no standby power. GE stated that, as a result of assigning a portion of the standby energy consumption measured for the full combined cooking product to the cooking top component, when comparing the IAEC between an electromechanically controlled stand-alone cooking top and a similarly controlled combined cooking product that has a cooking top, the combined product's cooking top will appear to use more energy. (GE, No. 72 at p. 2)

[33] AHAM's petition requesting the withdrawal of the test procedure for conventional cooking tops is available at: *https://www.regulations.gov/document?D=EERE-2018-BT-TP-0004-0002*.

DOE agrees with GE's assertion that apportioning standby power to the cooking top component on a combined cooking product negatively impacts the cooking top IAEC. As discussed in chapter 9 of the TSD for this NOPD, combined cooking products, such as ranges, represent over 70 percent of the total shipments for consumer conventional cooking products. As a result, DOE revised its analysis for electric coil and gas cooking tops, including the baseline efficiency levels, to account for the standby power consumption apportioned to the cooking top component of a combined product based on the maximum standby power for each product class in DOE's test sample for a cooking top that is part of a combined cooking product. DOE estimated the annual standby energy consumption for gas and electric coil cooking tops to be 30 thousand British thermal units per year ("kBtu/yr") and 5 kWh/yr, respectively. Because DOE's analysis for electric smooth cooking tops already included standby power, and because the range of observed standby power was similar for stand-alone electric smooth cooking tops and combined cooking products with an electric smooth cooking top, DOE is maintaining its estimates for the standby power consumption of electric smooth cooking tops in this NOPD. DOE also notes that the majority of products in AHAM's test sample, which was factored into this analysis, were conventional ranges that included standby power consumption for the cooking top component.

Based on AHAM's comments regarding the validity of DOE's test sample discussed in section IV.C.1.a of this document, DOE evaluated the combined dataset, including both DOE and AHAM test data, to determine the baseline efficiency levels for this NOPD. For each product class, the IAEC of several units in AHAM's test sample exceeded the baseline efficiency proposed in the September 2016 SNOPR. In light of this, DOE revised the baseline IAEC to equal the maximum IAEC observed in the combined DOE and AHAM test sample for each product class, as shown in Table IV-17.

Table IV-17 Evaluated Conventional Cooking Top Baseline Efficiency Levels

Product Class	IAEC
Electric Cooking Tops –Open (Coil) Elements	143.6 kWh/yr
Electric Cooking Tops – Smooth Elements	154.9 kWh/yr
Gas Cooking Tops	1443.3 kBtu/yr

Conventional Ovens

As part of the September 2016 SNOPR, 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 included energy use in active mode (including fan-only mode) and standby mode. 81 FR 60784, 60814 (Sept. 2, 2016). As discussed in the September 2016 SNOPR, to address concerns raised by interested parties in response to the June 2015 NOPR 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. 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. 81 FR 60784, 60815.

To establish the baseline efficiency levels for conventional ovens, DOE first derived a relationship between IAEC and cavity volume as discussed in section IV.C.2.c of this document. 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. As part of the September 2016 SNOPR, DOE proposed the baseline efficiency levels presented in Table IV-18, which are based on an oven with a cavity volume of 4.3 ft^3. 81 FR 60784, 60815–60816 (Sept. 2, 2016).

Table IV-18 September 2016 SNOPR Proposed 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
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 were normalized based on a 4.3 ft^3 volume oven.

DOE did not receive comment on the baseline efficiency levels considered for conventional ovens. Thus, DOE did not modify the baseline levels for conventional ovens in this NOPD.

b. Incremental Efficiency Levels

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

Conventional Cooking Tops

For the September 2016 SNOPR, DOE developed incremental efficiency levels for each cooking top product class by first considering information from the previous rulemaking analysis available in the 2009 TSD. In cases where DOE identified design options during testing and reverse engineering teardowns, DOE updated the efficiency levels based on the test data. 81 FR 60784, 60817 (Sept. 2, 2016). Table IV-19 and Table IV-20 show the incremental efficiency levels for the electric cooking top product classes as proposed in the September 2016 SNOPR, including whether the efficiency level is from the 2009 TSD or based on testing for that SNOPR.

Table IV-19 September 2016 SNOPR Proposed 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-20 September 2016 SNOPR Proposed 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%

AHAM commented that the induction cooking tops in AHAM's test sample appear to consume more energy than many of the smooth–electric resistance models in both the DOE and AHAM datasets, which AHAM claimed undermines DOE's estimate of the efficiency improvement due to induction. (AHAM, No. 64 at p. 21) AHAM stated that it was not clear whether the difference between DOE and AHAM's induction test data can be attributed to differences in how the laboratories conducted testing or to differences in the test units themselves. (AHAM, No. 64 at p. 22) AHAM expressed concern that smooth–electric resistance cooking tops, which perform better when the contact between the element and the pan is optimized, may benefit more from the flat cookware specified in the test procedure than do induction cooking tops. AHAM noted that induction cooking tops, which induce an electromagnetic field in the cookware itself, are not affected by contact. (AHAM, No. 64 at p. 22)

To evaluate whether DOE's analysis provides an accurate representation of the efficiency improvement associated with induction heating elements, DOE reviewed data for 128 electric cooking tops sold on the European market and compared the data to results from DOE's test sample. Cooking tops sold on the European market are tested and rated using the same basic test provisions as the DOE test procedure adopted in the December 2016 TP Final Rule. DOE also notes that, based on product teardowns conducted in support of the September 2016 SNOPR, the heating elements and glass cooking surfaces used in electric smooth cooking tops are typically purchased parts that are manufactured by companies that produce and supply these parts to countries worldwide.[34] As a result, DOE believes that the comparative energy use of smooth–

[34] DOE observed during product teardowns that many electric smooth cooking top heating elements are supplied by E.G.O. Worldwide *(http://www.egoproducts.com/en/home/*).

electric resistance and smooth–induction cooking tops on the European market is similar to the comparative performance of products on the U.S. market. As demonstrated in Table IV-21, for both smooth–electric resistance and smooth–induction cooking tops, DOE's test data fell within the range of AEC observed for products on the European market. For both DOE's test data and data for products on the European market, smooth–induction cooking tops are, on average, more efficient than smooth–electric resistance cooking tops.

Table IV-21 Range of AEC for the DOE Test Sample and Cooking Tops Sold on the European Market

		DOE Test Sample AEC (*kWh/yr*)	AHAM Test Sample AEC (*kWh/yr*)	EU Market Survey[35] AEC (*kWh/yr*)
Smooth–Electric Resistance	Maximum	113.7	132.3	123.7
	Average	109.5	119.7	112.1
	Minimum	106.6	105.4	100.9
Smooth–Induction	Maximum	103.0	145.6	118.9
	Average	98.8	127.5	106.0
	Minimum	94.6	118.2	89.7

If the test procedure provided an advantage to smooth–electric resistance cooking tops over smooth–induction cooking tops due to the flatness of the test vessel, DOE would expect to see similar results in the DOE, AHAM, and European market data. However, as discussed above, both DOE and European data indicate that smooth–induction cooking tops consume less energy compared to smooth–electric resistance cooking tops. Therefore, DOE believes that its test data and analysis accurately reflect

[35] Manufacturers selling products into the European market publish the normalized average test energy consumption for a cooking top. To compare EU data to DOE test data, DOE adjusted for the differences in the normalization factors specified in EN 60350-2:2013 and the DOE test procedure adopted in the December 2016 TP Final Rule. DOE then calculated annual energy consumption for the European cooking tops using the method specified in section 4.1.2.1.1 of the test procedure adopted in the December 2016 TP Final Rule.

the decrease in AEC associated with a change from electric resistance to induction heating. As a result, DOE relied on its own test sample to estimate the average decrease in AEC due to induction.

Moreover, as discussed in section III.B of this document, DOE updated the AEC and IAEC values for all electric smooth cooking tops in its test sample that were equipped with multi-ring surface units to reflect the test procedure adopted in the December 2016 TP Final Rule. Accordingly, DOE updated its estimates for the efficiency improvement due to induction for this NOPD. Additional discussion of DOE's estimate of the energy savings attributable to induction technology is presented in chapter 5 of the TSD for this NOPD.

AHAM expressed concern that the use of the automatic power-down low-standby-loss electronic controls design option to reduce energy consumption for electric smooth cooking tops is not technologically feasible. AHAM commented that, based on the combined dataset, reducing or eliminating standby energy consumption through the use of the automatic power-down design option would not be sufficient to achieve the proposed efficiency level for electric smooth cooking tops. AHAM noted that only one induction cooking top model in the test sample could meet the proposed level by reducing or eliminating its standby energy consumption. Therefore, AHAM recommended that DOE adopt a less stringent level for electric smooth cooking tops. (AHAM, No. 64 at pp. 22–23)

DOE notes that AHAM's conclusion appears to be based on the max-tech efficiency level rather than the efficiency levels associated with low-standby-loss electronic controls that were evaluated in this NOPD. As discussed in section IV.C.2.a of this document, DOE revised the baseline efficiency level for electric smooth cooking tops based on the combined dataset. DOE then applied its estimates for the decrease in IAEC that would be expected from implementing low-standby-loss electronic controls to the new baseline efficiency level. This resulted in higher overall IAECs for these efficiency levels than were proposed in the September 2016 SNOPR. With these revised efficiency levels, more than 50 percent of electric smooth cooking tops in the combined DOE and AHAM test sample have a measured IAEC that already meets the efficiency level associated with automatic power-down, the most stringent implementation of low-standby-loss electronic controls. Nonetheless, as discussed in section V.A of this document, DOE determined that the electric smooth cooking top efficiency level associated with the automatic power-down low-standby-loss design option may result in a loss in the utility of the clock display for combined cooking products. As a result, DOE evaluated prescriptive design standards in this NOPD for electric smooth cooking tops that would allow for a continuous clock display, and accordingly, would not require the elimination of clocks from products.

Table IV-22 and Table IV-23 show the efficiency levels considered for the electric cooking top product classes. As discussed in section IV.A.2.a and section IV.B.1.a of this document, DOE is no longer considering improved contact conductance and halogen lamp elements as design options for electric coil cooking tops and electric smooth cooking tops, respectively. As a result, DOE did not analyze incremental efficiency levels associated with these design options for this NOPD. For electric coil cooking tops, this resulted in no incremental efficiency levels above the baseline.

Additional discussion of DOE's analysis of the incremental efficiency levels is presented in chapter 5 of the TSD for this NOPD.

Table IV-22 Evaluated Open (Coil) Element Electric Cooking Top Efficiency Levels

Level	Efficiency Level Source	Design Option	IAEC (*kWh/yr*)	Relative % Decrease in IAEC
Baseline	AHAM Test Data	Baseline	143.6	-

Table IV-23 Evaluated Smooth Element Electric Cooking Top Efficiency Levels

Level	Efficiency Level Source	Design Option	IAEC (*kWh/yr*)	Relative % Decrease in IAEC
Baseline	AHAM Test Data	Baseline	154.9	-
1	SNOPR Testing	Baseline + SMPS	147.6	-4.7%
2	SNOPR Testing	1 + Automatic Power Down	131.4	-11.0%
3	SNOPR Testing	2 + Induction Heating Element	118.8	-9.6%

Table IV-24 shows the incremental efficiency levels for the gas cooking top product class proposed in the September 2016 SNOPR. 81 FR 60784, 60818 (Sept. 2, 2016).

Table IV-24 September 2016 SNOPR Proposed Gas Cooking Top Efficiency Levels

Level	Design Option	Proposed IAEC (*kBtu/yr*)	Relative % Decrease in IAEC
Baseline	Baseline	1104.6	-
1	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	Baseline + Optimized Burner/Optimized Grates (Achievable with at least one high input rate burners and cast-iron grates)	837.8	-9.4%
3	Baseline + Optimized Burner/Optimized Grates (Highest efficiency unit with cast-iron grates)	730.2	-12.8%

As discussed in the September 2016 SNOPR, DOE considered multiple efficiency levels associated with optimized burner and grate design for gas cooking tops. 81 FR 60784, 60817 (Sept. 2, 2016). DOE's testing 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 noted 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. Based on DOE's review of the test data for the gas cooking tops in its test sample, DOE identified three efficiency levels associated with improving the burner and grate design that take into account key burner configurations. *Id*.

DOE proposed 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 noted that while there are some such products with fewer than six surface units and fewer than four high input rate burners, DOE did not observe any products marketed as residential-style with the burner configuration DOE associated with Efficiency Level 1. *Id*.

DOE proposed 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. *Id*.

DOE proposed 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 noted 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. *Id*.

In response to the September 2016 SNOPR, AHAM agreed that DOE should adopt standards for gas cooking tops that would ensure that commercial-style cooking tops are not eliminated from the market. (AHAM, No. 64 at p. 24) However, AHAM commented that there were commercial-style products on the market at that time with up to six high input rate burners. AHAM's test data indicated that cooking products meeting this description were not able to meet DOE's Efficiency Level 1 (see Table IV-24, above) as proposed in the September 2016 SNOPR. (AHAM, No. 64 at p. 25) Because DOE's proposed standard level was designed to maintain the full functionality of commercial-style gas cooking tops, AHAM urged DOE to propose a less stringent level for gas cooking tops. (AHAM, No. 64 at p. 28)

Sub-Zero commented that the U.S. market has evolved differently than international markets such as Europe, which has driven manufacturers on the U.S. market to update product designs to satisfy consumer demand for high input rate burners. Sub-Zero commented that for high-performance cooking tops, a range of burner input rates allows consumers the ability to cook foods that require searing on one burner and foods that require melting temperatures on another burner. Sub-Zero commented that the large, massive grates complement the burner by absorbing heat and allowing consumers more control over the distribution of heat so that cooking vessels can be moved off of a burner's dead-center position, but still maintain a proper food temperature. To demonstrate evidence of the evolving commercial-style market and how DOE's efficiency levels for gas cooking tops do not adequately account for the utility provided by a range of burner input rates, Sub-Zero provided the IAECs for both a model that it had discontinued shortly before its comments (with five 15,000 Btu/h burners and one 9,200 Btu/h burner) and the updated version of that same model that incorporated higher input rate burners (including one burner at 20,000 Btu/h and two at 18,000 Btu/h). Sub-Zero's test data, presented in Table IV-25, showed that the updated model with the higher input rate burners had a higher measured IAEC. (Sub-Zero, No. 66 at pp. 3–4)

Table IV-25 Sub-Zero Gas Cooking Top Test Data

Model – Wolf SRT366	Burner Input Ratings (*Btu/h*)	Average Burner Input Rate (*Btu/h*)	IAEC (*kBtu/yr*)
Older Vintage	5×15,000; 9,200	14,033	922–955
Updated Model	20,000; 2×18,000; 2×15,000; 9,200	15,867	992*

* This model was a stand-alone cooking top with a measured energy consumption of 992 kBtu/yr. Because this unit was equipped with electromechanical controls and did not consume standby power, DOE estimated a baseline annual standby energy consumption of 30 kBtu/yr to account for cooking tops that are part of a combined cooking product when evaluating efficiency levels, as discussed in section IV.C.2.a of this document.

As discussed in section IV.B.1.a of this document, DOE is no longer considering optimized burners and grate designs as a technology option for gas cooking tops. As a result, DOE did not analyze incremental efficiency levels associated with these design options for this NOPD. For gas cooking tops, this resulted in no incremental efficiency levels above the baseline.

Table IV-26 includes the efficiency levels for gas cooking tops considered in this NOPD.

Table IV-26 Evaluated Gas Cooking Top Efficiency Levels

Level	Efficiency Level Source	Design Option	IAEC (*kBtu/yr*)	Relative % Decrease in IAEC
Baseline	AHAM Test Data	Baseline	1443.3	-

Conventional Ovens

For the September 2016 SNOPR, DOE developed incremental efficiency levels for each conventional oven product class by first considering information from the previous rulemaking analysis described in 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. 81 FR 60784, 60818 (Sept. 2, 2016). Table IV-27 through Table IV-30 present the efficiency levels for each product class proposed in the September 2016 SNOPR, normalized based on an oven with a cavity volume of 4.3 ft^3.

Table IV-27 September 2016 SNOPR Proposed Electric Standard Oven Efficiency Levels

Level	Efficiency Level Source	Design Option	Proposed IAEC (*kWh/yr*)	
			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-28 September 2016 SNOPR Proposed Electric Self-Clean Oven Efficiency Levels

Level	Efficiency Level Source	Design Option	Proposed IAEC (*kWh/yr*)	
			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
4	2009 TSD	3 + Reduced Conduction Losses	278.5	284.1

Table IV-29 September 2016 SNOPR Proposed Gas Standard Oven Efficiency Levels

Level	Efficiency Level Source	Design Option	Proposed IAEC (*kBtu/yr*)	
			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-30 September 2016 SNOPR Proposed Gas Self-Clean Oven Efficiency Levels

Level	Efficiency Level Source	Design Option	Proposed IAEC (*kBtu/yr*)	
			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

As described in section IV.A.2.b of this document, DOE is no longer considering intermittent/interrupted and intermittent pilot ignition systems or reduced conduction losses as technology options for conventional ovens. Accordingly, DOE has removed their corresponding efficiency levels from the NOPD analysis. Table IV-31 through Table IV-34 present the updated incremental efficiency levels.

Table IV-31 Evaluated Electric Standard Oven Efficiency Levels

Level	Efficiency Level Source	Design Option	IAEC (*kWh/yr*)	
			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	291.9	299.0
3	2009 TSD	2 + Improved Insulation	278.0	285.0
4	2009 TSD	3 + Improved Door Seals	273.2	280.3
5	NOPR Testing	4 + Forced Convection	261.7	268.7
6	NOPR Testing	5 + Oven Separator	220.6	227.7

Table IV-32 Evaluated Electric Self-Clean Oven Efficiency Levels

Level	Efficiency Level Source	Design Option	IAEC (*kWh/yr*)	
			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	327.3	334.3
3	NOPR Testing	2 + Oven Separator	277.8	284.7

Table IV-33 Evaluated Gas Standard Oven Efficiency Levels

Level	Efficiency Level Source	Design Option	IAEC (*kBtu/yr*)	
			Freestanding	Built-in / Slide-in
Baseline	-	Baseline	2083.1	2093.0
1	NOPR Testing	Baseline + SMPS	2052.5	2062.4
2	2009 TSD	1 + Improved Insulation	1946.4	1955.8
3	2009 TSD	2 + Improved Door Seals	1926.6	1935.9
4	NOPR Testing	3 + Forced Convection	1832.9	1841.7

Table IV-34 Evaluated Gas Self-Clean Oven Efficiency Levels

Level	Efficiency Level Source	Design Option	IAEC (*kBtu/yr*)	
			Freestanding	Built-in / Slide-in
Baseline	-	Baseline	1959.6	1969.6
1	NOPR Testing	Baseline + SMPS	1929.0	1939.0
2	NOPR Testing	1 + Forced Convection	1830.5	1839.9

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 adopted in the July 2015 TP Final Rule 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 September 2016 SNOPR, DOE established the slopes by first evaluating the data from the previous rulemaking analysis described in the 2009 TSD, which presented the relationship between measured energy factor ("EF") and cavity volume, then translating from EF to IAEC, considering the range of cavity volumes for the majority of products available on the market as well as testing of units in DOE's test sample. The intercepts for each efficiency level were then chosen so that the equations passed through the desired IAEC corresponding to a particular volume. 81 FR 60784, 60821–60822 (Sept. 2, 2016).

As part of the NOPD analysis, DOE updated the intercepts in the IAEC versus cavity volume relationships for each product class to reflect the revisions to the incremental efficiency levels described in section IV.C.2.b of this document. Table IV-35 and Table IV-36 present the updated slopes and intercepts for the IAEC versus cavity volume relationship for electric and gas ovens, respectively. Additional discussion of DOE's derivation of the oven IAEC versus cavity volume relationship is presented in chapter 5 of the TSD for this NOPD.

Table IV-35 Slopes and Intercepts of Evaluated Electric Oven IAEC versus Cavity Volume Relationship

	Standard Electric Ovens		**Self-Clean Electric Ovens**	
	Slope = 46.3		**Slope = 46.3**	
Level	**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	93.0	100.1	128.4	135.4
3	79.1	86.1	78.9	85.8
4	74.3	81.4	-	-
5	62.7	69.8	-	-
6	21.7	28.8	-	-

Table IV-36 Slopes and Intercepts of Evaluated Gas Oven IAEC versus Cavity Volume Relationship

	Standard Gas Ovens		Self-Clean Gas Ovens	
	Slope = 229.5		Slope = 229.5	
Level	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	959.5	968.9	843.5	852.9
3	939.6	948.9	-	-
4	846.0	854.8	-	-

3. Cost-efficiency Results

a. Conventional Cooking Tops

For the September 2016 SNOPR, DOE developed the cost-efficiency results for each conventional cooking top product class shown in Table IV-37. Where available, DOE developed incremental 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 rulemaking, DOE used the incremental manufacturing costs developed as part of the previous rulemaking analysis described in 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.[36] 81 FR 60784, 60822 (Sept. 2, 2016).

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

Table IV-37 September 2016 SNOPR Proposed Conventional Cooking Top Incremental Manufacturing Production Costs (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	-

DOE did not receive comments on the incremental MPCs for conventional cooking tops presented in the September 2016 SNOPR. As a result, DOE maintained its estimates for the incremental MPCs in this NOPD, but adjusted the cost-efficiency results to reflect updates to parts pricing estimates and the most recent PPI data. DOE also notes that it is no longer considering improved contact conductance for electric coil cooking tops, halogen lamp elements for electric smooth cooking tops, and optimized burner and grate designs for gas cooking tops, as discussed in section IV.C.2.b of this document. As a result, DOE updated the cost-efficiency results to reflect the revised efficiency levels. The updated estimates for the incremental MPCs considered in this NOPD are presented in Table IV-38.

Table IV-38 Evaluated Conventional Cooking Top Incremental Manufacturing Production Costs (2018$)

Level	Open (Coil) Element Electric Cooking Tops	Smooth Element Electric Cooking Tops	Gas Cooking Tops
Baseline	-	-	-
1	-	$0.69	-
2	-	$1.81	-
3	-	$198.33	-

b. Conventional Ovens

As described in the September 2016 SNOPR, DOE developed the cost-efficiency results for each conventional oven product class shown in Table IV-39. DOE noted that the estimated incremental MPCs would be equivalent for the freestanding and built-in/slide-in oven product classes. 81 FR 60784, 60823 (Sept. 2, 2016).

Table IV-39 September 2016 SNOPR Proposed Conventional Oven Incremental Manufacturing Production Costs (2014$)

	Electric Ovens		Gas Ovens	
Level	**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	-	-	-

As for conventional cooking tops, DOE did not receive comments on the incremental MPCs for conventional ovens presented in the September 2016 SNOPR. As a result, DOE maintained its estimates for the incremental MPCs in this NOPD, but adjusted the cost-efficiency results to reflect updates to parts pricing estimates and the most recent PPI data. DOE also notes that it is no longer considering intermittent/interrupted and intermittent pilot ignition systems or reduced conduction losses as design options for conventional ovens, as discussed in section IV.C.2.b of this document. As a result, DOE updated the cost-efficiency results to reflect the revised efficiency levels. The updated estimates for the incremental MPCs considered in this NOPD are presented in Table IV-40.

Table IV-40 Evaluated Conventional Oven Incremental Manufacturing Production Costs (2018$)

Level	Electric Ovens		Gas Ovens	
	Standard	**Self-Clean**	**Standard**	**Self-Clean**
Baseline	-	-	-	-
1	$0.81	$0.81	$0.81	$0.81
2	$2.73	$26.97	$6.00	$21.35
3	$7.91	$58.68	$8.40	-
4	$10.31	-	$28.94	-
5	$36.48	-	-	-
6	$68.19	-	-	-

4. Consumer Utility

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

a. Conventional Cooking Tops

DOE stated in the September 2016 SNOPR that it did not believe that the design options and efficiency levels associated with the proposed standards would impact the consumer utility of conventional cooking tops. DOE noted that the proposed standards for gas cooking tops corresponded to the efficiency level that would maintain 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. DOE stated in the September 2016 SNOPR that the proposed standards for gas cooking tops would not preclude the availability of cooking tops marketed as commercial-style. 81 FR 60784, 60823 (Sept. 2, 2016).

AHAM commented that commercial-style products provide consumer utility and incorporate certain features that are expected by purchasers of such products such as heavier cast iron grates to support larger, heavier loads and high input rate burners to provide faster cooking times for such loads. According to AHAM, the heavier grates provide additional consumer utility by retaining heat that helps provide for even heat distribution in the cooking vessel during the cool down/simmering phase and allows consumers to keep the cooking vessel warm by moving the pot off center. AHAM added that heavier grates allow for a sliding motion across burners to mix food without dislodging the grates. AHAM commented that heavier grates also provide increased durability and reliability over the lifetime of the product. AHAM stated that high input rate burners allow for cooking techniques not possible with lower burner input rates, such as flambé, wok cooking, canning, and pressure cooking. AHAM claims that high input rate burners also provide for a better sear on meat, which provides better flavor and texture, due to the higher temperature. (AHAM, No. 64 at p. 24)

Spire and AHAM stated that DOE's proposed standards would likely eliminate commercial-style gas cooking products from the market, which Spire believes would contravene the provisions set forth for adopting new or amended standards under section 6295(o)(4)) of EPCA. (AHAM, No. 64 at p. 27; Spire, No. 61 at p. 5)

AHAM stated that although products in Europe can be designed to have a lower flame to reduce energy consumption, this is not possible in the United States because the CO levels of the burner will increase beyond the acceptable limits specified in ANSI Z21.1. (AHAM, No. 64 at p. 28) AHAM stated that manufacturers are already incentivized to optimize burner and grate design because it is less costly to use smaller gauge metals.[37] AHAM believes the lower material costs for lighter-weight grates supports its point that heavier grates and higher input rate burners offer consumer utility—if consumers did not demand these features, manufacturers would choose the lower cost option. (AHAM, No. 64 at p. 24) Miele commented that the European market for cooking appliances varies greatly from the product offerings in the United States. Miele noted that gas cooking has a very small market share in Europe, electric cooking products are most prevalent, and commercial-style cooking products are not typically offered to residential consumers. Miele also noted that safety standards and CO emission levels are stricter in the United States. (Miele, No. 60 at p. 3)

For electric cooking tops, DOE conducted the engineering analysis by considering cooking top design options that are consistent with products currently on the U.S. market. For gas cooking tops, as discussed in section IV.C.2.b of this document, DOE revised the evaluated baseline efficiency level based on additional test data and information regarding commercial-style cooking tops. As discussed in section IV.A.1.a of this document, DOE did not consider establishing a separate product class for commercial-style gas cooking tops, noting that there are no clearly-defined and consistent design differences and corresponding utility provided by commercial-style gas cooking tops as compared to residential-style gas cooking tops. Further, as discussed in section III.B of this document, DOE eliminated optimized burner and grate designs from consideration as a technology option in this NOPD. As a result, DOE has initially determined that the

[37] AHAM also commented that while reducing the gauge of the grates reduces material cost, this does not include the retooling costs resulting from a switch from heavier grates to lighter ones. (AHAM, No. 64 at p. 24)

existing prescriptive standards for gas cooking tops that preclude the use of constant burning pilot lights do not warrant amendment.

b. Conventional Ovens

DOE stated in the September 2016 SNOPR 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. 81 FR 60784, 60823. DOE noted in the September 2016 SNOPR that it 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 recognized 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 noted 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 of this document, DOE repealed the oven test procedure in the December 2016 TP Final Rule due to uncertainties in its ability to measure representative energy use of commercial-style ovens. As a result of these uncertainties, DOE did not propose a performance-based standard for conventional ovens, but instead proposed a prescriptive design requirement for the conventional oven control system in the September 2016 SNOPR. 81 FR 60784, 60823–60824 (Sept. 2, 2016). DOE did not receive any comments regarding the impact of the proposed standards on conventional ovens. For the reasons discussed above, DOE maintains its findings from the September 2016 SNOPR that the evaluated prescriptive-based standards would not impact the consumer utility of conventional ovens.

D. Markups Analysis

The markups analysis develops appropriate markups (*e.g.*, manufacturer markups, retailer markups, distributor markups, contractor markups) in the distribution chain and sales taxes to convert the MPCs determined in the engineering analysis to consumer prices, which are then used in the LCC and PBP analysis and in the MIA. At each step in the distribution channel, companies mark up the price of the product to cover business costs and profit margins.

For consumer conventional cooking products, the main parties in the distribution chain are manufacturers, retailers, and consumers.

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 consumer conventional cooking products.

DOE developed baseline and incremental markups for each actor in the distribution chain. Baseline markups are applied to the price of products with baseline efficiency, while incremental markups are applied to the difference in price between baseline and higher-efficiency models (the incremental cost increase). The incremental markup is typically less than the baseline markup, and is designed to maintain similar per-unit operating profit before and after new or amended standards.[38]

DOE relied on economic data from the U.S. Census Bureau to estimate average baseline and incremental markups.[39]

AHAM commented that it strongly disagrees with the concept of incremental markups. According to AHAM, manufacturers, wholesalers, retailers and contractors have all provided numerous amounts of data, studies, and surveys saying that the incremental markup concept has no foundation in actual practice. AHAM asked what additional information DOE would need to reassess the markups approach. AHAM further asked if DOE would agree to put the concept of incremental markups up for peer review. (AHAM, No. 64 at p. 31) AHAM stated that DOE persists in relying on a simplistic interpretation of economic theory that assumes only variable costs can be passed through to customers because economic returns on capital cannot increase in a competitive marketplace. According to AHAM, it and the other associations and industry participants take the position that DOE's conclusions are incorrect and that percentage margins throughout the distribution channels have remained largely constant. In addition, AHAM asserted that Shorey Consulting has shown that empirical studies of industry structure and other variables have only weak correlation with profitability,

[38] Because the projected price of standards-compliant products is typically higher than the price of baseline products, using the same markup for the incremental cost and the baseline cost would result in higher per-unit operating profit. While such an outcome is possible, DOE maintains that in markets that are reasonably competitive it is unlikely that standards would lead to a sustainable increase in profitability in the long run.

[39] 2012 Annual Retail Trade Survey, Electronics and Appliance Stores (NAICS 443). 2012. Washington, D.C. *http://www.census.gov/retail/arts/historic_releases.html*.

demonstrating that the economic theory DOE relies upon is proven not to apply in practice. AHAM commented that DOE should submit both its work and that of the various industry groups to an independent peer review process. (AHAM, No. 64 at p. 31)

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 percentage 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 Shorey Consulting interviews with appliance retailers, although the retailers said that they maintained the same percentage margin after amended standards for refrigerators took effect, it is not clear to what extent the wholesale prices of refrigerators actually increased. There is some empirical evidence indicating that prices may not always increase following a new standard.[40,41,42] If this happened to be the case following the new refrigerator standard, then there is no reason to suppose that percentage margins changed either.

DOE's analysis necessarily considers a simplified version of the world of appliance retailing; namely, a situation in which other than appliance product offerings,

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[40] Spurlock, C. A. 2013. "Appliance Efficiency Standards and Price Discrimination." Lawrence Berkeley National Laboratory Report LBNL-6283E.
[41] Houde, S. and C. A. Spurlock. 2015. "Do Energy Efficiency Standards Improve Quality? Evidence from a Revealed Preference Approach." Lawrence Berkeley National Laboratory Report LBNL-182701.
[42] Taylor, M., C. A. Spurlock, and H.-C. Yang. 2015. "Confronting Regulatory Cost and Quality Expectations: An Exploration of Technical Change in Minimum Efficiency Performance Standards." *Resources for the Future* (*RFF*) 15-50.

nothing changes in response to amended standards. DOE's analysis assumes that product cost will increase while the other costs remain constant (*i.e.*, no change in labor, material, or operating costs), and asks whether retailers will be able to keep the same markup percentage over time. DOE recognizes that retailers are likely to seek to maintain the same markup percentage on appliances if the price they pay goes up as a result of appliance standards, but DOE contends that over time downward adjustments are likely to occur due to competitive pressures. Some retailers may find that they can gain sales by reducing the markup and maintaining the same per-unit gross profit as they had before the new standard took effect. Additionally, DOE contends that retail pricing is more complicated than a simple percentage margin or markup. Retailers undertake periodic sales and they reduce the prices of older models as new models come out to replace them.[43,44,45] Even if retailers maintain the same percent markup when appliance wholesale prices increase as the result of a standard, retailers may respond to competitive pressures and revert to pre-standard average per-unit profits by holding more frequent sales, discounting products under promotion to a greater extent, or discounting older products more quickly. These factors would counteract the higher percentage markup on average, resulting in much the same effect as a lower percentage markup in terms of the prices consumers actually face on average.

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

[43] Bagwell, K. and Riordan, M.H., 1991. "High and declining prices signal product quality." *The American Economic Review*, pp. 224–239.
[44] Betts, E. and Peter, J.M., 1995. "The strategy of the retail 'sale': typology, review and synthesis." *International Review of Retail, Distribution and Consumer Research*, 5(3), pp. 303–331.
[45] Elmaghraby, W. and Keskinocak, P., 2003. "Dynamic pricing in the presence of inventory considerations: Research overview, current practices, and future directions." *Management Science*, 49(10), pp. 1287–1309.

complex and varying with business conditions. However, DOE continues to maintain that its assumption that standards do not facilitate a sustainable increase in profitability is reasonable.

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

E. Energy Use Analysis

The purpose of the energy use analysis is to determine the annual energy consumption of consumer conventional cooking products at different efficiencies in representative U.S. single-family homes, and multi-family residences, and to assess the energy savings potential of increased cooking product efficiency. The energy use analysis estimates the range of energy use of consumer conventional cooking products in the field (*i.e.*, as they are actually used by consumers) at the considered efficiency levels. DOE uses these values in the LCC and PBP analyses and in the NIA to establish the savings in consumer operating costs at various product efficiency levels. DOE developed energy consumption estimates for all product classes analyzed in the engineering analysis.

For this analysis, DOE used the 2009 *California Residential Appliance Saturation Survey* ("RASS")[46] and a Florida Solar Energy Center ("FSEC") study[47] to establish

[46] California Energy Commission, *Residential Appliance Saturation Survey* (*RASS*) (2009).
[47] 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).

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 consumer conventional 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 2015 *Residential Energy Consumption Survey* ("RECS 2015").[48] RECS 2015 does not provide the annual energy consumption of cooking products, but it does provide the frequency of cooking product use.[49] DOE was unable to use the frequency of use to calculate the annual energy consumption using a bottom-up approach, as data in RECS did not include information about the duration of a cooking event to allow for an annual energy use calculation. DOE therefore relied on California RASS and FSEC studies to establish the average annual energy consumption of conventional cooking tops and ovens.

From RECS 2015, DOE developed household samples for each product class. For each household using a consumer 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

[48] U.S. Department of Energy: Energy Information Administration, Residential Energy Consumption Survey: 2015 RECS Survey Data (2017) (Available at: *http://www.eia.gov/consumption/residential/data/2015/*). RECS 2015 is based on a sample of 5,686 households statistically selected to represent 118.2 million housing units in the United States.

[49] 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.

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.

Since there were no comments on DOE's approach to developing the energy use analysis, DOE retained the approach used for this NOPD. Chapter 7 of the TSD for this NOPD describes the energy use analysis for consumer conventional cooking products in detail.

F. Life-Cycle Cost and Payback Period Analysis

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

- The LCC (life-cycle cost) is the total consumer expense of an appliance or product over the life of that product, consisting of total installed cost (MSP, distribution chain markups, sales tax, and installation costs) plus operating costs (expenses for energy use, maintenance, and repair). To compute the operating costs, DOE discounts future operating costs to the time of purchase and sums them over the lifetime of the product.

- The PBP (payback period) is the estimated amount of time (in years) it takes consumers to recover the increased purchase cost (including installation) of a more-efficient product through lower operating costs. DOE calculates the PBP by dividing the change in purchase cost at higher efficiency levels by the change in annual operating cost for the year that amended or new standards are assumed to take effect.

For any given efficiency level, DOE measures the change in LCC relative to the LCC in the no-new-standards case, which reflects the estimated efficiency distribution of cooking products in the absence of new or amended energy conservation standards. In contrast, the PBP for a given efficiency level is measured relative to the baseline product.

For each considered efficiency level in each product class, DOE calculated the LCC and PBP for a nationally representative set of housing units. As stated previously, DOE developed household samples from the 2015 RECS. For each sample household, DOE determined the energy consumption for the cooking product and the appropriate electricity price. By developing a representative sample of households, the analysis captured the variability in energy consumption and energy prices associated with the use of consumer conventional cooking products.

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

The computer model DOE uses to calculate the LCC and PBP, which incorporates Crystal Ball™ (a commercially-available software program), relies on a Monte Carlo simulation to incorporate uncertainty and variability into the analysis. The Monte Carlo simulations randomly sample input values from the probability distributions and cooking product user samples. The model calculated the LCC and PBP for products at each efficiency level for 10,000 housing units per simulation run.

DOE calculated the LCC and PBP for all consumers of conventional cooking products as if each were to purchase a new product in the expected first year of required compliance with new or amended standards. Any amended standards would apply to cooking products manufactured 3 years after the date on which any new or amended standard is published. (42 U.S.C. 6295(m)(4)(A)(i)) Therefore, DOE used 2023 as the first full year of compliance with any amended standards for consumer conventional cooking products.

Table IV-41 summarizes the approach and data DOE used to derive inputs to the LCC and PBP calculations. The subsections that follow provide further discussion. Details of the spreadsheet model, and of all the inputs to the LCC and PBP analyses, are contained in chapter 8 of the TSD for this NOPD and its appendices.

Table IV-41 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 2015 RECS.
Energy Prices	Electricity: Based on EIA's Form 861 data for 2018. Variability: Regional energy prices determined for 9 census divisions.
Energy Price Trends	Based on the EIA's *Annual Energy Outlook* ("*AEO*") *2019* price forecasts.
Repair and Maintenance Costs	Assumed no change with efficiency level for all cooking tops and electric ovens.
Product Lifetime	16.8 years for electric and 14.5 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	2023

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

1. Product Cost

To calculate consumer product costs, DOE multiplied the MPCs developed in the engineering analysis by the markups described in section IV.D of this document (along with sales taxes). DOE used different markups for baseline products and higher-efficiency products, because DOE applies an incremental markup to the increase in MSP associated with higher-efficiency products. DOE assumed that the product costs would be the same in the compliance year as at the time of this analysis.

2. Installation Cost

Installation costs include labor, overhead, and any miscellaneous materials and parts needed to install the product. For this evaluation, DOE used data from the 2015 *RS Means Residential Cost Data* on labor requirements to estimate installation costs for consumer conventional cooking products.[50]

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 cookware 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 and average retail price of induction-compatible cooking utensils to estimate this portion of the installation cost. AHAM requested DOE to provide details on how the cost required to change cookware when purchasing an induction cooking top was obtained. The comment specifically requested details regarding the approach used for estimating the average number of pots and pans to be replaced, as well as the retail average price of an induction-compatible utensil. AHAM also suggested that DOE investigate consumers' cost of upgrading their wiring to ensure necessary amperes are directed to the cooking activity without compromising power to other areas of the home. (AHAM, No. 64 at pp. 31–32) For the September 2016 SNOPR as well as the updated analysis in this proposal, DOE utilized the Willem *et al*. study to determine the average number of pots and pans to be replaced.[51] With regard to those consumers who may need to upgrade the electrical wiring to accommodate for higher amperage, DOE did not have

[50] RS Means Company Inc., RS Means Residential Cost Data (2015) (Available at *http://rsmeans.reedconstructiondata.com/default.aspx*).
[51] Willem, H. *et al*. 2015. "Understanding Cooking Behavior in U.S. Households."

information about the existing amperage of the electrical circuit of the consumer population. In order to be representative of the consumer population in this NOPD, DOE estimated an average additional cost based on the assumption that 50 percent of the user population may need upgrades and 50 percent may not, using the wiring cost contained in 2015 RS Means Mechanical Cost Data. See chapter 8 of the TSD for this NOPD for details about this component. Given the installation costs of the induction cooking top, the market share is expected to remain at 1.6 percent in the standards case in the year 2023. See section IV.F.9 and section IV.H.1 of this document for details on the market shares.

3. Annual Energy Consumption

For each sampled household, DOE determined the energy consumption for a cooking product at different efficiency levels using the approach described above in section IV.E of this document.

4. Energy Prices

DOE used average prices (for baseline products) and marginal prices (for higher-efficiency products) which vary by season, region, and baseline electricity consumption level for the LCC. DOE derived marginal residential electricity and natural gas prices for 27 geographic areas.[52] Marginal prices are appropriate for determining energy cost savings associated with possible changes to efficiency standards.

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

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 the Edison Electric Institute ("EEI"), Typical Bill and Average Rates reports for summer and winter 2018.[53] 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.

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 (2018).[54]

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

[53] Edison Electric Institute. Typical Bills and Average Rates Report. Winter 2018 published January 2018, Summer 2018 published July 2018. Available at: *http://www.eei.org/resourcesandmedia/products/Pages/Products.aspx*

[54] 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*

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.[55] DOE used the complete annual data for 2017 to calculate an average annual price for each geographic area. (For use in the LCC model, prices were scaled to 2018$.) 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 energy prices in future years, DOE multiplied the average regional energy prices by projections of annual change in national-average residential energy

[55] U.S. Department of Energy–Energy Information Administration. Natural Gas Navigator. 2014. (Last accessed September 26, 2016.) *http://eia.doe.gov/dnav/ng/ng_pri_sum_dcu_nus_m.htm*

found in *AEO 2019*.[56] *AEO 2019* has an end year of 2050. To estimate price trends after 2050, DOE used the average annual rate of change in prices from 2030 through 2050.

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

5. Maintenance and Repair Costs

Repair costs are associated with repairing or replacing product components that have failed in an appliance; maintenance costs are associated with maintaining the operation of the product. Typically, small incremental increases in product efficiency produce no, or only minor, changes in repair and maintenance costs compared to baseline efficiency products.

For all electric cooking products, DOE did not include any changes in maintenance and repair for products more efficient than baseline products.

Spire stated that DOE did not provide explanation as to why Electrolux's comment regarding glo-bar repair frequency was ignored. (Spire, No. 61 at p. 6–7). In the September 2016 SNOPR, DOE determined the repair and maintenance costs associated with different types of ignition systems for gas ovens. Utilizing inputs from interested parties, including Electrolux, along with the earlier data from manufacturers, DOE revised the average repair cost attributable to glo-bar and electronic spark ignition

[56] EIA. *Annual Energy Outlook 2019 with Projections to 2050*. Washington, D.C. Available at *www.eia.gov/forecasts/aeo/*.

systems and annualized it over the life of the unit for glo-bar and electronic spark ignition systems. 81 FR 60784, 60827. For this rule, taking into account manufacturer inputs and test data for standard and self-clean gas ovens, DOE revised the efficiency levels, and electronic spark ignition has been eliminated in the considered levels (see section IV.C of this document). The issue of frequency of repair of glo-bar is therefore no longer relevant.

Based on input from manufacturers, DOE did not include maintenance costs for glo-bars.

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

6. Product Lifetime

Equipment lifetime is the age at which the equipment is retired from service. In the September 2016 SNOPR, DOE revised the average lifetime estimates based on data provided by AHAM, thereby establishing average product lifetime of 16 years for all electric cooking products and 13 years for all gas cooking products. 81 FR 60784, 60827. AHAM provided further detail on the average useful life by product categories, such as electric range, gas range, wall oven, and electric cooking top. (AHAM, No. 64 at p. 32) Utilizing this detail and the market shares of these product categories, DOE fine-tuned the average lifetime estimates to a more representative 16.8 years for all electric cooking products and 14.5 years for all gas cooking products. DOE characterized the product lifetimes with Weibull probability distributions.

See chapter 8 of the TSD accompanying this NOPD for further details on the sources used to develop product lifetimes, as well as the use of Weibull distribution.

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 cooking products based on consumer financing costs and the opportunity cost of consumer funds.

DOE applies weighted-average discount rates calculated from consumer debt and asset data, rather than marginal or implicit discount rates.[57] DOE notes that the LCC does not analyze the appliance purchase decision, so the implicit discount rate is not relevant in this model. The LCC estimates net present value over the lifetime of the product, so the appropriate discount rate will reflect the general opportunity cost of household funds, taking this time scale into account. Given the long time horizon modeled in the LCC, the application of a marginal interest rate associated with an initial source of funds is inaccurate. Regardless of the method of purchase, consumers are expected to continue to rebalance their debt and asset holdings over the LCC analysis period, based on the restrictions consumers face in their debt payment requirements and

[57] The implicit discount rate is inferred from a consumer purchase decision between two otherwise identical goods with different first cost and operating cost. It is the interest rate that equates the increment of first cost to the difference in net present value of lifetime operating cost, incorporating the influence of several factors: transaction costs, risk premiums and response to uncertainty, time preferences, interest rates at which a consumer is able to borrow or lend.

the relative size of the interest rates available on debts and assets. DOE estimates the aggregate impact of this rebalancing using the historical distribution of debts and assets.

To establish residential discount rates for the LCC analysis, DOE identified all relevant household debt or asset classes in order to approximate a consumer's opportunity cost of funds related to appliance energy cost savings. It estimated the average percentage shares of the various types of debt and equity by household income group using data from the Federal Reserve Board's Survey of Consumer Finances[58] ("SCF") for 1995, 1998, 2001, 2004, 2007, 2010, 2013, and 2016. Using the SCF and other sources, DOE developed a distribution of rates for each type of debt and asset by income group to represent the rates that may apply in the year in which amended standards would take effect. DOE assigned each sample household a specific discount rate drawn from one of the distributions. The average rate across all types of household debt and equity and income groups, weighted by the shares of each type, is 4.2 percent. See chapter 8 of the TSD for this NOPD for further details on the development of consumer discount rates.

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

To accurately estimate the share of consumers that would be affected by a potential energy conservation standard at a particular efficiency level, DOE's LCC analysis considered the projected distribution (market shares) of product efficiencies

[58]The Federal Reserve Board, Survey of Consumer Finances 1995, 1998, 2001, 2004, 2007, 2010, 2013, and 2016. *http://www.federalreserve.gov/pubs/oss/oss2/scfindex.html*

under the no-new-standards case (*i.e.*, the case without amended or new energy conservation standards).

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[59] that assumes most consumers (*i.e.*, home owners[60]) 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[61] and the PPI of household cooking appliance manufacturing[62] in the years 2002–2012, along with the consumer purchase price derived from the engineering

[59] DOE developed this consumer choice model for this proposed determination, the details of which are outlined in chapter 8 of the TSD for this NOPD. 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.

[60] 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 product or gas oven.

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

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

analysis, to analyze factors that influence consumer purchasing decisions. Using this model, DOE found that historical shipments 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[63] 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 2023.

Table IV-42, Table IV-43, and Table IV-44 present the market shares of the efficiency levels in the no-new-standards case for consumer conventional cooking products.[64]

[63] Model data collected from the websites of A J Madison, Best Buy, and Lowe's.

[64] 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.2.c of this document, DOE developed slopes and intercepts to characterize the relationship between IEAC and cavity volume for each efficiency level.

Table IV-42 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	143.6	100%	Baseline	154.9	54.7%	Baseline	1,443.3	100%
			1	147.6	22.2%			
			2	131.4	21.8%			
			3	118.8	1.2%			

Table IV-43 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	39.6%	Baseline	354.9	362.0	51.5%
1	306.3	313.3	8.9%	1	346.0	353.0	16.2%
2	291.9	299.0	11.8%	2	327.3	334.3	17.7%
3	278.0	285.0	11.4%	3	277.8	284.7	14.5%
4	273.2	280.3	11.2%				
5	261.7	268.7	9.4%				
6	220.6	227.7	7.7%				

Table IV-44 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	46.3%	Baseline	1,959.6	1,969.6	55.4%
1	2,052.5	2,062.4	12.4%	1	1,929.0	1,939.0	21.5%
2	1,946.4	1,955.8	14.2%	2	1,830.5	1,839.9	23.1%
3	1,926.6	1,935.9	14.1%				
4	1,832.9	1,841.7	13.0%				

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

9. Payback Period Analysis

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

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

As noted above, EPCA, as amended, establishes a rebuttable presumption that a standard is economically justified if the Secretary finds that the additional cost to the consumer of purchasing a product complying with an energy conservation standard level will be less than three times the value of the first year's energy savings resulting from the standard, as calculated under the applicable test procedure. (42 U.S.C. 6295(o)(2)(B)(iii)) For each considered efficiency level, DOE determined the value of the first year's energy savings by calculating the energy savings in accordance with the applicable DOE test procedure, and multiplying those savings by the average energy price projection for the year in which compliance with the new or amended standards would be required.

G. Shipments Analysis

DOE uses projections of annual product shipments to calculate the national impacts of potential amended or new energy conservation standards on energy use, NPV, and future manufacturer cash flows.[65] The shipments model takes an accounting approach, tracking market shares of each product class and the vintage of units in the stock. Stock accounting uses product shipments as inputs to estimate the age distribution of in-service product stocks for all years. The age distribution of in-service product stocks is a key input to calculations of both the NES and NPV, because operating costs for any year depend on the age distribution of the stock. The shipment projections are based on historical data and an analysis of key market drivers for each product. For conventional cooking products, DOE accounted for three market segments: (1) new

[65] DOE uses data on manufacturer shipments as a proxy for national sales, as aggregate data on sales are lacking. In general one would expect a close correspondence between shipments and sales.

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 2019* through 2052. The market saturation data for new housing came from RECS 2015.

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 2013–2052. 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[66] and U.S. Appliance Industry Statistical Review.[67] The shares are kept constant over time.

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

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

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

Table IV-45 summarizes the approach and data DOE used to derive the inputs to the shipments analysis for this NOPD.

Table IV-45 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 *AEO 2019* projections. New housing product saturations based on RECS 2015. Saturations maintained at 2015 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 would increase due to the considered 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 for cooking products as described in appendix 9A of the TSD for this NOPD. 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, before the unit would be replaced with a new cooking unit.

AGA and APGA stated that DOE failed to assess the potential for fuel switching from natural gas to electric cooking products as a result of a conservation standard. (AGA and APGA, No. 68 at p. 3) Because DOE is proposing standards for both electric and natural gas appliances, any increase in the price of the appliance would impact cooking products of both fuel types. As switching typically includes additional installation costs for accessing the new fuel source (*e.g.*, installation of a gas line for gas appliances and installation of electrical lines for electrical appliances), which would outweigh the incremental change in equipment price, DOE determined that fuel switching would not occur.

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

H. National Impact Analysis

The NIA assesses the NES and the NPV from a national perspective of total consumer costs and savings that would be expected to result from new or amended standards at specific efficiency levels.[68] ("Consumer" in this context refers to consumers of the product being regulated.) DOE calculates the NES and NPV for the potential standard levels considered based on projections of annual product shipments, along with the annual energy consumption and total installed cost data from the energy use and LCC analyses.[69] For the present analysis, DOE projected the energy savings, operating cost savings, product costs, and NPV of consumer benefits over the lifetime of conventional cooking products sold from 2023 through 2052.

DOE evaluates the impacts of new or amended standards by comparing a case without such standards with standards-case projections. The no-new-standards case characterizes energy use and consumer costs for each product class in the absence of new or amended energy conservation standards. For this projection, DOE considers historical trends in efficiency and various forces that are likely to affect the mix of efficiencies over time. DOE compares the no-new-standards case with projections characterizing the market for each product class if DOE adopted new or amended standards at specific energy efficiency levels (*i.e.*, the TSLs or standards cases) for that class. For the standards cases, DOE considers how a given standard would likely affect the market shares of products with efficiencies greater than the standard.

DOE uses a spreadsheet model to calculate the energy savings and the national consumer costs and savings from each TSL. Interested parties can review DOE's

[68] The NIA accounts for impacts in the 50 States and U.S. territories.
[69] For the NIA, DOE adjusts the installed cost data from the LCC analysis to exclude sales tax, which is a transfer.

analyses by changing various input quantities within the spreadsheet. The NIA spreadsheet model uses typical values (as opposed to probability distributions) as inputs.

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 2023 through 2052.

Table IV-46 summarizes the key inputs for the NIA. The sections following provide further details, as does chapter 10 of the TSD for this NOPD.

Table IV-46 Inputs for the National Impact Analysis

Input	Description
Shipments	Annual shipments from shipments model.
Compliance date	May 1, 2023.
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 2023 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 2019* forecasts (to 2050) and extrapolation beyond 2050 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	2019.

1. Product Efficiency Trends

A key component of DOE's estimates of NES and NPV is the energy efficiencies forecasted over time. Section IV.F.8 of this document describes how DOE developed an energy efficiency distribution for the no-new-standards case (which yields a shipment weighted-average efficiency) for each of the considered product classes for the year of anticipated compliance with an amended or new standard. For the no-new-standards case, DOE utilized the consumer choice model (in combination with the equipment price projection (as described in section IV.F.1 of this document) to determine the efficiencies in each future year, for conventional electric cooking products and gas ovens. For conventional gas cooking tops, DOE relied on manufacturer inputs, model-based market distribution available from retail websites. The approach is further described in chapter 10 of the TSD for this NOPD.

For the standards cases, 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.

2. National Energy Savings

The NES analysis involves a comparison of national energy consumption of the considered products between each potential standards case (TSL) and the case with no new or amended energy conservation standards. DOE calculated the national energy consumption by multiplying the number of units (stock) of each product (by vintage or age) by the unit energy consumption (also by vintage). DOE calculated annual NES based on the difference in national energy consumption for the no-new-standards case and for each higher efficiency standard case. DOE estimated energy consumption and savings based on site energy and converted the electricity consumption and savings to primary energy (*i.e.*, the energy consumed by power plants to generate site electricity) using annual conversion factors derived from *AEO 2019*. Cumulative energy savings are the sum of the NES for each year over the timeframe of the analysis.

Use of higher-efficiency products is occasionally associated with a direct rebound effect, which refers to an increase in utilization of the product due to the increase in efficiency. DOE did not find any data on the rebound effect specific to cooking products. The calculated NES at each efficiency level therefore remains unimpacted by rebound effect. DOE does not include the rebound effect in the NPV analysis because it reasons that the increased service from greater use of the product has an economic value that is reflected in the value of the foregone energy savings.

In 2011, in response to the recommendations of a committee on "Point-of-Use and Full-Fuel-Cycle Measurement Approaches to Energy Efficiency Standards" appointed by the National Academy of Sciences, DOE announced its intention to use FFC measures of energy use and greenhouse gas and other emissions in the national impact analyses and emissions analyses included in future energy conservation standards rulemakings. 76 FR 51281 (Aug. 18, 2011). After evaluating the approaches discussed in the August 18, 2011 notice, DOE published a statement of amended policy in which DOE explained its determination that EIA's National Energy Modeling System ("NEMS") is the most appropriate tool for its FFC analysis and its intention to use NEMS for that purpose. 77 FR 49701 (Aug. 17, 2012). NEMS is a public domain, multi-sector, partial equilibrium model of the U.S. energy sector[70] that EIA uses to prepare its *Annual Energy Outlook*. The FFC factors incorporate losses in production and delivery in the case of natural gas (including fugitive emissions) and additional energy used to produce and deliver the various fuels used by power plants. The approach used for deriving FFC

[70] For more information on NEMS, refer to *The National Energy Modeling System: An Overview 2009*, DOE/EIA-0581(2009), October 2009. Available at *http://www.eia.gov/forecasts/aeo/index.cfm*.

measures of energy use and emissions is described in appendix 10A of the TSD for this NOPD.

Table IV-47 through Table IV-51 present the FFC equivalent of IAEC for the considered efficiency levels.

Table IV-47 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	143.6	439	Baseline	154.9	473	Baseline	1,443.3	1,600
			1	147.6	451			
			2	131.4	402			
			3	118.8	363			

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

Table IV-48 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	964	985
1	306.3	313.3	936	958
2	291.9	299.0	892	914
3	278.0	285.0	850	871
4	273.2	280.3	835	857
5	261.7	268.7	800	821
6	220.6	227.7	675	696

Table IV-49 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	1,085	1,107
1	346.0	353.0	1,058	1,079
2	327.3	334.3	1,001	1,022
3	277.8	284.7	849	870

Table IV-50 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	2,309	2,320
1	2,052.5	2,062.4	2,275	2,286
2	1,946.4	1,955.8	2,157	2,168
3	1,926.6	1,935.9	2,135	2,146
4	1,832.9	1,841.7	2,031	2,041

Table IV-51 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	2,172	2,183
1	1,929.0	1,939.0	2,138	2,149
2	1,830.5	1,839.9	2,029	2,039

3. Net Present Value Analysis

The inputs for determining the NPV of the total costs and benefits experienced by consumers are: (1) total annual installed cost, (2) total annual operating costs, and (3) a discount factor to calculate the present value of costs and savings. DOE calculates net savings each year as the difference between the no-new-standards case and each standards case in terms of total savings in operating costs versus total increases in installed costs. DOE calculates operating cost savings over the lifetime of each product shipped during the projection period.

DOE assumed that consumer product costs for conventional cooking products would remain unchanged over the analysis period.

The operating cost savings are energy cost savings accounting for associated repair and maintenance costs, which are calculated using the estimated energy savings in each year and the projected price of the appropriate form of energy. To estimate energy prices in future years, DOE used projections of annual national-average residential energy price changes from *AEO 2019* (see section IV.F.4 for details). To estimate price trends after 2050, DOE used the average annual rate of change in prices from 2030 through 2050. DOE also analyzed scenarios that used inputs from cases that have lower and higher energy price trends. NIA results based on these cases are presented in appendix 10C of the TSD for this NOPD.

In calculating the NPV, DOE multiplies the net savings in future years by a discount factor to determine their present value. For this NOPD, DOE estimated the NPV of consumer benefits using both a 3-percent and a 7-percent real discount rate. DOE uses these discount rates in accordance with guidance provided by the Office of

Management and Budget ("OMB") to Federal agencies on the development of regulatory analysis.[71] The discount rates for the determination of NPV are in contrast to the discount rates used in the LCC analysis, which are designed to reflect a consumer's perspective. The 7-percent real value is an estimate of the average before-tax rate of return to private capital in the U.S. economy. The 3-percent real value represents the "social rate of time preference," which is the rate at which society discounts future consumption flows to their present value.

I. Manufacturer Impact Analysis

1. Overview

DOE conducted an MIA for consumer conventional cooking products to estimate the financial impacts of analyzed new and amended energy conservation standards on manufacturers of consumer conventional cooking 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 the consumer conventional cooking products covered in this proposed determination. The key GRIM inputs are data on the industry cost structure, MPCs, and shipments; as well as assumptions about manufacturer markups and manufacturer conversion costs. The key MIA output is INPV. The GRIM calculates annual cash flows using standard accounting principles. DOE used the GRIM to compare changes in INPV between the no-new-standards case and various TSLs (the standards cases). The difference in INPV between the no-new-standards case and the

[71] United States Office of Management and Budget. *Circular A-4: Regulatory Analysis*. September 17, 2003. Section E. Available at *www.whitehouse.gov/omb/memoranda/m03-21.html*.

standards cases represents the financial impact of potential new and amended energy conservation standards on consumer conventional cooking product manufacturers. Different sets of assumptions (manufacturer markup 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, including small manufacturers; the cumulative regulatory burden placed on consumer conventional cooking product manufacturers; and any impacts on competition.

2. GRIM Analysis and Key Inputs

DOE uses the GRIM to quantify the changes in cash flows over time due to potential 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 the no-new-standards case. The GRIM uses a standard annual cash-flow analysis that incorporates MPCs, manufacturer markups, shipments, and industry financial information as inputs. It then models changes in MPCs, investments, and manufacturer margins that may result from analyzed new and amended energy conservation standards. The GRIM uses these inputs to calculate a series of annual cash flows beginning with the reference year of the analysis, 2019, and continuing to the terminal year of the analysis, 2052. 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, the same discount rate used in the September 2016 SNOPR, for consumer conventional cooking product manufacturers in this NOPD. Many of the GRIM inputs come from the engineering analysis, the shipments analysis, manufacturer interviews, and other research conducted during the MIA. The major GRIM inputs are described in detail in the following sections.

a. Manufacturer Production Costs

Manufacturing more efficient consumer conventional cooking products is more expensive than manufacturing baseline products due to the need for more complex and costly components. The higher MPCs for these more efficient products can affect the revenues, gross margins, and cash flow of the industry, making these product costs key inputs for the GRIM and the MIA.

In the MIA, DOE used the MPCs calculated in the engineering analysis, as described in section IV.C of this document and further detailed in chapter 5 of the TSD for this NOPD. For this NOPD analysis, DOE updated the MPCs used in the September 2016 SNOPR analysis based on comments received from interested parties and additional research. The MIA stated these values in 2018 dollars, as opposed to the September 2016 SNOPR's 2015 dollar values. DOE used these updated MPCs for this NOPD analysis.

b. Shipments Projections

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

DOE updated the shipments analysis for this NOPD analysis to reflect new historical statistics, updated AEO 2019 values, and the elimination of certain efficiency levels, due to comments and data provided by interested parties in response to the September 2016 SNOPR. The MIA used these updated shipments for this NOPD analysis. For a complete description of the shipments, see the shipments analysis discussion in section IV.G of this document and chapter 9 of the TSD for this NOPD.

c. Product and Capital Conversion Costs

DOE expects the analyzed new and amended consumer conventional cooking product energy conservation standards would cause manufacturers to incur conversion costs to bring their production facilities and product designs into compliance with potential new and amended standards. For the MIA, DOE classified these conversion costs into two 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 so 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 potential new and amended standards.

In general, DOE assumes all conversion-related investments occur between the year of publication of the final rule and the year by which manufacturers must comply with the potential new and amended standards. Product conversion costs depend on the per-model costs associated with redesigning non-compliant models into compliant ones and then re-testing and marketing those newly compliant models. Product conversion costs also depend on the number of models estimated to require a redesign. DOE used the efficiency distribution of shipments calculated in the shipment analysis as an input to estimate the number of models that would not meet an analyzed efficiency level. As discussed in section IV.I.2.b of this document, shipments were updated as part of this NOPD, and these new shipment efficiency distributions were used to calculate the product conversion costs used in this NOPD MIA.

The updated efficiency distribution increased the product conversion costs at most efficiency levels for most product classes. Additionally, Felix Storch commented that DOE overlooked a number of consumer conventional cooking product manufacturers that sell products in the United States in its manufacturer list. (Felix Storch, No. 62 at p. 2) DOE revisited the list of potential manufacturers and total number of covered models offered by these manufacturers. As a result, DOE added three manufacturers to its list of manufacturers of covered products. DOE also increased the number of covered models due to this updated manufacturer list. This caused capital and product conversion costs to increase due to the addition of more manufacturers and more covered models.

DOE notes that while the conversion costs for most efficiency levels increased from the September 2016 SNOPR to this NOPD, the TSLs used in this NOPD generally comprise lower efficiency levels than the TSLs used in the September 2016 SNOPR, causing the conversion costs at most TSLs to decrease from the September 2016 SNOPR to this NOPD. DOE also represented these conversion costs in 2018 dollars, as opposed to the September 2016 SNOPR's 2015 dollar values. Overall, although the conversion costs used in this NOPD analysis differ from those used in the September 2016 SNOPR MIA, the methodology, per-model conversion costs, and per-manufacturer conversion costs used to calculate conversion costs remain the same as those used in the September 2016 SNOPR.[72]

The conversion cost estimates used in the GRIM can be found in section V.B.2.a of this document. For additional information on the estimated capital and product conversion costs, see chapter 11 of the TSD for this NOPD.

d. Markup Scenarios

As discussed in section IV.I.2.a of this document, the MPCs for consumer conventional cooking products are the manufacturers' costs for those units. These costs include materials, direct labor, depreciation, and overhead, which are collectively referred to as the cost of goods sold. The MSP is the price received by consumer conventional cooking product manufacturers from the first sale of those products, typically to a distributor, regardless of the downstream distribution channel through which the consumer conventional cooking products are ultimately sold. The MSP is not the price the end-user pays for consumer 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 consumer conventional cooking product manufacturer's non-production costs (*i.e.*, selling, general, and administrative expenses; research and development; and interest) as well as profit. Total industry revenue for consumer conventional cooking product manufacturers equals the MSPs at each

[72] MIA conversion cost estimates and INPV results from the September 2016 SNOPR can be found at 81 FR 60874, 60851 (Sept. 2, 2016).

efficiency level multiplied by the number of shipments at that efficiency level for all product classes.

Modifying the manufacturer markups in the standards cases yields a different set of impacts on consumer conventional cooking product manufacturers than in the no-new-standards case. For the MIA, DOE modeled two standards case manufacturer markup scenarios for consumer conventional cooking products to represent the uncertainty regarding the potential impacts on MSPs and profitability for consumer conventional cooking product manufacturers following the implementation of potential new and amended energy conservation standards. The two manufacturer markup 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 MPCs derived in the engineering analysis, result in varying revenue and cash-flow impacts on consumer conventional cooking product manufacturers.

DOE modeled two manufacturer markup scenarios to represent the upper and lower bounds of MSPs and profitability following potential new and amended standards. The preservation of gross margin markup scenario represents the best-case scenario for manufacturers. DOE recognizes that manufacturers may not be able to mark up the additional cost of production in the standards cases, given the competitive consumer conventional cooking products market. Therefore, DOE also modeled a preservation of operating profit markup scenario to represent a lower bound on profitability for manufacturers. While DOE used the same markup scenarios in this NOPD MIA that were used in the September 2016 SNOPR analysis, the manufacturer markup values of the preservation of operating profit depend on the efficiency distribution of shipments calculated in the shipments analysis. As discussed in section IV.I.2.b of this document, shipments were updated and these new efficiency distributions were used to calculate manufacturer markups in the preservation of operating profit manufacturer markup scenario. Therefore, the manufacturer markups used in the preservation of operating profit scenario in this NOPD analysis differ slightly from those used in the September 2016 SNOPR MIA. However, the methodology used to calculate those manufacturer markup values remains the same.

3. Discussion of Comments

a. Discount Rate

Spire commented that the assumption of low discount rates works against the natural gas-fuel appliance industry and indicates a pattern of bias that does not comport with DOE's statutory obligations. (Spire, No. 61 at p. 7) DOE uses the weighted-average cost of capital in conjunction with the capital asset pricing model to calculate the industry discount rate. DOE calculated an industry discount rate of 9.1 percent using this standard accounting practice and financial data from publicly traded consumer conventional cooking product manufacturers. DOE then verified this estimated industry discount rate with manufacturers during manufacturer interviews. DOE also notes that the industry discount rate used in the GRIM is a real discount rate, as are all other variables in the GRIM. DOE first calculated a nominal industry discount rate of 12.2 percent. DOE then subtracted 3.1 percent from this nominal discount rate to account for the historical inflation rate before arriving at the 9.1 percent real industry discount rate used in the GRIM. For additional information, refer to chapter 11 of the TSD for this NOPD.

DOE requests comment on its use of 12.2 percent as a nominal industry discount rate and its use of 3.1 percent as the historical inflation rate, to arrive at a 9.1 percent real industry discount rate.

b. Changes in Test Procedure and Manufacturer Interviews

AHAM commented that manufacturer interviews were conducted in the earlier stages of the rulemaking before DOE proposed to repeal the oven test procedure and to adopt a different cooking top test procedure. AHAM suggested that these developments raise doubt on the relevance of the information received during the interviews. (AHAM, No. 64 at pp. 34, 35) DOE received information during manufacturer interviews dealing with conversion costs and production costs for a variety of different design changes that were analyzed both for this NOPD and for the September 2016 SNOPR. The conversion cost estimates given during manufacturer interviews were primarily based on meeting performance-based energy conservation standards. In this NOPD analysis, DOE estimated the performance characteristics of consumer conventional cooking products at the analyzed prescriptive standard levels. The design options, and costs of meeting those design options, discussed in the manufacturer interviews conducted in the earlier stages of the rulemaking are relevant estimates for manufacturers to meet the analyzed prescriptive standards in this NOPD analysis.

c. Other Comments

Other comments made by interested parties concerned either the cumulative regulatory burden or the small business analysis. The cumulative regulatory burden comments are addressed in section V.B.2.e of this document and the small business comments are addressed in section VI.C of this document.

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 consumer conventional cooking products rulemaking. The following section describes the key issues identified by consumer conventional cooking product manufacturers during these manufacturer 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. DOE did not conduct any further interviews with manufacturers between the September 2016 SNOPR and this NOPD because further interviews were not necessary to revise the MIA for this NOPD. Instead DOE, used comments from interested parties to update the MIA.

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 gas cooking tops typically have features such as heavier cast iron grates that decrease efficiency by acting as an additional thermal load.

Also, this style of gas cooking top typically has wider spacing 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 lighter-weight, 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 when measured according to the DOE test procedure in effect at the time of the interviews, due to the greater thermal mass of the cavity and racks. Manufacturers warned DOE that focusing only on the efficiency of consumer 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. As explained in section IV.C.2.b of this document, DOE did not analyze, and is not proposing standards at, higher efficiency levels for gas cooking tops in this NOPD. While DOE agrees that commercial-style ovens would not be able to meet the higher gas oven standards analyzed, DOE is not proposing amended standards for gas ovens in this NOPD.

b. Induction Cooking Products

Some manufacturers stated that induction cooking tops should be considered as a separate product class apart from electric smooth element cooking tops. Manufacturers stated that although induction cooking tops tend to be more efficient that other electric smooth element cooking tops, induction cooking tops could require consumers to replace some or all of their cookware if they are not ferromagnetic. DOE did not evaluate a separate product class for induction cooking tops, as discussed in section IV.A.1.a of this document. Additionally, DOE is not proposing new standards for electric smooth element cooking tops in this NOPD.

c. Product Utility

Manufacturers stated that energy efficiency is not one of the most important attributes that consumers value when purchasing consumer conventional cooking products. Manufacturers stated that there are several other factors, such as performance and durability, which consumers value more when purchasing consumer conventional cooking products. Required improvements to the efficiency of their products could lead some manufacturers to remove premium features that consumers desire from their products, potentially reducing overall consumer utility. As discussed in section V.C.4 of this document, DOE is not proposing new or amended standards for consumer conventional cooking products in this NOPD, and thus the utility or performance of the consumer conventional cooking products under consideration in this proposed determination would not be reduced.

d. Testing and Certification Burdens

Several manufacturers expressed concern about the testing and recertification costs associated with new and amended energy conservation standards for consumer 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 potential new and amended standards, manufacturers would be forced to spend a significant amount of money testing and certifying products that were redesigned.

Manufacturers stated that these testing and certification costs associated with consumer conventional cooking products could significantly strain their limited resources if these costs were all incurred in the 3-year period between the publication of a potential final rule and the compliance date of the potential new and amended standards. As part of the MIA, DOE included all certification and re-certification costs that would be required to comply with the evaluated standards. Additionally, DOE is not proposing any new or amended standards in this NOPD, and has withdrawn the conventional cooking products test procedure. Therefore, manufacturers would not incur any testing or certification costs due to this NOPD.

V. Analytical Results and Conclusions

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

A. Trial Standard Levels

DOE analyzed the benefits and burdens of three TSLs for consumer 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 TSD for this NOPD.

Table V-1 through Table V-3 present the TSLs and the corresponding efficiency levels for consumer conventional cooking products.[73] TSLs developed for the September 2016 SNOPR were updated for this proposed determination to account for updates to the engineering analysis based on additional testing and analysis. Details regarding the updates to the efficiency level analysis are discussed in section IV.C.2 of this document.

TSL 3 represents the max-tech improvements in energy efficiency for all product classes, except for electric open (coil) element cooking tops and gas cooking tops. TSL 2 comprises efficiency levels providing maximum NES with positive NPV. TSL 1 was configured to include a controls based strategy that would not eliminate the utility of a clock display on combined cooking products from the market.

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 (*kBtu/yr*)
1	Baseline	143.6	1	147.6	Baseline	1,443.3
2	Baseline	143.6	2	131.4	Baseline	1,443.3
3	Baseline	143.6	3	118.8	Baseline	1,443.3

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	4	273.2	4	280.3	1	346.0	1	353.0
3	6	220.6	6	227.7	3	277.8	3	284.7

[73] 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.2.c of this document, DOE developed slopes and intercepts to characterize the relationship between IEAC and cavity volume for each efficiency level.

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 (*kBtu/yr*)	Efficiency Level	IAEC (*kBtu/yr*)	Efficiency Level	IAEC (*kBtu/yr*)	Efficiency Level	IAEC (*kBtu/yr*)
1	1	2,052.5	1	2,062.4	1	1,929.0	1	1,939.0
2	3	1,926.6	3	1,935.9	1	1,929.0	1	1,939.0
3	4	1,832.9	4	1,841.7	2	1,830.5	2	1,839.9

B. Economic Justification and Energy Savings

1. Economic Impacts on Individual Consumers

DOE analyzed the economic impacts on consumer conventional cooking products consumers by looking at the effects that potential new and amended standards at each TSL would have on the LCC and PBP. These analyses are discussed below.

a. Life-Cycle Cost and Payback Period

In general, higher-efficiency products can affect consumers in two ways: (1) purchase price increases and (2) annual operating costs decreases. Inputs used for calculating the LCC and PBP include total installed costs (*i.e.*, product price plus installation costs), and operating costs (*i.e.*, annual energy use, energy prices, energy price trends, repair costs, and maintenance costs). The LCC calculation also uses product lifetime and a discount rate. Chapter 8 of the TSD for this NOPD 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 consumer conventional cooking product class (“PC”). 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 NOPD). Because some consumers purchase products with higher efficiency in the no-new-standards case, the average savings are less than the difference between the average LCC of the baseline product and the average LCC at each TSL. The savings refer only to consumers who are affected by a standard at a given TSL. Those who already purchase a product with efficiency at or above a given TSL are not affected. Consumers for whom the LCC increases at a given TSL experience a net cost.

Table V-4 Average LCC and PBP Results by Efficiency Level for PC1 Electric Open (Coil) Element Cooking Tops

TSL	Efficiency Level	Average Costs *2018$*				Simple Payback *years*	Average Lifetime *years*
		Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
1-3	Baseline	$283	$18	$385	$668	--	16.8

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

Table V-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 Net Cost	Average Savings* *2018$*
1-3	Baseline	0%	$0.00

*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 *2018$*				Simple Payback *years*	Average Lifetime *years*
		Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
1	1	$540	$20	$410	$950	1.1	16.8
2	2	$542	$18	$381	$923	0.9	16.8
3	3	$1,072	$16	$359	$1,432	111.7	16.8

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

Table V-7 Average LCC Savings Relative to the No-New-Standards Case Efficiency Distribution for PC2 Electric Smooth Element Cooking Tops

TSL	Efficiency Level	Life-Cycle Cost Savings	
		% of Consumers that Experience Net Cost	Average Savings* *2018$*
1	1	0%	$6.50
2	2	0%	$27.63
3	3	99%	($475.28)

*The calculation includes households with zero LCC savings (no impact). Numbers in parentheses indicate negative numbers.

Table V-8 Average LCC and PBP Results by Efficiency Level for PC3 Gas Cooking Tops

TSL	Efficiency Level	Average Costs *2018$*				Simple Payback *years*	Average Lifetime *years*
		Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
1-3	Baseline	$400	$23	$425	$824	--	14.5

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-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 Net Cost	Average Savings*
			2018$
1-3	Baseline	0%	$0.00

*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 *2018$*				Simple Payback *years*	Average Lifetime *years*
		Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
1	1	$614	$19	$432	$1,047	0.9	16.8
2	4	$628	$17	$408	$1,036	4.8	16.8
3	6	$715	$14	$368	$1,084	16.6	16.8

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

Table V-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 Net Cost	Average Savings*
			2018$
1	1	0%	$6.77
2	4	26%	$12.13
3	6	75%	($29.30)

*The calculation includes households with zero LCC savings (no impact). Numbers in parentheses indicate negative numbers.

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 *2018$*				Simple Payback *years*	Average Lifetime *years*
		Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
1	1	$642	$20	$446	$1,088	0.9	16.8
2	4	$657	$18	$421	$1,078	4.8	16.8
3	6	$744	$15	$382	$1,126	16.6	16.8

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

Table V-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	*2018$*
1	1	0%	$6.77
2	4	26%	$12.14
3	6	75%	($29.32)

*The calculation includes households with zero LCC savings (no impact). Numbers in parentheses indicate negative numbers.

Table V-14 Average LCC and PBP Results by Efficiency Level for PC6 Electric Self-Clean Ovens, Free-Standing

TSL	Efficiency Level	Average Costs *2018$*				Simple Payback *years*	Average Lifetime *years*
		Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
1,2	1	$672	$25	$507	$1,179	0.9	16.8
3	3	$759	$21	$457	$1,216	17.1	16.8

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

Table V-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 Net Cost	Average Savings* *2018$*
1,2	1	0%	$8.99
3	3	66%	($17.37)

*The calculation includes households with zero LCC savings (no impact). Numbers in parentheses indicate negative numbers.

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 *2018$*				Simple Payback *years*	Average Lifetime *years*
		Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
1,2	1	$700	$26	$521	$1,221	0.9	16.8
3	3	$787	$22	$470	$1,258	17.0	16.8

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

Table V-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 Net Cost	Average Savings* *2018$*
1,2	1	0%	$8.99
3	3	66%	($17.29)

*The calculation includes households with zero LCC savings (no impact). Numbers in parentheses indicate negative numbers.

Table V-18 Average LCC and PBP Results by Efficiency Level for PC8 Gas Standard Ovens, Free-Standing

TSL	Efficiency Level	Average Costs *2018$*				Simple Payback *years*	Average Lifetime *years*
		Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
1	1	$660	$43	$687	$1,347	0.9	14.5
2	3	$671	$42	$676	$1,347	5.7	14.5
3	4	$702	$42	$671	$1,373	16.5	14.5

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-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 Net Cost	Average Savings* *2018$*
1	1	7%	$6.78
2	3	29%	$6.37
3	4	76%	($15.85)

*The calculation includes households with zero LCC savings (no impact). Numbers in parentheses indicate negative numbers.

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 *2018$*				Simple Payback *years*	Average Lifetime *years*
		Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
1	1	$688	$43	$692	$1,380	0.9	14.5
2	3	$700	$43	$680	$1,380	5.7	14.5
3	4	$730	$42	$675	$1,405	16.5	14.5

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-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 Net Cost	Average Savings*
			2018$
1	1	7%	$6.78
2	3	29%	$6.40
3	4	76%	($15.79)

*The calculation includes households with zero LCC savings (no impact). Numbers in parentheses indicate negative numbers.

Table V-22 Average LCC and PBP Results by Efficiency Level for PC10 Gas Self-Clean Ovens, Free-Standing

TSL	Efficiency Level	Average Costs *2018$*				Simple Payback *years*	Average Lifetime *years*
		Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
1,2	1	$799	$45	$713	$1,512	0.9	14.5
3	2	$830	$45	$707	$1,537	18.1	14.5

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-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 Consumers that Experience Net Cost	Average Savings*
			2018$
1,2	1	8%	$8.15
3	2	66%	($11.15)

*The calculation includes households with zero LCC savings (no impact). Numbers in parentheses indicate negative numbers.

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 *2018$*				Simple Payback *years*	Average Lifetime *years*
		Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
1,2	1	$827	$46	$718	$1,545	0.9	14.5
3	2	$858	$45	$712	$1,570	18.1	14.5

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-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 Consumers that Experience Net Cost	Average Savings* *2018$*
1,2	1	8%	$8.15
3	2	66%	($11.12)

*The calculation includes households with zero LCC savings (no impact). Numbers in parentheses indicate negative numbers.

b. Rebuttable Presumption Payback

As discussed in section IV.F of this document, EPCA establishes a rebuttable presumption that an energy conservation standard is economically justified if the increased purchase cost for a product that meets the standard is less than three times the value of the first-year energy savings resulting from the standard. (42 U.S.C. 6295(o)(2)(B)(iii)) In calculating a rebuttable presumption PBP for each of the considered TSLs, DOE used discrete values, and, as required by EPCA, based the energy use calculation on the now-withdrawn DOE test procedures for consumer conventional cooking products. In contrast, the PBPs presented in section V.B.1.a of this document were calculated using distributions that reflect the range of energy use in the field. See chapter 8 of the NOPD TSD for more information on the rebuttable presumption payback analysis.

2. Economic Impacts on Manufacturers

DOE performed an MIA to estimate the impact of potential new and amended energy conservation standards on manufacturers of consumer conventional cooking products. The following sections describe the expected impacts on consumer conventional cooking product manufacturers at each TSL. Chapter 11 of the TSD for this NOPD explains the MIA in further detail.

a. Industry Cash Flow Analysis Results

In this section, DOE provides GRIM results from the analysis, which examines changes in the industry that could result from new and amended standards. Table V-26 and Table V-27 depict the estimated financial impacts (represented by changes in INPV) of potential new and amended energy conservation standards on consumer 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 consumer conventional cooking product industry, DOE modeled two manufacturer markup scenarios that correspond to the range of anticipated market responses to new and amended standards. Each manufacturer 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 (2019) through the end of the analysis period (2052). The results also discuss the difference in cash flows between the no-new-standards case and the standards cases in the year before the analyzed compliance date for potential new and amended energy conservation standards. This figure represents the size of the required conversion costs relative to the cash flow generated by the consumer 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 analyzed 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 document.

To assess the upper (less severe) end of the range of potential impacts on consumer 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 consumer 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-26 and Table V-27 present the projected results for consumer 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-26 Manufacturer Impact Analysis for Consumer Conventional Cooking Products – Preservation of Gross Margin Markup Scenario

	Units	No-New-Standards Case	Trial Standard Level		
			1	2	3
INPV	(*2018$ millions*)	1,587.7	1,543.4	1,505.1	1,203.1
Change in INPV	(*2018$ millions*)	-	(44.3)	(82.6)	(384.6)
	(*%*)	-	(2.8)	(5.2)	(24.2)
Product Conversion Costs	(*2018$ millions*)	-	25.2	54.9	362.9
Capital Conversion Costs	(*2018$ millions*)	-	35.1	62.4	413.4
Total Conversion Costs	(*2018$ millions*)	-	60.3	117.3	776.3

* Numbers in parentheses indicate negative numbers

Table V-27 Manufacturer Impact Analysis for Consumer Conventional Cooking Products – Preservation of Operating Profit Markup Scenario

	Units	No-New-Standards Case	Trial Standard Level		
			1	2	3
INPV	(*2018$ millions*)	1,587.7	1,542.1	1,499.5	958.7
Change in INPV	(*2018$ millions*)	-	(45.6)	(88.2)	(629.0)
	(*%*)	-	(2.9)	(5.6)	(39.6)
Product Conversion Costs	(*2018$ millions*)	-	25.2	54.9	362.9
Capital Conversion Costs	(*2018$ millions*)	-	35.1	62.4	413.4
Total Conversion Costs	(*2018$ millions*)	-	60.3	117.3	776.3

TSL 1 sets the efficiency level at baseline for two product classes (electric open (coil) element cooking tops and gas cooking tops) and at EL 1 for all other product classes (electric smooth element cooking tops, all electric ovens, and all gas ovens). At TSL 1, DOE estimates impacts on INPV to range from -$45.6 million to -$44.3 million, or a change in INPV of -2.9 percent to -2.8 percent. At TSL 1, industry free cash flow (operating cash flow minus capital expenditures) is estimated to decrease to $106.3 million, or a drop of 18.9 percent, compared to the no-new-standards case value of $131.0 million in 2022, the year leading up to the analyzed compliance date of potential 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 consumer conventional cooking products projected to comply with the analyzed standards at this TSL. DOE projects that in the analyzed year of compliance (2023), 100 percent of electric open (coil) element cooking top and gas cooking top shipments, 45 percent of electric smooth element cooking top shipments, 60 percent of electric standard oven (free-standing and built-in) shipments, 48 percent of electric self-clean oven (free-standing and built-in) shipments, 54 percent of gas standard oven (free-standing and built-in) shipments, and 45 percent of gas self-clean oven (free-standing and built-in) shipments will 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 consumer conventional cooking product manufacturers would incur $25.2 million in product conversion costs for product redesigns that include converting electric smooth element cooking tops and both gas and electric ovens to transition from using linear power supplies to SMPS in order to reduce standby power consumption. DOE expects $35.1 million in capital conversion costs for manufacturers to upgrade production lines and retool equipment associated with achieving this reduction in standby power.

At TSL 1, under the preservation of gross margin markup scenario, the shipment weighted-average MPC increases very slightly by approximately 0.1 percent relative to the no-new-standards case MPC. This slight price increase is outweighed by the $60.3 million in conversion costs estimated at TSL 1, resulting in slightly negative INPV impacts at TSL 1 under the preservation of gross margin markup scenario.

Under the preservation of operating profit markup scenario, manufacturers earn the same nominal operating profit as would be earned in the no-new-standards case, but manufacturers do not earn additional profit from their investments. The 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 $60.3 million in conversion costs result in slightly negative INPV impacts at TSL 1 under the preservation of operating profit.

TSL 2 sets the efficiency level at baseline for two product classes (electric open (coil) element cooking tops and gas cooking tops); EL 1 for four product classes (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 2 for electric smooth element cooking tops; EL 3 for two product classes (gas standard free-standing ovens and gas standard built-in ovens); and EL 4 for two product classes (electric standard free-standing ovens and electric standard built-in ovens). At TSL 2, DOE estimates impacts on INPV to range from -$88.2 million to -$82.6 million, or a change in INPV of -5.6 percent to -5.2 percent. At this standard level, industry free cash flow is estimated to decrease to $83.5 million, or a drop of 36.3 percent, compared to the no-new-standards case value of $131.0 million in 2022, the year leading up to the analyzed compliance date of potential new and amended energy conservation standards.

Percentage impacts on INPV are moderately negative at TSL 2. The $117.3 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 5.6 percent and a significant decrease of 36.3 percent in free cash flow in the year leading up to the analyzed compliance date of potential new and amended standards. DOE projects that in 2023, 100 percent of electric open (coil) cooking top and gas cooking top shipments, 23 percent of electric smooth element cooking top shipments, 28 percent of electric standard oven (free-standing and built-in) shipments, 48 percent of electric self-clean oven (free-standing and built-in) shipments, 27 percent of gas standard oven (free-standing and built-in) shipments, and 45 percent of gas self-cleaning oven (free-standing and built-in) shipments will meet or exceed the efficiency levels at TSL 2.

DOE expects that product conversion costs will rise from $25.2 million at TSL 1 to $54.9 million at TSL 2 for extensive product redesigns and testing. Capital conversion costs will also increase from $35.1 million at TSL 1 to $62.4 million at TSL 2 to upgrade production equipment to accommodate added or redesigned features in each product class. The larger conversion costs at TSL 2 are driven by the need to reduce vent rates, improve insulation and door seals, and include forced convection for electric standard ovens; and improve insulation and door seals for gas standard ovens.

At TSL 2, under the preservation of gross margin markup scenario, the shipment weighted-average MPC increases by 0.5 percent, relative to the no-new-standards case MPC. In this scenario, INPV impacts are moderately negative because manufacturers would incur sizable conversion costs ($117.3 million) and would not be able to recover much of those conversion costs through the 0.5 percent increase in the shipment weighted-average MPC at TSL 2.

Under the preservation of operating profit markup scenario, the 0.5 percent shipment weighted-average increase in MPC results in a slightly lower average manufacturer markup. This slightly lower average manufacturer markup and the $117.3 million in conversion costs results in moderately negative INPV impacts at TSL 2.

TSL 3 sets the efficiency level at baseline for two product classes (electric open (coil) element cooking tops and gas cooking tops); EL 2 for two product classes (gas self-clean free-standing ovens and gas self-clean built-in ovens); EL 3 for three product classes (electric smooth element cooking tops, electric self-clean free-standing ovens, and electric self-clean built-in ovens); EL 4 for two product classes (gas standard free-standing ovens and gas standard built-in ovens); and EL 6 for two product classes (electric standard free-standing ovens and electric standard built-in ovens). This represents max-tech for all product classes for which efficiency levels above the baseline were analyzed. At TSL 3, DOE estimates impacts on INPV to range from -$629.0 million to -$384.6 million, or a change in INPV of -39.6 percent to -24.2 percent. At TSL 3, industry free cash flow is estimated to decrease to -$184.0 million, or a drop of 240.4 percent, compared to the no-new-standards case value of $131.0 million in 2022, the year leading up to the analyzed compliance date of potential new and amended energy conservation standards.

At TSL 3 conversion costs significantly increase, causing free cash flow to become significantly negative, -$184.0 million, in the year leading up to the analyzed compliance date of potential new and amended standards and causing manufacturers to lose a substantial amount of INPV. Also, the percent change in INPV at TSL 3 is significantly negative due to the extremely large conversion costs, $776.3 million. Manufacturers at this TSL would have a very difficult time in the short term to make the necessary investments to comply with the analyzed new and amended energy conservation standards prior to the analyzed compliance date.

A high percentage of total shipments would need to be redesigned to meet the efficiency levels prescribed at TSL 3. DOE projects that in 2023, 100 percent of electric open (coil) element cooking top and gas cooking top shipments, 1 percent of electric smooth element cooking top shipments, 8 percent of electric standard oven (free-standing and built-in) shipments, 15 percent of electric self-clean oven (free-standing and built-in) shipments, 13 percent of gas standard oven (free-standing and built-in) shipments, and 23 percent of gas self-clean oven (free-standing and built-in) shipments will meet the efficiency levels at TSL 3.

DOE expects significant conversion costs at TSL 3, which represents max-tech. DOE expects product conversion costs to significantly increase from $54.9 million at TSL 2 to $362.9 million at TSL 3. Large increases in product conversion costs are due to most shipments needing extensive redesign as well as a significant increase in re-certification for re-designed products. DOE estimates that capital conversion costs will also significantly increase from $62.4 million at TSL 2 to $413.4 million at TSL 3. Capital conversion costs are driven by investments in production equipment to switch to induction heating elements for electric smooth element cooking tops; reduce vent rates, improve insulation and door seals, and include forced convection and oven separators for electric standard ovens; include forced convection and oven separators for electric self-clean ovens; improve insulation and door seals and include forced convection for gas standard ovens; and include forced convection in gas self-clean ovens.

At TSL 3, under the preservation of gross margin markup scenario, the shipment weighted-average MPC increases by 18.4 percent relative to the no-new-standards case MPC. In this scenario, INPV impacts are significantly negative because the $776.3

million in conversion costs outweigh the modest increase in shipment weighted-average MPC, resulting in significantly negative INPV impacts at TSL 3.

Under the preservation of operating profit markup scenario, the 18.4 percent shipment weighted-average increase in MPC results in a lower average manufacturer markup (1.192 compared to the no-new-standards case average manufacturer markup of 1.200). This lower average manufacturer markup and the $776.3 million in conversion costs result in significantly negative INPV impacts at TSL 3.

b. Direct Impacts on Employment

To quantitatively assess the potential impacts of new and amended energy conservation standards on direct employment in the conventional cooking products industry, DOE used the GRIM to estimate the domestic labor expenditures and number of direct employees in the no-new-standards case and at each TSL from 2023 to 2052. DOE used statistical data from the U.S. Census Bureau's 2016 *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 proposed determination.

The employment impacts shown in Table V-28 represent the potential domestic production employment that could result following the analyzed 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 the analyzed 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 the analyzed 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 2023, the following sections also include qualitative discussions of the likelihood of negative employment impacts at the various TSLs.

Using 2016 *ASM* data and interviews with manufacturers, DOE estimates that approximately 60 percent of the consumer conventional cooking products sold in the United States are manufactured domestically. With this assumption, DOE estimates that in the absence of any new and amended energy conservation standards, there would be approximately 7,186 domestic production workers involved in manufacturing consumer conventional cooking products in 2023. Table V-28 shows the range of the impacts of the analyzed new and amended energy conservation standards on U.S. production workers in the consumer conventional cooking product industry.

Table V-28 Potential Changes in the Total Number of Domestic Consumer Conventional Cooking Product Production Workers in 2023

	No-New-Standards Case	Trial Standard Level		
		1	2	3
Total Number of Domestic Production Workers in 2023 (without changes in production locations)	7,186	7,192	7,213	7,864
Potential Changes in Domestic Production Workers in 2023*	-	(359) - 6	(1,796) - 27	(3,593) - 678

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

At TSL 2 and TSL 3, most manufacturers would be required to make at least some modifications to their existing production lines. However, manufacturers stated that due to the larger size of most consumer conventional cooking products, very few units are manufactured and shipped from far distances such as Asia or Europe. The vast majority of consumer conventional cooking products are currently made in North America. Some manufacturers stated that even significant changes to production lines would not cause them to shift their production to lower labor-cost countries, as several manufacturers either only produce consumer conventional cooking products domestically or have recently made significant investments to continue to produce consumer conventional cooking products domestically.

At TSL 2, manufacturers could alter production locations in response to standards, since most product classes would be required to meet energy conservation standards that would most likely require modifications to more than just standby mode power consumption. DOE estimated that at most 25 percent of the domestic labor for consumer conventional cooking products could move to other countries in response to the analyzed standards at TSL 2.

At TSL 3, manufacturers could alter production locations in response to standards, since all product classes other than electric open (coil) element cooking tops and gas cooking tops would be required to meet max-tech. DOE estimated that at most 50 percent of the domestic labor for consumer conventional cooking products could move to other countries in response to the analyzed standards at TSL 3.

c. Impacts on Manufacturing Capacity

Consumer conventional cooking product manufacturers stated that they did not anticipate any capacity constraints at TSL 1, which would only require modifications to electronic control components. 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 1 percent of the existing electric smooth element cooking tops use induction technology. Manufacturers stated that converting 99 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.

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 on small businesses in section VI.B of this document. DOE also identified the commercial-style manufacturer subgroup as a potential manufacturer subgroup that could be adversely impacted by the considered standards based on the results of the industry characterization.

The commercial-style manufacturer subgroup consists of consumer conventional cooking product manufacturers that primarily sell gas cooking tops, gas ovens, and electric self-clean ovens marketed as commercial-style, either as a stand-alone product or as a component of a conventional range. While no commercial-style manufacturers (*i.e.*, manufacturers that are producing conventional ovens that are primarily marketed as commercial-style) produce electric coil element cooking tops, some 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 heavier-gauge cavity walls and heavier racks that result in inherently lower efficiencies compared to residential-style ovens with comparable cavity sizes, due to the greater thermal mass of the cavity and racks, when measured by the earlier DOE test procedure. The vast majority of commercial-style electric and gas ovens already use SMPS in their ovens and would not have difficulty meeting a potential standard level requiring SMPS for ovens. However, there would be significant uncertainty as to whether commercial-style manufacturers would be able to test their conventional ovens, in the absence of a DOE test procedure for these products, to potentially meet the analyzed standards at TSLs that require design options in addition to SMPS for ovens (TSL 2 and TSL 3).

Therefore, these commercial-style manufacturers would likely be forced to exit the conventional oven market as a result of conventional oven standards set above TSL 1.

e. Cumulative Regulatory Burden

One aspect of assessing manufacturer burden involves looking at the cumulative impact of multiple DOE standards and the product-specific regulatory actions of other Federal agencies that affect the manufacturers of a covered product or equipment. While any one regulation may not impose a significant burden on manufacturers, the combined effects of several existing or impending regulations may have serious consequences for some manufacturers, groups of manufacturers, or 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 for consumer conventional cooking products.

DOE recognizes that cooking products that include both a conventional cooking top and oven (*i.e.*, 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 a conventional range. 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 conventional ranges (including shared components and assembly lines) separately on different timelines. As discussed in section II.B.2 of this document, DOE combined the rulemakings to consider energy conservation standards for conventional cooking tops and ovens together and has aligned the compliance dates for both product categories to reduce redesign cycles and to mitigate manufacturer costs.

AHAM commented that home appliances are now in a continuous cycle of regulation, where as soon as one compliance effort ends or is near completion, another round of regulation to change the standard begins again. According to AHAM, this puts a continual burden on manufacturers. AHAM also stated that there is no time for DOE, manufacturers, or efficiency advocates to assess the success of standards or review their impacts on consumers and manufacturers. (AHAM, No. 64 at p. 36) Under EPCA, DOE is required to analyze potential new and amended energy conservation standards for specific products within specific time periods. (*See* 42 U.S.C. 6295(m)) DOE will continue to meet its legal obligations for either amending standards or determining that revised standards are not justified.

DOE acknowledges that some consumer conventional cooking product manufacturers also make appliances that are or could be subject to future energy conservation standards implemented by DOE. DOE is also aware of energy conservation standards that could affect consumer conventional cooking product manufacturers. These energy conservation standards include those for walk-in coolers and freezers with a compliance date in 2020,[74] residential boilers with a compliance date in 2021,[75] residential central air conditioners and heat pumps with a compliance date in 2023,[76] and

[74] Energy conservation standards final rule for walk-in coolers and freezers. 82 FR 31808 (July 10, 2017).
[75] Energy conservation standards final rule for residential boilers. 81 FR 2320 (Jan. 15, 2016).
[76] Energy conservation standards final rule for residential central air conditioners and heat pumps. 82 FR 1786 (Jan. 6, 2017).

small, large, and very large commercial package air conditioning and heating equipment with a second compliance date in 2023.[77] The compliance years and expected industry conversion costs of all relevant new and amended energy conservation standards are indicated in Table V-29.

Table V-29 Compliance Dates and Expected Conversion Expenses of Federal Energy Conservation Standards Affecting Consumer Conventional Cooking Product Manufacturers

Regulation	Number of Manufacturers*	Number of Manufacturers from Today's Rule**	Approximate Standards Year	Industry Conversion Costs (*Millions $*)	Industry Conversion Costs / Revenue†
Commercial and Industrial Pumps 81 FR 4368 (Jan. 26, 2016)	86	1	2020	81.2 (2014$)	4.5%
Walk-in Coolers and Freezers 82 FR 31808 (Jul. 10, 2017)	10	2	2020	18.7 (2015$)	2.0%
Residential Boilers 81 FR 2320 (Jan. 15, 2016)	36	2	2021	2.5 (2014$)	0.1%
Residential Central Air Conditioners and Heat Pumps 82 FR 1786 (Jan. 6, 2017)	30	6	2023	342.6 (2014$)	0.1%
Small, Large, and Very Large Commercial Package Air Conditioning and Heating Equipment 81 FR 2420 (Jan. 15, 2016)	13	2	2023	520.8 (2014$)	4.9%
Portable Air Conditioners 85 FR 1378 (Jan. 10, 2020)	10	1	2025	320.9 (2015$)	6.7%

* 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 consumer 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.

[77] Energy conservation standards final rule for small, large, and very large commercial package air conditioning and heating equipment. 81 FR 2420 (Jan. 15, 2016).

When conducting the cumulative regulatory burden analysis, DOE considers other energy conservation standards for products that consumer conventional cooking product manufacturers make, especially if those standards occur either 3 years before or after the anticipated compliance date for consumer conventional cooking products standards, as part of this analysis. DOE discusses these and other requirements and includes the full details of the cumulative regulatory burden analysis in Chapter 11 of the TSD for this NOPD.

AHAM expressed concern about DOE amending test procedures and proposing standards simultaneously. AHAM commented that the time and resources needed to evaluate and respond to both amended test procedures and new and amended energy conservation standards should not be discounted as a source of cumulative regulatory burden. AHAM also stated that manufacturers experience difficulty in determining how their products will perform in relation to the standards when the test procedure has not been finalized, which nearly precluded commenting on the test procedure. (AHAM, No. 64 at pp. 35, 36) DOE understands that responding to test procedure and standards proposals take time and resources from manufacturers. As discussed, DOE published an update to the Process Rule. 85 FR 8626. Pursuant to the update, test procedure rulemakings establishing methodologies used to evaluate proposed energy conservation standards will be finalized at least 180 days prior to publication of a NOPR proposing new or amended energy conservation standards. Section 8(d) of the Process Rule.

3. National Impact Analysis

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

a. Significance of Energy Savings

To estimate the energy savings attributable to potential new and amended standards for consumer conventional cooking products, DOE compared their energy consumption under the no-new-standards case to their anticipated energy consumption under each TSL. The savings are measured over the entire lifetime of products purchased in the 30-year period that begins in the year of anticipated compliance with potential new and amended standards (2023–2052). Table V-30 presents DOE's projections of the NES for each TSL considered for consumer conventional cooking products. The savings were calculated using the approach described in section IV.H of this document.

Table V-30 Consumer Conventional Cooking Products: Cumulative National Energy Savings for Products Shipped in 2023–2052 (quads)

Product Type	Energy Savings	1	2	3
Conventional Cooking Tops	Site energy	0.02	0.10	0.16
	Primary energy	0.06	0.27	0.42
	FFC energy	0.07	0.28	0.44
Conventional Ovens	Site energy	0.08	0.12	0.41
	Primary energy	0.21	0.29	0.99
	FFC energy	0.22	0.30	1.04
TOTAL (All Products)	Site energy	0.10	0.22	0.57
	Primary energy	0.28	0.55	1.41
	FFC energy	0.29	0.58	1.48

OMB Circular A-4[78] requires agencies to present analytical results, including separate schedules of the monetized benefits and costs that show the type and timing of benefits and costs. Circular A-4 also directs agencies to consider the variability of key elements underlying the estimates of benefits and costs. For this proposed determination, DOE undertook a sensitivity analysis using 9, 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.[79] The review timeframe established in EPCA is generally not synchronized with the product lifetime, product manufacturing cycles, or other factors specific to consumer 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-31. The impacts are counted over the lifetime of conventional cooking products purchased in 2023–2031.

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[78] U.S. Office of Management and Budget, Circular A-4: Regulatory Analysis. September 17, 2003. Available at: *https://obamawhitehouse.archives.gov/omb/circulars_a004_a-4/*.

[79] Section 325(m) of EPCA requires DOE to review its standards at least once every 6 years, and requires, for certain products, a 3-year period after any new standard is promulgated before compliance is required, except that in no case may any new standards be required within 6 years of the compliance date of the previous standards. If DOE makes a determination that amended standards are not needed, it must conduct a subsequent review within three years following such a determination. As DOE is evaluating the need to amend the standards, the sensitivity analysis is based on the review timeframe associated with amended standards. While adding a 6-year review to the 3-year compliance period adds up to 9 years, DOE notes that it may undertake reviews at any time within the 6-year period and that the 3-year compliance date may yield to the 6-year backstop. A 9-year analysis period may not be appropriate given the variability that occurs in the timing of standards reviews and the fact that for some products, the compliance period is 5 years rather than 3 years.

Table V-31 Consumer Conventional Cooking Products: Cumulative National Energy Savings for Products Shipped in 2023–2031 (quads)

Product Type	Energy Savings	Trial Standard Level		
		1	2	3
Conventional Cooking Tops	Site energy	0.01	0.02	0.04
	Primary energy	0.02	0.07	0.12
	FFC energy	0.02	0.07	0.12
Conventional Ovens	Site energy	0.02	0.03	0.11
	Primary energy	0.06	0.08	0.26
	FFC energy	0.06	0.08	0.28
TOTAL (All Products)	Site energy	0.03	0.06	0.15
	Primary energy	0.07	0.14	0.38
	FFC energy	0.08	0.15	0.40

b. Net Present Value of Consumer Costs and Benefits

DOE estimated the cumulative NPV of the total costs and savings for consumers that would result from the TSLs considered for consumer conventional cooking products. In accordance with OMB's guidelines on regulatory analysis,[80] DOE calculated NPV using both a 7-percent and a 3-percent real discount rate. Table V-32 shows the consumer NPV results for each TSL DOE considered for consumer conventional cooking products. The impacts are counted over the lifetime of products purchased in 2023–2052.

[80] U.S. Office of Management and Budget. *Circular A-4: Regulatory Analysis*. September 17, 2003. Available at *https://obamawhitehouse.archives.gov/omb/circulars_a004_a-4/*.

Table V-32 Cumulative Net Present Value of Consumer Benefits for Consumer Conventional Cooking Products; 30 Years of Shipments (2023–2052)

Equipment Type	Discount Rate	Trial Standard Level		
		1	2	3*
		Billion 2018$		
Conventional Cooking Tops	3%	0.5	2.0	(29.1)
	7%	0.2	0.8	(15.8)
Conventional Ovens	3%	1.6	1.7	(3.0)
	7%	0.7	0.7	(2.6)
TOTAL (All Products)	3%	2.1	3.7	(32.1)
	7%	0.9	1.5	(18.4)

*Parentheses indicate negative (-) values.

The NPV results based on the aforementioned 9-year analytical period are presented in Table V-33. The impacts are counted over the lifetime of products purchased in 2023–2031. 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-33 Cumulative Net Present Value of Consumer Benefits for Consumer Conventional Cooking Products; 9 Years of Shipments (2023–2031)

Equipment Type	Discount Rate	Trial Standard Level		
		1	2	3*
		Billion 2018$		
Conventional Cooking Tops	3%	0.2	0.7	(9.0)
	7%	0.1	0.4	(6.8)
Conventional Ovens	3%	0.6	0.6	(0.9)
	7%	0.3	0.3	(1.2)
TOTAL (All Products)	3%	0.7	1.3	(9.9)
	7%	0.4	0.7	(8.0)

*Parentheses indicate negative (-) values.

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

C. Proposed Determination

When considering amended energy conservation standards, the standards that DOE adopts for any type (or class) of covered product must be designed to achieve the maximum improvement in energy efficiency that the Secretary determines is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A)) In determining whether a standard is economically justified, the Secretary must determine whether the benefits of the standard exceed its burdens by, to the greatest extent practicable, considering the seven statutory factors discussed previously. (42 U.S.C. 6295(o)(2)(B)(i)) The new or amended standard must also result in significant conservation of energy. (42 U.S.C. 6295(o)(3)(B))

For this proposed determination, DOE considered the impacts of amended standards for consumer conventional cooking products at analyzed TSLs, beginning with the maximum technologically feasible level, to determine whether that level was economically justified. Because an analysis of potential economic justification and energy savings first requires an evaluation of the relevant technology, in the following sections DOE first discusses the technological feasibility of amended standards. DOE then addresses the energy savings and economic justification associated with potential amended standards.

Table V-34 and Table V-35 summarize the quantitative impacts estimated for each TSL for consumer conventional cooking products. The national impacts are measured over the lifetime of consumer conventional cooking products purchased in the 30-year period that begins in the anticipated year of compliance with potential new and amended standards (2023–2052). The efficiency levels contained in each TSL are described in section V.A of this document.

Table V-34 Summary of Analytical Results for Consumer Conventional Cooking Products TSLs: National Impacts

Category	TSL 1	TSL 2	TSL 3
Cumulative National Site and FFC Energy Savings (*quads*)			
Site	0.10	0.22	0.57
FFC	0.29	0.58	1.48
NPV of Consumer Costs and Benefits (*billion 2018$*)			
3% discount rate	2.08	3.72	(32.09)
7% discount rate	0.87	1.49	(18.41)

Parentheses indicate negative (-) values.

Table V-35 Summary of Analytical Results for Consumer Conventional Cooking Products TSLs: Manufacturer and Consumer Impacts

Category	TSL 1	TSL 2	TSL 3
Manufacturer Impacts			
Industry NPV (*million 2018$*) (No-new-standards case INPV = 1,587.7)	1,542.1 – 1,543.4	1,499.5 – 1,505.1	958.7 – 1,203.1
Industry NPV (*% change*)	(2.9) – (2.8)	(5.6) – (5.2)	(39.6) – (24.2)
Consumer Average LCC Savings (*2018$*)			
Electric Open (Coil) Element Cooking Tops	n.a.	n.a.	n.a.
Electric Smooth Element Cooking Tops	$6.50	$27.63	($457.28)
Gas Cooking Tops	n.a.	n.a.	n.a.
Electric Standard Ovens, Free-Standing	$6.77	$12.13	($29.30)
Electric Standard Ovens, Built-In/Slide-In	$6.77	$12.14	($29.32)
Electric Self-Clean Ovens, Free-Standing	$8.99	$8.99	($17.37)
Electric Self-Clean Ovens, Built-In/Slide-In	$8.99	$8.99	($17.29)
Gas Standard Ovens, Free-Standing	$6.78	$6.37	($15.85)
Gas Standard Ovens, Built-In/Slide-In	$6.78	$6.40	($15.79)
Gas Self-Clean Ovens, Free-Standing	$8.15	$8.15	($11.15)
Gas Self-Clean Ovens, Built-In/Slide-In	$8.15	$8.15	($11.12)
Shipment Weighted-Average*	$5.27	$9.10	$(83.41)
Consumer Simple PBP (*years*)			
Electric Open (Coil) Element Cooking Tops	n.a.	n.a.	n.a.
Electric Smooth Element Cooking Tops	1.1	0.9	111.7
Gas Cooking Tops	--	--	--
Electric Standard Ovens, Free-Standing	0.9	4.8	16.6
Electric Standard Ovens, Built-In/Slide-In	0.9	4.8	16.6
Electric Self-Clean Ovens, Free-Standing	0.9	0.9	17.1
Electric Self-Clean Ovens, Built-In/Slide-In	0.9	0.9	17.0
Gas Standard Ovens, Free-Standing	0.9	5.7	16.5
Gas Standard Ovens, Built-In/Slide-In	0.9	5.7	16.5
Gas Self-Clean Ovens, Free-Standing	0.9	0.9	18.1
Gas Self-Clean Ovens, Built-In/Slide-In	0.9	0.9	18.1
Shipment Weighted-Average*	0.6	1.3	27.0
Percent of Consumers that Experience a Net Cost			
Electric Open (Coil) Element Cooking Tops	0%	0%	0%
Electric Smooth Element Cooking Tops	0%	0%	99%
Gas Cooking Tops	0%	0%	0%
Electric Standard Ovens, Free-Standing	0%	26%	75%
Electric Standard Ovens, Built-In/Slide-In	0%	26%	75%
Electric Self-Clean Ovens, Free-Standing	0%	0%	66%
Electric Self-Clean Ovens, Built-In/Slide-In	0%	0%	66%
Gas Standard Ovens, Free-Standing	7%	29%	76%
Gas Standard Ovens, Built-In/Slide-In	7%	29%	76%
Gas Self-Clean Ovens, Free-Standing	8%	8%	66%
Gas Self-Clean Ovens, Built-In/Slide-In	8%	8%	66%
Shipment Weighted-Average*	1%	5%	52%

* Weighted by shares of each product class in total projected shipments in 2023.

1. Technological Feasibility

EPCA mandates that DOE consider whether amended energy conservation standards for consumer conventional cooking products would be technologically feasible. (42 U.S.C. 6295(m)(1)(A) and (n)(2)(B)) DOE has tentatively determined that there are technology options that would improve the efficiency of consumer conventional cooking products. These technology options are being used in commercially available consumer conventional cooking products and therefore are technologically feasible. (See section IV.B of this document for further information.) Hence, DOE has tentatively determined that amended energy conservation standards for consumer conventional cooking products are technologically feasible.

2. Significant Conservation of Energy

EPCA also mandates that DOE consider whether amended energy conservation standards for consumer conventional cooking products would result in significant conservation of energy. (42 U.S.C. 6295(m)(1)(A) and 42 U.S.C. 6295(n)(2)(A)) As discussed in section III.D.2 of this document, to determine whether energy savings are significant, DOE conducts a two-step approach that considers both an absolute site energy savings threshold and a threshold that is a percent reduction in the covered energy use. Section 6(b) of the Process Rule. DOE first evaluates the projected energy savings from a potential max-tech standard over a 30-year period against a 0.3 quads of site energy threshold. Section 6(b)(2) of the Process Rule. If the 0.3 quad-threshold is not met, DOE then compares the max-tech savings to the total energy usage of the covered equipment to calculate a percentage reduction in energy usage. Section 6(b)(3) of the

Process Rule. If this comparison does not yield a reduction in site energy use of at least 10 percent over a 30-year period, DOE proposes that no significant energy savings would likely result from setting new or amended standards. Section 6(b)(4) of the Process Rule.

To estimate the energy savings attributable to potential amended standards for consumer conventional cooking products, DOE compared their energy consumption under the no-new-standards case to their anticipated energy consumption under each potential standard level. The savings are measured over the entire lifetime of products purchased in the 30-year period that begins in the year of anticipated compliance with amended standards (2023–2052).

DOE first considered TSL 3, which represents the max-tech efficiency levels. TSL 3 would save an estimated 0.57 quads of site energy, an amount DOE considers significant as it exceeds the 0.3 quad-threshold established in section 6(b)(2) of the Process Rule for evaluating the significance of energy savings.

DOE then considered TSL 2, which would save an estimated 0.22 quads of energy over the evaluation period, which represents a 4.9-percent decrease in energy use of the evaluated products. The estimated energy savings does not reach the 0.3 quad-threshold or the 10-percent energy saving threshold established in section 6(b) of the Process Rule, and therefore would not be significant. Because TSL 2 would not achieve significant energy savings, DOE did not consider it further.

Finally, DOE considered TSL 1, which would save an estimated 0.10 quads of energy over the evaluation period, which represents a 2.2-percent decrease in energy use of the evaluated products. The estimated energy savings does not reach the 0.3 quad-threshold or the 10-percent energy saving threshold established in section 6(b) of the Process Rule, and therefore would not be significant. Because TSL 1 would not achieve significant energy savings, DOE did not consider it further.

3. Economic Justification

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)) One of those seven factors includes whether the proposed standard level is cost-effective, as defined under 42 U.S.C. 6295(o)(2)(B)(i)(II). Under 42 U.S.C. 6295(o)(2)(B)(i)(II), an evaluation of cost-effectiveness requires DOE to consider savings in operating costs throughout the estimated average life of the covered products in the type (or class) compared to any increase in the price, initial charges, or maintenance expenses for the covered products that are likely to result from the standard. This factor is assessed using LCC and PBP analysis. DOE conducted an LCC analysis to estimate the net costs/benefits to users from increased efficiency in the considered consumer conventional cooking products. (See results in Table V-53.) DOE then aggregated the results from the LCC analysis to estimate the NPV of the total costs and benefits experienced by the Nation. (See results in Table V-44 and Table V-45.) As noted, the inputs for determining the NPV are (1) total annual installed cost, (2) total annual operating costs (energy costs and repair and maintenance costs), and (3) a discount factor to calculate the present value of costs and savings.

Under TSL 3, the NPV of consumer benefit would be negative $18.4 billion using a discount rate of 7 percent, and negative $32.1 billion using a discount rate of 3 percent.

At TSL 3, the average LCC impact ranges from a savings of negative $457 for PC2 (Electric Smooth Element Cooking Tops) to negative $11.12 for PC11 (Gas Self-Clean Oven –Built-In/Slide-In). The simple payback period ranges from 16.5 years for PC8 (Gas Standard Oven –Free-Standing) and PC9 (Gas Standard Oven – Built-In/Slide-In) to 111.7 years for PC2 (Electric Smooth Cooking Tops). The fraction of consumers experiencing a net LCC cost ranges from zero percent for PC1 (Electric Open (Coil) Element Cooking Tops) and PC3 (Gas Cooking Tops), to 99 percent for PC2 (Electric Smooth Element Cooking Tops).

DOE is concerned that TSL 3 may result in the unavailability of certain product types for conventional ovens, because there would be significant uncertainty as to whether commercial-style manufacturers would be able to test their products, in the absence of a DOE test procedure for conventional ovens. DOE also notes that the reduction in IAEC at TSL 3 for PC2 (Electric Smooth Cooking Tops) could result in the loss of certain functions that provide utility to consumers, specifically the continuous clock display for combined cooking products. In addition, 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 previous version of the oven test procedure, which DOE has now repealed in the December 2016 TP Final Rule 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 $629.0 million to a decrease of $384.6 million, which correspond to decreases of 39.6 percent and 24.2 percent, respectively.

Products that meet the efficiency standards specified by TSL 3 are forecast to represent 39 percent of shipments in 2023, the analyzed compliance year of the evaluated standards. As such, manufacturers would have to redesign the majority of their products by 2023. Redesigning these units to meet max-tech would require considerable investment from manufacturers. At TSL 3, DOE estimates capital conversion costs would total $413.4 million and product conversion costs would total $362.9 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. Additionally, manufacturers are more likely to reduce their margins to maintain a price-competitive product at higher TSLs, so DOE expects that TSL 3 would yield impacts closer to the most severe range of INPV impacts. If the most severe range of impacts is reached, the max-tech standard could result in a net loss of 39.6 percent in INPV to consumer conventional cooking product manufacturers. As a result, at TSL 3, DOE expects that some companies could be forced to exit the consumer conventional cooking product market. The commercial-style manufacturer subgroup would most likely not be able to meet the conventional ovens standards required at this TSL and would likely be forced to exit the conventional oven market.

Based on the negative NPV of TSL 3, the negative INPV range, and the potential loss of utility resulting from a standard at TSL 3, DOE has tentatively determined that any potential positive impact of the other statutory factors would not outweigh the estimated negative impacts. Hence, DOE has tentatively determined that an amended standard at TSL 3 is not economically justified. Based on this consideration, DOE is not proposing to amend energy conservation standards to adopt TSL 3 for consumer conventional cooking products.

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

In this proposed determination, based on the consideration of the significance of energy savings and the factors required for consideration of whether amended standards would be economically justified, and the initial determination that amended standards would not result in significant energy savings and would not be economically justified, DOE has tentatively determined that energy conservation standards for consumer conventional cooking products do not need to be amended. DOE will consider all comments received on this proposed determination in issuing any final determination.

VI. Procedural Issues and Regulatory Review

A. Review Under Executive Order 12866

This proposed determination has been determined to be not significant for purposes of Executive Order ("E.O.") 12866, "Regulatory Planning and Review," 58 FR 51735 (Oct. 4, 1993). As a result, OMB did not review this proposed determination.

B. Review Under Executive Orders 13771 and 13777

On January 30, 2017, the President issued E.O. 13771, "Reducing Regulation and Controlling Regulatory Costs." 82 FR 9339 (Feb. 3, 2017). E.O. 13771 stated the policy of the executive branch is to be prudent and financially responsible in the expenditure of funds, from both public and private sources. E.O. 13771 stated it is essential to manage the costs associated with the governmental imposition of private expenditures required to comply with Federal regulations.

Additionally, on February 24, 2017, the President issued E.O. 13777, "Enforcing the Regulatory Reform Agenda." 82 FR 12285 (March 1, 2017). E.O. 13771 required the head of each agency designate an agency official as its Regulatory Reform Officer ("RRO"). Each RRO oversees the implementation of regulatory reform initiatives and policies to ensure that agencies effectively carry out regulatory reforms, consistent with applicable law. Further, E.O. 13777 requires the establishment of a regulatory task force at each agency. The regulatory task force is required to make recommendations to the agency head regarding the repeal, replacement, or modification of existing regulations, consistent with applicable law. At a minimum, each regulatory reform task force must attempt to identify regulations that:

1) Eliminate jobs, or inhibit job creation;

2) Are outdated, unnecessary, or ineffective;

3) Impose costs that exceed benefits;

4) Create a serious inconsistency or otherwise interfere with regulatory reform initiatives and policies;

5) Are inconsistent with the requirements of Information Quality Act, or the guidance issued pursuant to that Act, in particular those regulations that rely in whole or

in part on data, information, or methods that are not publicly available or that are insufficiently transparent to meet the standard for reproducibility; or

6) Derive from or implement Executive Orders or other Presidential directives that have been subsequently rescinded or substantially modified.

DOE initially concludes that this proposed determination is consistent with the directives set forth in these executive orders.

As discussed in this document, DOE is proposing not to amend energy conservation standards for consumer conventional cooking products. Consistent with E.O. 13771, this proposed determination, if finalized, is not estimated to result in any costs or cost savings. Therefore, if finalized as proposed, this determination is expected to be an E.O. 13771 "Other Action."

C. Review Under the Regulatory Flexibility Act

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

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

D. Review Under the Paperwork Reduction Act

Manufacturers of consumer conventional cooking products must certify to DOE that their products comply with any applicable energy conservation standards. DOE has established regulations for the certification and recordkeeping requirements for all covered consumer products and commercial equipment, consumer conventional cooking products. (See generally 10 CFR part 429.) The collection-of-information requirement for the certification and recordkeeping is subject to review and approval by OMB under the Paperwork Reduction Act ("PRA"). This requirement has been approved by OMB under OMB control number 1910-1400. Public reporting burden for the certification is estimated to average 35 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

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.

E. Review Under the National Environmental Policy Act of 1969

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

F. Review Under Executive Order 13132

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

G. Review Under Executive Order 12988

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

H. Review Under the Unfunded Mandates Reform Act of 1995

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

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

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

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

J. Review Under Executive Order 12630

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

K. 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 this NOPD under the OMB and DOE guidelines and has concluded that it is consistent with applicable policies in those guidelines.

L. Review Under Executive Order 13211

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

Because this proposed determination does not propose amended energy conservation standards for consumer conventional cooking products, it is not a significant energy action, nor has it been designated as such by the Administrator at OIRA. Accordingly, DOE has not prepared a Statement of Energy Effects.

M. Information Quality

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

In response to OMB's Bulletin, DOE conducted formal peer reviews of the energy conservation standards development process and the analyses that are typically used and has prepared a report describing that peer review.[81] 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. DOE has determined that the peer-reviewed analytical process continues to reflect current practice, and the Department followed that process for developing energy conservation standards in the case of the present action.

VII. Public Participation

A. Participation in the Webinar

The time and date of the webinar are listed in the **DATES** section at the beginning of this document. If no participants register for the webinar then it will be cancelled. Webinar registration information, participant instructions, and information about the capabilities available to webinar participants will be published on DOE's website: *https://www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=34*. Participants are responsible for ensuring their systems are compatible with the webinar software.

B. Procedure for Submitting Prepared General Statements for Distribution

[81] "Energy Conservation Standards Rulemaking Peer Review Report." 2007. Available at *http://energy.gov/eere/buildings/downloads/energy-conservation-standards-rulemaking-peer-review-report-0*.

Any person who has an interest in the topics addressed in this NOPD, or who is representative of a group or class of persons that has an interest in these issues, may request an opportunity to make an oral presentation at the webinar. Such persons may hand-deliver requests to speak to the address shown in the **ADDRESSES** section at the beginning of this notification of proposed determination between 9:00 a.m. and 4:00 p.m., Monday through Friday, except Federal holidays. Requests may also be sent by postal mail or email to the Appliance and Equipment Standards Program, U.S. Department of Energy, Building Technologies Office, Mailstop EE-5B 1000 Independence Avenue, SW., Washington, DC 20585-0121, or *ApplianceStandardsQuestions@ee.doe.gov*. Persons who wish to speak should include with their request a computer file in WordPerfect, Microsoft Word, PDF, or text (ASCII) file format that briefly describes the nature of their interest in this rulemaking and the topics they wish to discuss. Such persons should also provide a daytime telephone number where they can be reached.

Persons requesting to speak should briefly describe the nature of their interest in this rulemaking and provide a telephone number for contact. DOE requests persons selected to make an oral presentation to submit an advance copy of their statements at least two weeks before the webinar. At its discretion, DOE may permit persons who cannot supply an advance copy of their statement to participate, if those persons have made advance alternative arrangements with the Building Technologies Office. As necessary, requests to give an oral presentation should ask for such alternative arrangements.

C. Conduct of the Webinar

DOE will designate a DOE official to preside at the webinar/public meeting and may also use a professional facilitator to aid discussion. The meeting will not be a judicial or evidentiary-type public hearing, but DOE will conduct it in accordance with section 336 of EPCA (42 U.S.C. 6306). A court reporter will be present to record the proceedings and prepare a transcript. DOE reserves the right to schedule the order of presentations and to establish the procedures governing the conduct of the webinar/public meeting. There shall not be discussion of proprietary information, costs or prices, market share, or other commercial matters regulated by U.S. anti-trust laws. After the webinar/public meeting and until the end of the comment period, interested parties may submit further comments on the proceedings and any aspect of the rulemaking.

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

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

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

D. Submission of Comments

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

Submitting comments via http://www.regulations.gov. The *http://www.regulations.gov* webpage 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 *http://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 *http://www.regulations.gov* cannot be claimed as CBI. Comments received through the website will waive any CBI claims for the information submitted. For information on submitting CBI, see the Confidential Business Information section.

DOE processes submissions made through *http://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 *http://www.regulations.gov* provides after you have successfully uploaded your comment.

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

Include contact information each time you submit comments, data, documents, and other information to DOE. If you submit via postal 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 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.

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

E. Issues on Which DOE Seeks Comment

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

1) DOE seeks comment on both its initial decision to no longer consider intermittent/interrupted or intermittent pilot ignition systems as a technology option, and its initial decision to only evaluate prescriptive standards requiring that conventional ovens not be equipped with a control system that uses a linear power supply (see section IV.A.2.b of this NOPD).

2) DOE requests comment on the evaluated 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 NOPD (see section IV.C.2 of this NOPD).

3) DOE requests input and data on the estimated 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 NOPD (see section IV.C.3 of this NOPD).

4) 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 IV.F.8 of this NOPD)

5) 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 potential new and amended standards on impacts across products within the same fuel class and equipment type (see section IV.G of this NOPD).

6) DOE requests comment on its use of 12.2 percent as a nominal industry discount rate and its use of 3.1 percent as the historical inflation rate, to arrive at a 9.1 percent real industry discount rate (see section IV.I.3.a of this NOPD).

Additionally, DOE welcomes comments on other issues relevant to the conduct of this proposed determination that may not specifically be identified in this document. In particular, DOE notes that under Executive Order 13771, "Reducing Regulation and Controlling Regulatory Costs," Executive Branch agencies such as DOE must manage the costs associated with the imposition of expenditures required to comply with Federal regulations. See 82 FR 9339 (Feb. 3, 2017). Consistent with that Executive Order, DOE encourages the public to provide input on measures DOE could take to lower the cost of its energy conservation standards rulemakings, recordkeeping and reporting requirements, and compliance and certification requirements applicable to consumer conventional cooking products while remaining consistent with the requirements of EPCA.

VIII. Approval of the Office of the Secretary

The Secretary of Energy has approved publication of this notification of proposed determination.

Signing Authority

This document of the Department of Energy was signed on December 2, 2020, by Daniel R Simmons, Assistant Secretary for Energy Efficiency and Renewable Energy, pursuant to delegated authority from the Secretary of Energy. That document with the original signature and date is maintained by DOE. For administrative purposes only, and in compliance with requirements of the Office of the Federal Register, the undersigned DOE Federal Register Liaison Officer has been authorized to sign and submit the document in electronic format for publication, as an official document of the Department of Energy. This administrative process in no way alters the legal effect of this document upon publication in the *Federal Register*.

Signed in Washington, DC, on December 2, 2020

X Daniel R. Simmons

Digitally signed by Daniel R. Simmons
Date: 2020.12.02 10:39:19 -05'00'

Daniel R Simmons
Assistant Secretary for Energy Efficiency and Renewable Energy