[6450-01-P]

DEPARTMENT OF ENERGY

10 CFR Parts 429 and 430

[Docket Number EERE–2011–BT–STD–0048]

RIN: 1904–AC07

Energy Conservation Program: Energy Conservation Standards for Standby Mode and Off Mode for Microwave Ovens

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

ACTION: Supplemental notice of proposed rulemaking (SNOPR) and public meeting.

SUMMARY: The Energy Policy and Conservation Act (EPCA) prescribes energy conservation standards for various consumer products and commercial and industrial equipment. Microwave ovens are covered products under EPCA, although there are no existing microwave oven standards. EPCA requires the U.S. Department of Energy (DOE) to determine whether amended, more stringent, standards are technologically feasible and economically justified, and would save a significant amount of energy. Additionally, the Energy Independence and Security Act of 2007 (EISA 2007) amended EPCA to require any final rule adopted after July 1, 2010 establishing or revising energy

conservation standards for covered products, including microwave ovens, to address standby mode and off mode energy use. On October 17, 2008, DOE issued a notice of proposed rulemaking (NOPR) in which DOE proposed amendments to the energy conservation standards for several residential and commercial products, including microwave ovens. In response to the NOPR, DOE received comment expressing concern and encouraging the Department to re-examine standby mode and off mode of microwave ovens as a part of DOE's rulemaking analyses. Additionally, DOE received comment alleging certain data problems affecting DOE's rulemaking analyses. DOE's preliminary assessment suggested that the concerns might be valid, thereby necessitating additional, supplemental rulemaking analyses. In this notice, DOE responds to the comments received on the NOPR and proposes amended energy conservation standards for microwave oven standby mode and off mode. The notice also announces a public meeting to receive comment on these proposed standards and associated analyses and results.

DATES: DOE will hold a public meeting on March 14, 2012, from 9:00 a.m. to 4:00 p.m., in Washington, D.C. The meeting will also be broadcast as a webinar. See section VIII, "Public Participation," for webinar registration information, participant instructions, and information about the capabilities available to webinar participants.

DOE will accept comments, data, and information regarding this SNOPR before and after the public meeting, but no later than **[**INSERT DATE 60 DAYS AFTER

FEDERAL REGISTER PUBLICATION]. See section VIII, "Public Participation," for details.

ADDRESSES: The public meeting will be held at the U.S. Department of Energy, Forrestal Building, Room 8E-089, 1000 Independence Avenue, SW., Washington, D.C. 20585. To attend, please notify Ms. Brenda Edwards at (202) 586–2945. Please note that foreign nationals visiting DOE Headquarters are subject to advanced security screening procedures. Any foreign national wishing to participate in the meeting should advise DOE as soon as possible by contacting Ms. Brenda Edwards at (202) 586-2945 to initiate the necessary procedures.

Any comments submitted must identify the SNOPR for Energy Conservation Standards for Microwave Oven Standby Mode and Off Mode and must provide docket number EERE–2011–BT–STD–0048 and/or regulatory information number (RIN) 1904–AC07. Comments may be submitted using any of the following methods.

1. Federal eRulemaking Portal: www.regulations.gov. Follow the instructions for submitting comments.
2. E-mail: MWO-2011-BT-STD-0048@ee.doe.gov Include the docket number and/or RIN in the subject line of the message.
3. Mail: Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Program, Mailstop EE-2J, 1000 Independence Avenue, SW., Washington, D.C.

20585-0121. If possible, please submit all items on a CD. It is not necessary to include printed copies.

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

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

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

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

A link to the docket web page can be found at:
http://www.regulations.gov/#!docketDetail;dct=FR+PR+N+O+SR;rpp=10;po=0;D=EER

E-2011-BT-STD-0048 . This web page will contain a link to the docket for this notice on the regulations.gov site. The regulations.gov web page will contain simple instructions on how to access all documents, including public comments, in the docket. See section VIII for information on how to submit comments through regulations.gov.

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

FOR FURTHER INFORMATION CONTACT:

Mr. Wes Anderson, U.S. Department of Energy, Energy Efficiency and Renewable Energy, Building Technologies Program, EE–2J, 1000 Independence Avenue, SW, Washington, D.C. 20585-0121. Telephone: (202) 586–7335. E-mail: wes.anderson@ee.doe.gov.

Mr. Ari Altman, Esq., U.S. Department of Energy, Office of the General Counsel, GC–71, 1000 Independence Avenue, SW., Washington, D.C. 20585-0121. Telephone: (202) 287-6307. E-mail: Ari.Altman@hq.doe.gov.

SUPPLEMENTARY INFORMATION:

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I. **Summary of the Proposed Rule**

The Energy Policy and Conservation Act (42 U.S.C. 6291 et seq.; EPCA or the Act), as amended, provides that any amended energy conservation standard DOE prescribes for certain consumer products, such as microwave ovens, 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)) The new or amended standard must "result in significant conservation of energy." (42 U.S.C. 6295(o)(3)(B)) In accordance with these and other statutory provisions discussed in this notice, DOE proposes amended energy conservation standards for microwave oven standby mode and off mode. The proposed standards, which prescribe the maximum allowable energy use when a product is in standby mode, are shown in Table I.1.[1] These proposed standards, if adopted, would apply to all products listed in Table I.1 and manufactured in, or imported into, the United States on or after April 1, 2014.

Table I.1 Proposed Energy Conservation Standards for Microwave Oven Standby Mode and Off Mode (Compliance Starting in 2014)

Product Classes	Proposed Energy Conservation Standard
Microwave-Only Ovens and Countertop Combination Microwave Ovens	Maximum Standby Power = 1.0 watt
Built-In and Over-the-Range Combination Microwave Ovens	Maximum Standby Power = 2.2 watts

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[1] DOE considered energy use in off mode for microwave ovens, but is not proposing a maximum allowable off mode power because it is unaware of any current microwave ovens that are capable of operating in such a mode.

DOE's analyses indicate that the proposed standards would save a significant amount of energy–an estimated 0.41 quads over 30 years (2014 through 2043). According to the Energy Information Administration's (EIA's) Annual Energy Outlook 2010 (AEO 2010), total residential energy consumption is projected to be 21.3 quads in 2015. The amount of energy saved per year is equivalent to 0.06 percent of the projected household energy use.

The cumulative national net present value (NPV) of total consumer costs and savings of the proposed standards for products shipped in 2014–2043, in 2010$, ranges from $1.82 billion (at a 7-percent discount rate) to $3.59 billion (at a 3-percent discount rate).[2] The NPV is the estimated total value of future operating-cost savings during the analysis period, minus the estimated increased product costs, discounted to 2011. The industry net present value (INPV) is the sum of the discounted cash flows to the industry from the base year through the end of the analysis period (2014 to 2043). Using a real discount rate of 7.2 percent, DOE estimates that INPV for manufacturers of all microwave ovens in the base case is $1.1 billion in 2010$. If DOE adopts the proposed standard, it expects manufacturers will lose 4.7 to 6.5 percent of their INPV, or approximately $52.9 million to $73.6 million. Using a 7-percent discount rate, the NPV of consumer costs and savings from today's proposed standards would amount to 25 to 34 times the total estimated industry losses. Using a 3-percent discount rate, the NPV would amount to 49 to 68 times the total estimated industry losses.

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[2] DOE uses discount rates of 7 and 3 percent based on guidance from the Office of Management and Budget (OMB Circular A-4, section E, September 17, 2003). See section IV.E for further information.

The projected economic impacts of the proposed standards on individual consumers are positive. For example, for Microwave-Only and Countertop Combination Microwave Ovens (Product Class 1), the estimated average life-cycle cost (LCC) savings in 2010$ are $13, and all consumers of these products would have positive economic impacts. For Built-In and Over-the-Range Combination Microwave Ovens (Product Class 2), the estimated average LCC savings in 2010$ are $4, and most consumers of this product would have positive economic impacts.

In addition, the proposed standards would have significant environmental benefits. The energy savings projected from the proposed standards would result in cumulative greenhouse gas emission reductions of 31.48 million metric tons (Mt)[3] of carbon dioxide (CO_2) in 2014–2043. During this period, the proposed standards would result in emissions reductions of 25.6 tons of nitrogen oxides (NO_X), and have a negligible impact on emissions of mercury (Hg).[4] DOE estimates the present monetary value of the CO_2 emissions reduction is between $139 million and $2,118 million, expressed in 2010$. DOE also estimates the present monetary value of the NO_X emissions reduction, expressed in 2010$, is between $3.82 million and $39.3 million at a

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[3] Results for NO_X and Hg are presented in short tons. A metric ton is equivalent to 1.1 short tons.
[4] DOE calculates emissions reductions relative to the most recent version of the Annual Energy Outlook (AEO) Reference case forecast. This forecast accounts for emissions reductions from in-place regulations, including the Clean Air Interstate Rule (CAIR, 70 FR 25162 (May 12, 2005)), but not the Clean Air Mercury Rule (CAMR, 70 FR 28606 (May 18, 2005)). Subsequent regulations, including the Cross-State Air Pollution rule issued on July 6, 2011, do not appear in the forecast at this time.

7-percent discount rate, and between $7.44 million and $76.4 million at a 3-percent discount rate.[5]

The benefits and costs of today's proposed standards can also be expressed in terms of annualized values over a 30-year period. The annualized monetary values are the sum of (1) the annualized national economic value of the benefits from operating products that meet the proposed standards (consisting primarily of operating cost savings from using less energy, minus increases in product purchase costs, which is another way of representing consumer NPV), and (2) the monetary value of the benefits of emission reductions, including CO_2 emission reductions.[6] The value of the CO_2 reductions, otherwise known as the Social Cost of Carbon (SCC), is calculated using a range of values per metric ton of CO_2 developed by a recent interagency process. The monetary costs and benefits of cumulative emissions reductions are reported in 2010$ to permit comparisons with the other costs and benefits in the same dollar units. The derivation of the SCC values is discussed in section IV.K.

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[5] DOE is aware of multiple agency efforts to determine the appropriate range of values used in evaluating the potential economic benefits of reduced Hg emissions. DOE has decided to await further guidance regarding consistent valuation and reporting of Hg emissions before it once again monetizes Hg in its rulemakings.

[6] DOE used a two-step calculation process to convert the time-series of costs and benefits into annualized values. First, DOE calculated a present value in the same year used for discounting the NPV of total consumer costs and savings. To calculate the present value, DOE used discount rates of 3 and 7 percent for all costs and benefits except for the value of CO_2 reductions. For the latter, DOE used a range of discount rates, as shown in Table I.2. From the present value, DOE then calculated the corresponding time-series of fixed annual payments over a 30-year period starting in the same year used for discounting the NPV of total consumer costs and savings. The fixed annual payment is the annualized value. Although DOE calculated annualized values, this does not imply that the time-series of cost and benefits from which the annualized values were determined would be a steady stream of payments.

Although combining the values of operating savings and CO_2 reductions provides a useful perspective, two issues should be considered. First, the national operating savings are domestic U.S. consumer monetary savings that occur as a result of market transactions, whereas the value of CO_2 reductions is based on a global value. Second, the assessments of operating cost savings and CO_2 savings are performed with different methods that use different time frames for analysis. The national operating cost savings is measured for the lifetime of microwave ovens shipped in 2014–2043. The SCC values, on the other hand, reflect the present value of all future climate-related impacts resulting from the emission of one ton of CO_2 in each year. These impacts continue well beyond 2100.

Table I.2 shows the annualized values for today's proposed standards, expressed in 2010$. The results under the primary estimate are as follows. Using a 7-percent discount rate for benefits and costs other than CO_2 reductions, for which DOE used a 3-percent discount rate along with the SCC series corresponding to a value of $22.3/ton in 2010, the cost of the standards proposed in today's rule is $20.3 million per year in increased product costs, while the annualized benefits are $167 million in reduced product operating costs, $35.4 million in CO_2 reductions, and $1.74 million in reduced NO_X emissions. In this case, the net benefit amounts to $184 million per year. Using a 3-percent discount rate for all benefits and costs and the SCC series corresponding to a value of $22.3/ton in 2010, the cost of the standards proposed in today's rule is $21.6 million per year in increased product costs, while the annualized benefits are $205 million in reduced operating costs, \$35.4 million in CO_2 reductions, and \$2.14 million in reduced NO_X emissions. In this case, the net benefit amounts to \$221 million per year.

Table I.2 Annualized Benefits and Costs of Proposed Standards for Microwave Oven Standby Mode and Off Mode for Products Sold in 2014-2043

	Discount Rate	Primary Estimate*	Low Benefits Estimate*	High Benefits Estimate*
		Monetized (million 2010$/year)		
Benefits				
Operating Cost Savings	7%	167	150	185
	3%	205	182	229
CO_2 Reduction at $4.9/t**	5%	9.02	8.49	9.55
CO_2 Reduction at $22.3/t**	3%	35.4	33.3	37.6
CO_2 Reduction at $36.5/t**	2.5%	55.9	52.5	59.3
CO_2 Reduction at $67.6/t**	3%	108.0	101.5	114.6
NO_X Reduction at $2,537/t**	7%	1.74	1.65	1.82
	3%	2.14	2.02	2.26
Total†	7% plus CO_2 range	178 to 277	160 to 253	196 to 301
	7%	204	185	224
	3%	243	217	269
	3% plus CO_2 range	216 to 315	193 to 286	241 to 346
Costs				
Incremental Product Costs	7%	20.32	23.39	20.25
	3%	21.59	25.48	21.48
Total Net Benefits				
Total†	7% plus CO_2 range	157 to 256	137 to 230	176 to 281
	7%	184	162	204
	3%	221	192	247
	3% plus CO_2 range	195 to 294	167 to 260	219 to 324

* The Primary, Benefits, and High Benefits Estimates utilize forecasts of energy prices and housing starts from the AEO2010 Reference case, Low Economic Growth case, and High Economic Growth case, respectively. In addition, incremental product costs reflect a declining trend (default learning rate) for product prices in the Primary Estimate, constant prices (no learning rate) for product prices in the Low Estimate, and a declining trend (high learning rate) in the High Estimate. The derivation and application of learning rates for product prices is explained in section IV.D.1.

** The CO_2 values represent global values (in 2010$) of the social cost of CO_2 emissions in 2010 under several scenarios. The values of $4.9, $22.3, and $36.5 per ton are the averages of SCC distributions calculated using 5-percent, 3-percent, and 2.5-percent discount rates, respectively. The value of $67.6 per ton represents the 95th percentile of the SCC distribution calculated using a 3-percent discount rate. The value for NO_X (in 2010$) is the average of the low and high values used in DOE's analysis.

† Total Benefits for both the 3-percent and 7-percent cases are derived using the SCC value calculated at a 3-percent discount rate, which is $22.3/ton in 2010 (in 2010$). In the rows labeled as "7% plus CO_2 range"

and “3% plus CO_2 range,” the operating cost and NO_X benefits are calculated using the labeled discount rate, and those values are added to the full range of CO_2 values.

DOE has made an initial determination that the proposed standards represent the maximum improvement in energy efficiency that is technologically feasible and economically justified, while maintaining product utility in the form of a continual clock display, and would result in the significant conservation of energy. DOE further notes that products achieving these standard levels are already commercially available for one of the product classes covered by today's proposal.[7] Based on the analyses described above, DOE found the benefits of the proposed standards to the Nation (energy savings, positive NPV of consumer benefits, consumer LCC savings, and emission reductions) outweigh the burdens (loss of INPV for manufacturers).

Based on consideration of the public comments DOE receives in response to this supplemental notice and related information collected and analyzed during the course of this rulemaking effort, DOE may adopt energy use levels presented in this notice that are either higher or lower than the proposed standards, or some combination of level(s) that incorporate the proposed standards in part. In particular, DOE is proposing TSL 3 for built-in products as the level which it has tentatively concluded meet the applicable statutory criteria (i.e., the highest level that is technologically feasible, economically justified, and would result in significant conservation of energy). Based upon public

[7] Products in the Microwave-Only Ovens and Countertop Combination Microwave Ovens product class that meet the proposed standards are currently commercially available. The Built-In and Over-the-Range Combination Microwave Ovens class does not currently comprise products that meet the proposed standards, primarily because of the larger components necessary for the convection system and the more complex displays. However, DOE believes it is technologically feasible for all microwave ovens to meet the proposed standards.

comments and any accompanying data submissions, DOE would consider finalizing other TSLs (as presented in this NOPR or at some level in between), including the option of not finalizing the standard for built-ins proposed in this rule. Accordingly, DOE is presenting a variety of issues throughout today's notice upon which it is seeking comment, which will bear upon its consideration of standards for built-ins in the final rule.

II. **Introduction**

The following section briefly discusses the statutory authority underlying today's proposal as well as some of the relevant historical background related to the establishment of energy conservation standards for microwave oven standby mode and off mode.

A. Authority

Title III of EPCA sets forth various provisions designed to improve energy efficiency. Part B of Title III (42 U.S.C. 6291–6309) provides for the Energy Conservation Program for Consumer Products Other Than Automobiles.[8] EPCA covers consumer products and certain commercial equipment (referred to collectively hereafter as "covered products"), including the microwave ovens that are the subject of this rulemaking. (42 U.S.C. 6292(a)(10))[9]

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

[9] DOE notes that under 42 U.S.C. 6295(m), the agency must periodically review its already established energy conservation standards for a covered product. Under this requirement, the next review that DOE would need to conduct would occur no later than 6 years from the issuance of a final rule establishing or amending a standard for a covered product.

Under the Act, DOE's energy conservation program for covered products consists essentially of four parts: (1) testing, (2) labeling, (3) the establishment of Federal energy conservation standards, and (4) certification and enforcement procedures. The Federal Trade Commission (FTC) is primarily responsible for labeling, and DOE implements the rest of the program. Section 323 of the Act authorizes DOE, subject to certain criteria and conditions, to develop test procedures to measure the energy efficiency, energy use, or estimated annual operating cost of each covered product. (42 U.S.C. 6293) The National Appliance Energy Conservation Act of 1987 (NAECA), Pub. L. 100-12, amended EPCA to establish prescriptive standards for cooking products, specifically gas cooking products. No standards were established for microwave ovens. 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 (42 U.S.C. 6295(s)) and when making representations to the public regarding the energy use or efficiency of those products. (42 U.S.C. 6293(c)) Similarly, DOE must use these test procedures to determine whether the products comply with standards adopted under EPCA. (42 U.S.C. 6295(s)) The test procedure for microwave ovens currently appears at title 10, Code of Federal Regulations (CFR), part 430, subpart B, appendix I.

EPCA provides criteria for prescribing amended standards for covered products. As indicated above, any 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, EPCA precludes DOE from adopting any standard for certain products, including microwave ovens, if no test procedure has been established for the product. (42 U.S.C. 6295(o)(3)(A)) Moreover, DOE may not prescribe a standard: (1) if it would not result in the significant conservation of energy, or (2) if DOE determines by rule that the proposed standard is not technologically feasible or economically justified. (42 U.S.C. 6295(o)(3)(B)) The Act also provides that, in deciding whether a proposed standard is economically justified, DOE must determine whether the benefits of the standard exceed its burdens. (42 U.S.C. 6295(o)(2)(B)(i)) DOE must do so after receiving comments on the proposed standard, and by considering, to the greatest extent practicable, the following seven factors:

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

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

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

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

5. The impact of any lessening of competition, as determined in writing by the Attorney General, that is likely to result from the imposition of the standard;

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

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

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 the Secretary finds that interested persons have established by a preponderance of the evidence that the standard is likely to result in the unavailability in the United States of any covered product type (or class) of performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially the same as those generally available in the United States at the time of the Secretary's finding. (42 U.S.C. 6295(o)(4))

Further, 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. See 42 U.S.C. 6295(o)(2)(B)(iii).

Additionally, 42 U.S.C. 6295(q)(1) specifies requirements when promulgating a standard for a type or class of covered product that has two or more subcategories. DOE must specify a different standard level than that which applies generally to such type or class of products for any group of covered products which have the same function or intended use, if 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 than applies or will apply to the other products within that type or class. Id. 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))

Federal energy conservation requirements generally supersede State laws or regulations concerning energy conservation testing, labeling, and standards. (42 U.S.C. 6297(a)–(c)) DOE can, however, grant waivers of Federal preemption for particular State laws or regulations, in accordance with the procedures and other provisions of section 327(d) of the Act. (42 U.S.C. 6297(d))

Finally, section 310(3) of the Energy Independence and Security Act of 2007 (EISA 2007; Pub. L. 110-140) amended EPCA to require that energy conservation standards address standby mode and off mode energy use. (42 U.S.C. 6295(gg)) Specifically, when DOE adopts a standard for a covered product after July 1, 2010, it must, pursuant to criteria for adoption of standards at 42 U.S.C. 6295(o), incorporate standby mode and off mode energy use into the standard, if feasible, or adopt a separate standard for such energy use for that product. (42 U.S.C. 6295(gg)(3)) These provisions in EISA 2007 do not preclude DOE from considering standards for standby mode and off mode energy use in a rulemaking that does not consider standards for active mode energy use. In this rulemaking, DOE intends to incorporate standby mode and off mode energy use into any standard it adopts in the final rule.

It is pursuant to the authority set forth above that DOE is conducting the present SNOPR rulemaking for standby mode and off mode electricity consumption of microwave ovens.

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

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

B. Background

1. Current Standards

Section 310 of EISA 2007 amends section 325 of EPCA to require DOE to regulate standby mode and off mode energy use for all covered products, including microwave ovens, as part of energy conservation standards for which a final rule is adopted after July 10, 2010. (42 U.S.C. 6295(gg)(3)(A))

Based on its ongoing analyses and comments from interested parties, DOE decided not to amend energy conservation standards for microwave oven energy factor (microwave oven operation in active mode), but instead develop a separate energy use metric for standby mode and off mode. 74 FR 16040 (Apr. 8, 2009).

2. History of Standards Rulemaking for Microwave Ovens

On March 15, 2006, DOE published on its website a document titled, "Rulemaking Framework for Commercial Clothes Washers and Residential Dishwashers, Dehumidifiers, and Cooking Products" (Framework Document).[10] 71 FR 15059. The Framework Document described the procedural and analytical approaches that DOE anticipated using to evaluate energy conservation standards for these products, and identified various issues to be resolved in conducting the rulemaking. On December 4,

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[10] This document is available on the DOE website at: www.eere.energy.gov/buildings/appliance_standards/residential/dehumidifiers.html. (Last accessed March 18, 2011.)

2006, DOE posted on its website two spreadsheet tools for this rulemaking.[11] The first tool calculates life-cycle cost (LCC) and payback periods (PBPs). The second tool—the national impact analysis (NIA) spreadsheet—calculates the impacts on shipments and the national energy savings (NES) and NPV at various candidate standard levels. DOE subsequently published the advance notice of proposed rulemaking (ANOPR) for this rulemaking (72 FR 64432 (Nov. 15, 2007), the November 2007 ANOPR) and on December 13, 2007, held a public meeting to present and seek comment on the analytical methodology and results in the ANOPR (the December 2007 Public Meeting).

At the December 2007 Public Meeting, DOE invited comment in particular on the following issues concerning microwave ovens: (1) incorporation of the International Electrotechnical Commission (IEC) test standard IEC Standard 62301[12] into DOE's microwave oven test procedure to measure standby mode and off mode power; (2) IEC Standard 62301 test conditions; and (3) a requirement that if the measured standby mode power varies as a function of the time displayed, the standby mode power test would run for 12 hours, with an initial clock setting of 12:00.

Interested parties' comments presented during the December 2007 Public Meeting and submitted in response to the November 2007 ANOPR addressed the standby mode and off mode energy use of microwave ovens and the ability to combine that energy use

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[11] These spreadsheets are available on the DOE website at: http://www1.eere.energy.gov/buildings/appliance_standards/residential_products.html. (Last accessed March 18, 2011)

[12] IEC standards are available for purchase at: http://www.iec.ch/.

into a single metric with cooking energy use. Those concerns lead DOE to thoroughly investigate standby mode, off mode, and active mode power consumption of microwave ovens.

On October 17, 2008, DOE published a NOPR (the October 2008 NOPR) for cooking products and commercial clothes washers in the Federal Register proposing amended energy conservation standards. 73 FR 62034. In the October 2008 NOPR, DOE tentatively concluded that a standard for microwave oven standby mode and off mode energy use would be technologically feasible and economically justified. Id. at 62120. Therefore, concurrent with the standards NOPR, DOE published in the Federal Register a test procedure NOPR for microwave ovens to incorporate a measurement of standby mode and off mode power and to consider inclusion of such power as part of the energy conservation standards rulemaking. 73 FR 62134 (Oct. 17, 2008).

In conjunction with the October 2008 NOPR, DOE posted on its website the associated technical support document (TSD). The TSD included the results of DOE's analyses, including: (1) the market and technology assessment, (2) screening analysis, (3) engineering analysis, (4) energy and water use determination, (5) markups analysis to determine product price, (6) LCC and PBP analyses, (7) shipments analysis, (8) NES and NIA, and (9) manufacturer impact analysis (MIA). The engineering analysis spreadsheet, the LCC spreadsheets, the national and regional impact analysis spreadsheets, and the MIA spreadsheet were all made available at www.eere.energy.gov/buildings/appliance_standards/commercial/clothes_washers.html.

In the October 2008 NOPR, DOE concluded based on its additional investigations that, "although it may be mathematically possible to combine energy consumption into a single metric encompassing active (cooking), standby, and off modes, it is not technically feasible to do so at this time…." 73 FR 62034, 62043 (Oct. 17, 2008). The separate prescriptive standby mode and off mode energy conservation standards proposed in the October 2008 NOPR for microwave ovens were as shown in Table II.1.

Table II.1 October 2008 NOPR Proposed Energy Conservation Standards for Microwave Oven Standby Mode and Off Mode

Product Class	**Proposed Energy Conservation Standard**
Microwave Ovens	Maximum Standby Power = 1.0 watt

In the October 2008 NOPR, DOE described and sought further comment on the analytical framework, models, and tools (e.g., LCC and NIA spreadsheets) it was using to analyze the impacts of energy conservation standards for this product. DOE held a public meeting in Washington, DC, on November 13, 2008 (the November 2008 Public Meeting), to present the methodologies and results for the October 2008 NOPR analyses.

Multiple interested parties commented in response to the October 2008 NOPR that insufficient data and information were available to complete this rulemaking, and requested that it be postponed to allow DOE to gather such inputs on which to base its analysis. Whirlpool Corporation (Whirlpool) commented that DOE should work with industry to gather comprehensive data. Whirlpool stated that DOE and industry must ensure the product is useful to the consumer at the standards adopted, which could mean delaying standards until the next round of rulemaking. (Whirlpool, No. 50 at p. 2; Whirlpool, Public Meeting Transcript, No. 40.5 at p. 63)[13] GE Consumer & Industrial (GE) stated that DOE's approach could have important implications for how standby power is approached for other covered products, and thus it is essential that DOE take the time to address these issues. GE commented that DOE should postpone the microwave oven standby mode and off mode energy conservation standards rulemaking to allow standby power issues for covered products to be addressed either through negotiation or through a rulemaking that considers how the definition of standby power would affect all appliances, not just microwave ovens. GE further commented that if the microwave oven standby mode and off mode energy conservation standards rulemaking was not postponed, DOE should issue a "no standard" standard for microwave oven standby power. (GE, No. 48, at pp. 2, 4)

DOE agreed with these commenters that additional information would improve its analysis and, in April 2009, it concluded that it should defer a decision regarding amended energy conservation standards for standby mode and off mode energy use for microwave ovens pending further rulemaking. FR 16040, 16042 (Apr. 8, 2009). In the interim, DOE proceeded with consideration of energy conservation standards for

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[13] A notation in the form "Whirlpool, No. 50 at p. 2" identifies a written comment that DOE has received and has included in the docket of the standards rulemaking for microwave ovens (Docket No. EE–2006–STD–0127). This particular notation refers to a comment (1) submitted by Whirlpool, (2) recorded in document number 50 in the docket of this rulemaking, and (3) which appears on page 2 of document number 50. A notation in the form "Whirlpool, Public Meeting Transcript, No. 40.5 at p. 63" identifies an oral comment that DOE received during the November 13, 2008 NOPR public meeting and which was recorded in the public meeting transcript in the docket for this rulemaking (Docket No. EE–2006–STD–0127), available on www.regulations.gov. This particular notation refers to a comment (1) made by Whirlpool during the public meeting, (2) recorded in document number 40.5, which is the public meeting transcript that is filed in the docket of this rulemaking, and (3) which appears on page 63 of document number 40.5.

microwave oven active mode energy use based on its proposals in the October 2008 NOPR, and its analysis determined that no new standards for microwave oven active mode (as to cooking efficiency) were technologically feasible and economically justified. Therefore, in a final rule published on April 8, 2009, DOE maintained the "no standard" standard for microwave oven active mode energy use. Id. at 16087. The final rule is available on DOE's website at: www1.eere.energy.gov/buildings/appliance_standards/residential/pdfs/74fr16040.pdf

After continuing its analysis of microwave oven standby mode and off mode through additional testing, research, and consideration of an updated version of IEC Standard 62301, DOE developed this SNOPR to enable interested parties to comment on the revised standby power levels proposed for microwave oven standby mode and off mode energy use.

The effective date of any new energy conservation standards for this product would be 3 years after the final rule is published in the Federal Register.

III. **General Discussion**

A. Test Procedures

The test procedures for cooking products including microwave ovens initially appeared at 10 CFR part 430, subpart B, appendix I. Those test procedures were part of a May 10, 1978 final rule that first established test procedures for conventional ranges, cooktops, and ovens (including microwave ovens). 43 FR 20108. DOE later revised its test procedures for cooking products to measure their efficiency and energy use more accurately, publishing a final rule on October 3, 1997. 62 FR 51976. The 1997 rule incorporated parts of IEC Standard 705–1998 and Amendment 2–1993, “Methods for Measuring the Performance of Microwave Ovens for Households and Similar Purposes.” It measured microwave oven cooking efficiency, but did not address energy use in the standby mode or off mode.

Section 310 of EISA 2007 amended EPCA to require DOE to amend the test procedures for covered products to address energy consumption of standby mode and off mode. If technically infeasible, DOE must prescribe a separate standby mode and off mode energy use test procedure. (42 U.S.C. 6295(gg)(2)(A))

As discussed previously, DOE published a notice of proposed rulemaking in October 2008 to amend the microwave oven test procedure to provide for measuring standby mode and off mode power consumption, (73 FR 62134 (Oct. 17, 2008)) and held a public meeting on the proposed rulemaking on November 14, 2008. DOE received comments from interested parties both in written responses to the October 2008 NOPR and at the November 2008 Public Meeting.

After considering stakeholder comments and additional information, DOE issued an SNOPR for the test procedure for measuring microwave oven standby mode and off mode power consumption. 75 FR 42612 (July 22, 2010). In that SNOPR, DOE proposed adopting definitions of modes based on relevant provisions from IEC Standard 62301

Second Edition, Committee Draft for Vote (IEC Standard 62301 CDV), as well as language to clarify application of those provisions for measuring microwave oven standby mode and off mode power consumption. Id. Also on July 22, 2010, DOE issued a repeal final rule (the July 2010 TP Final Rule) eliminating the active mode cooking efficiency provisions in the microwave oven test procedure after it determined that those provisions did not produce accurate and repeatable results. 75 FR 42579. DOE held a public meeting on September 16, 2010, and accepted comments, data, and information regarding the test procedure SNOPR no later than October 4, 2010. DOE also invited inputs on microwave active mode test procedures for a potential new test procedure rulemaking. After consideration of these comments, an interim final rule for a microwave oven test procedure addressing standby mode and off mode power was published in the Federal Register on March 9, 2011 (the March 2011 TP Interim Final Rule). 76 FR 12825. DOE provided a 180-day comment period on the March 2011 TP Interim Final Rule, during which it received several comments on potential improvements to the microwave oven test procedure recently adopted. DOE is currently considering these comments, but does not believe that any of the suggested amendments would impact the analysis in today's notice.

B. Technological Feasibility

1. General

DOE considers a design option to be technologically feasible if it is in use by the associated industry or if research has progressed to development of a working prototype. In each standards rulemaking, therefore, DOE conducts a screening analysis, based on information it has gathered regarding existing technology options and prototype designs. In consultation with manufacturers, design engineers, and other stakeholders, DOE develops a list of design options for consideration in the rulemaking. After DOE determines that particular design options are technologically feasible, the first of the screening criteria, it evaluates each option in light of the following three additional criteria: (a) practicability to manufacture, install, and service; (b) adverse impacts on product utility or availability; and (c) adverse impacts on health or safety. 10 CFR part 430, subpart C, appendix A, section 4(a)(3) and (4). All technologically feasible design options that pass the three additional screening criteria are candidates for further assessment in the engineering and subsequent analyses in the NOPR stage. DOE may amend the list of retained design options in SNOPR analyses based on comments received on the NOPR and on further research.

DOE published a list of evaluated microwave oven technologies in the November 2007 ANOPR. 72 FR 64432 (Nov. 15, 2007). DOE identified lower-power display technologies, improved power supplies and controllers, and alternative cooking sensor technologies as options to reduce standby power. DOE conducted this research when it became aware of the likelihood of EISA 2007 being signed, which DOE understood was to contain provisions pertaining to standby mode and off mode energy use. Therefore, DOE presented details of each design option to stakeholders at the December 2007 Public Meeting even though the results were not available in time for publication in the November 2007 ANOPR. DOE believes all of these options are technologically feasible, and in the ANOPR invited comment on technology options that reduce standby power in microwave ovens. 72 FR 64432, 64513 (Nov. 15, 2007). For more details of these technology options and stakeholder comments, see section IV.B of this notice.

2. Maximum Technologically Feasible Levels

When DOE proposes to adopt, or to decline to adopt, an amended or new standard for a type (or class) of product such as microwave ovens, it must "determine the maximum improvement in energy efficiency or maximum reduction in energy use that is technologically feasible" for such a product. (42 U.S.C. 6295(p)(1)) Using the design parameters that lead to creation of the highest available product efficiencies, in the engineering analysis DOE determined the maximum technologically feasible ("max-tech") standby power levels[14] for microwave ovens, as shown in Table III.1. (See chapter 3 in the SNOPR TSD.) The max-tech microwave oven standby power level corresponds to a unit equipped with a default automatic power-down function that shuts off certain power-consuming components after a specified period of user inactivity. The max-tech microwave oven standby power level was determined in the October 2008 NOPR to be 0.02 watts (W). 73 FR 62052 (Oct. 17, 2008). Based upon additional analyses for today's SNOPR, DOE is proposing that this max-tech level applies to the product class of microwave-only ovens and countertop combination microwave ovens. For built-in and over-the-range combination microwave ovens, DOE proposes, based on its analysis, a max-tech standby power level of 0.04 W. For more details of the max-tech levels and stakeholder comments, see section IV.C of this notice.

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[14] As noted previously, DOE is unaware of any microwave ovens currently available that can operate in off mode. Therefore, efficiency levels for the purposes of evaluating standby mode and off mode energy use in microwave ovens are defined on the basis of standby power only.

Table III.1 Proposed Max-Tech Microwave Oven Standby Power Levels

Product Class	Max-Tech Standby Power Level
Microwave-Only Ovens and Countertop Combination Microwave Ovens	0.02 watts
Built-In and Over-the-Range Combination Microwave Ovens	0.04 watts

C. Energy Savings

1. Determination of Energy Savings

DOE used its NIA spreadsheet tool to estimate energy savings from amended standards for standby mode and off mode energy use for microwave ovens. (Section IV.E of today's supplemental notice and chapter 10 of the SNOPR TSD describe the NIA spreadsheet model.) DOE forecasted energy savings throughout the period of analysis (beginning in 2014, the year that amended standards would go into effect, and ending in 2043) for each TSL, relative to the base case, which represents the forecast of energy consumption in the absence of amended energy conservation standards. DOE quantified the energy savings attributable to amended energy conservation standards as the difference in energy consumption between each standards case and the base case. The base case incorporates market demand for more efficient products.

The NIA spreadsheet tool calculates the electricity savings in "site energy" expressed in kilowatt-hours (kWh). Site energy is the energy consumed directly on location by an individual product. DOE reports national energy savings on an annual basis in terms of the aggregated source energy savings, which is the savings in energy used to generate and transmit the energy consumed at the site. To convert site energy to source energy, DOE derived conversion factors, which change with time, from the AEO 2010. (See SNOPR TSD chapter 10 for further details.)

2. Significance of Savings

EPCA, as amended, prohibits DOE from adopting a standard for a product if that standard would not result in "significant" energy savings. (42 U.S.C. 6295(o)(3)(B)) Although EPCA does not define the term "significant," the U.S. Court of Appeals for the District of Columbia Circuit, in Natural Resources Defense Council v. Herrington, 768 F.2d 1355, 1373 (D.C. Cir. 1985), indicated that Congress intended "significant" energy savings in this context to be savings that were not "genuinely trivial." The energy savings for energy conservation standards at the TSL considered in this rulemaking are nontrivial, and, therefore, DOE considers them "significant" within the meaning of 42 U.S.C. 6295(o)(3)(B).

D. Economic Justification

1. Specific Criteria

As noted earlier, EPCA provides seven factors to be evaluated in determining whether an energy conservation standard is economically justified. (42 U.S.C. 6295(o)(2)(B)) The following sections describe how DOE has addressed each of those seven factors in this rulemaking.

a. Economic Impacts on Manufacturers and Consumers

In determining the impacts of an amended standard on manufacturers, DOE first determines the quantitative impacts using an annual cash-flow approach. This step includes both a short-term assessment—based on the cost and capital requirements during the period between the issuance of a regulation and when entities must comply with the regulation—and a long-term assessment over a 30-year analysis period. The industry-wide impacts analyzed include INPV (which values the industry on the basis of expected future cash flows), cash flows by year, changes in revenue and income, and other measures of impact, as appropriate. Second, DOE analyzes and reports the impacts on different types of manufacturers, paying particular attention to 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 different DOE regulations and other regulatory requirements on manufacturers. For more details on the MIA, see section IV.G and chapter 12 of the SNOPR TSD.

For consumers, measures of economic impact include the changes in life-cycle cost (LCC) and payback period for the product at each TSL. Under EPCA, the LCC is one of seven factors to be considered in determining economic justification. (42 U.S.C. 6295(o)(2)(B)(i)(II)) It is discussed in detail in the following section.

b. Life-Cycle Cost

The LCC is the sum of the purchase price of product (including any installation) and the operating expense (including energy and maintenance expenditures), discounted over the lifetime of the product.

In this rulemaking, DOE calculated both LCC and LCC savings for various power consumption levels in standby and off modes. DOE established the variability and uncertainty in energy use by defining the uncertainty and variability in the standby and off modes (hours per day) of the product. The variability in energy prices was characterized by use of regional energy prices. To account for uncertainty and variability in other inputs, such as product lifetime and discount rate, DOE used a distribution of values with probabilities attached to each value. For each consumer with a microwave oven, DOE sampled the values of those inputs from the probability distributions.

DOE's analysis produced a range of LCCs. In addition to providing the average LCC savings or average payback for a standard, this approach enables DOE to identify the percentage of consumers achieving LCC savings or attaining certain payback values due to an energy conservation standard. DOE presents the LCC savings as a distribution, with a mean value and a range. In the analysis prepared for the October 2008 NOPR, DOE assumed that consumers will purchase the product in 2012. For today's SNOPR, that assumption has been changed to 2014, as this is the expected first year of compliance. See section IV.D for more details on the LCC and PBP analysis.

c. Energy Savings

Significant conservation of energy is a separate statutory requirement for imposing an energy conservation standard. Additionally, EPCA requires DOE, in determining the economic justification of a proposed standard, to consider the total energy savings that are projected to result directly from a standard. (42 U.S.C. 6295(o)(2)(B)(i)(III)) As noted in the October 2008 NOPR, DOE used the NIA spreadsheet to estimate total energy savings attributable to the considered standard levels. 73 FR 62034, 62046 (Oct. 17, 2008). See section IV.E and chapter 10 of the SNOPR TSD for more details on this analysis.

d. Lessening of Utility or Performance of Product

In preparing the NOPR, DOE considered whether the evaluated design options likely would lessen the utility or performance of the standby mode and off mode of microwave ovens. (42 U.S.C. 6295(o)(2)(B)(i)(IV)) In the October 2008 NOPR, DOE determined that none of the considered TSLs would reduce the utility or performance of microwave ovens; all consumer utility features that affect standby power, such as a clock display and a cooking sensor, would be retained. 73 FR 62034, 62047 (Oct. 17, 2008).

e. Impact of Any Lessening of Competition

EPCA directs DOE to consider any lessening of competition likely to result from standards. It directs the Attorney General of the United States (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)(i)(V) and (B)(ii)). DOE received the Attorney General's determination, dated December 16, 2008, on standards proposed in the October 2008 NOPR. The Attorney General's determination for October 2008 NOPR did not mention microwave oven standards. (DOJ, No. 53 at pp. 1–2). DOE has transmitted a copy of today's proposed rule to the Attorney General and has requested that the Department of Justice provide its determination on this issue.

f. Need of the Nation to Conserve Energy

The non-monetary benefits of proposed standards are likely to be reflected in improvements to the reliability of the Nation's energy system—namely, reductions in the demand for energy will result in reduced costs for maintaining reliability of the Nation's electricity system. DOE conducts a utility impact analysis to estimate how standards may impact the Nation's needed power generation capacity. This analysis captures the effects of efficiency improvements on electricity consumption by the product that is the subject of this rulemaking.

Proposed standards also likely result in improvements to the environment. In quantifying those improvements, DOE has calculated emission reductions based on the estimated level of power generation displaced by each TSL for microwave oven standby power. DOE reports the environmental effects from the proposed standards in an environmental assessment in chapter 15 of the SNOPR TSD. (42. U.S.C. 6295(o)(2)(B)(i)(VI) and 6316(a)) See section IV.J for more details on this analysis.

g. Other Factors

The Secretary, in determining whether a standard is economically justified, may consider other factors that the Secretary deems to be relevant. (42 U.S.C. 6295(o)(2)(B)(i)(VII)) In considering amended standards for today's supplemental notice of proposed rulemaking, the Secretary found no relevant factors other than those identified elsewhere in today's SNOPR.

2. Rebuttable Presumption

As set forth under 42 U.S.C. 6295(o)(2)(B)(iii), there is a rebuttable presumption that an energy conservation standard is economically justified if the increased installed 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. DOE's LCC and PBP analyses generate values that calculate the payback period for consumers of products that meet potential energy conservation standards. Included is the 3-year payback period contemplated under the rebuttable presumption test. DOE routinely conducts a full economic analysis that considers the full range of impacts, however, including those to the consumer, manufacturer, Nation, and environment, as required under 42 U.S.C. 6295(o)(2)(B)(i). The results of this analysis serve as the basis for DOE to definitively evaluate the economic justification for a potential standard level (thereby supporting or rebutting the results of any preliminary determination of economic justification). Section V.B.1.c of today's supplemental notice and chapter 8 of the SNOPR TSD address the calculation of rebuttable-presumption payback.

IV. **Methodology and Revisions to the Analyses Employed in the October 2008 Proposed Rule**

In weighing the benefits and burdens of amended standards for microwave oven standby mode and off mode energy use, DOE used economic models to estimate the impacts of each TSL. The life-cycle cost (LCC) spreadsheet calculates the LCC impacts and payback periods for potential amended energy conservation standards. DOE used the engineering spreadsheet to develop the relationship between cost and efficiency and to calculate the simple payback period for purposes of addressing the rebuttable presumption that a standard with a payback period of less than 3 years is economically justified. The NIA spreadsheet provides shipments forecasts and then calculates NES and NPV impacts of potential amended energy conservation standards. DOE also assessed manufacturer impacts, largely through use of the Government Regulatory Impact Model (GRIM).

Additionally, DOE estimated the impacts of potential amended energy conservation standards on utilities and the environment. DOE used a version of the EIA's National Energy Modeling System (NEMS) for the utility and environmental analyses. The EIA has developed the NEMS model, which simulates the energy economy of the United States, over several years primarily for the purpose of preparing the AEO. The NEMS produces forecasts for the United States energy situation that are available in the public domain. The version of NEMS used for appliance standards analysis is called

NEMS-BT.[15] The NEMS-BT offers a sophisticated picture of the effect of standards, because it accounts for the interactions among the various energy supply and demand sectors and the economy as a whole.

A. Product Classes

In general, when evaluating and establishing energy conservation standards, DOE divides covered products into classes by the type of energy used, capacity, or other performance-related features that affect consumer utility and efficiency. (42 U.S.C. 6295(q); 6316(a)) Different energy conservation standards may apply to different product classes. Id.

At the time of the October 2008 NOPR, DOE's regulations codified at 10 CFR 430.2 defined a microwave oven as a class of kitchen ranges and ovens which is a household cooking appliance consisting of a compartment designed to cook or heat food by means of microwave energy. In the October 2008 NOPR, DOE proposed a single product class for microwave ovens that would encompass microwave ovens with and without browning (thermal) elements, but would not include microwave ovens that incorporate convection systems. 73 FR 62034, 62048 (Oct. 17, 2008).

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[15] The EIA approves the use of the name NEMS to describe only an AEO version of the model without any modification to code or data. Because the present analysis entails some minor code modifications and runs the model under various policy scenarios that deviate from AEO assumptions, the model used here has been named NEMS-BT. ("BT" stands for DOE's Building Technologies Program.) For more information on NEMS, refer to The National Energy Modeling System: An Overview, DOE/EIA–0581 (98) (Feb. 1998) (available at: http://tonto.eia.doe.gov/FTPROOT/forecasting/058198.pdf). (Last accessed March 18, 2011.)

Whirlpool commented that DOE's proposed definition of covered products creates a new product definition without proper engagement of interested parties by covering microwave ovens with or without thermal elements designed for surface browning of food. Whirlpool also commented that DOE stated combination microwave ovens, which were previously undefined, are not products covered by the microwave oven test procedure or standard. Whirlpool stated that DOE's proposed definition of covered products is inconsistent with the regulatory definition of a microwave oven provided in 10 CFR part 430 because there is no mention of thermal elements designed for browning food, and furthermore is not clear and should be clarified. (Whirlpool, No. 50 at pp. 1–2; Whirlpool, Public Meeting Transcript, No. 40.5 at p. 29) GE also commented that DOE should clarify what products are considered covered products. GE stated that DOE should review data for different product types, and exclude those for which there is insufficient data to support DOE's analysis. (GE, No. 48 at pp. 2–3)

As part of its microwave oven test procedure rulemaking, DOE reassessed what products would be considered microwave ovens under the regulatory definition, and whether multiple product classes would be appropriate. As discussed in the March 2011 TP Interim Final Rule, DOE amended the definition of microwave oven in 10 CFR 430.2 to clarify that it includes microwave ovens with or without thermal elements designed for surface browning of food and combination ovens. DOE also discussed its determination that all ovens equipped with microwave capability would be considered a covered product, regardless of which cooking mode (i.e., radiant heating or microwave energy) is primary. Based on its preliminary analysis, DOE concluded that the general standby mode and off mode operation for microwave ovens that incorporate other means of cooking food does not differ from that of microwave-only units. As a result, DOE amended the microwave oven test procedure to require that the same standby mode and off mode testing methods be used for all microwave ovens. 76 FR 12825, 12828–30 (Mar. 9, 2011).

In order to determine whether specific types of microwave ovens should be separated into different product classes, DOE investigated whether there are any performance related features that would justify the establishment of a separate energy conservation standard. As discussed in the October 2008 NOPR, DOE tested a sample of 32 countertop microwave-only units and measured standby mode power ranging from 1.2 W to 5.8 W. 73 FR 62034, 62042 (Oct. 17, 2008). None of these units was capable of operation in off mode, nor, as noted previously, is DOE aware of any other current microwave ovens capable of such operation. As discussed below in section IV.B, DOE noted that standby power consumption for microwave-only units largely depended on the presence of a cooking sensor, the display technology, the power supply and control board, and implementation of a power-down feature. With regards to display technologies, DOE noted that microwave-only units incorporated Light Emitting Diode (LED) displays, Liquid Crystal Displays (LCDs), and Vacuum Fluorescent Displays (VFDs).

Based on comments received in response to the October 2008 NOPR (Association of Home Appliance Manufacturers (AHAM), No. 47 at p. 6; Whirlpool, No. 50 at p. 1), DOE conducted a survey of over-the-range microwave-only units available on the U.S. market. DOE determined that the display technologies used are similar to those used in countertop microwave-only units (i.e., LED displays, LCDs, and VFDs). DOE also conducted in-store standby mode testing on a limited sample of over-the-range microwave-only units which showed similar standby power consumption as countertop microwave-only units. For these reasons, DOE tentatively concludes that over-the-range microwave-only units would not warrant a separate product class. DOE understands that over-the-range microwave-only units may have additional components that are energized during active mode operation (i.e., exhaust fan motors). However, DOE's testing showed that the presence of such features did not increase the standby power consumption to warrant establishing a separate product class.

DOE also conducted standby power testing on a sample of 13 representative combination microwave ovens, including 5 countertop combination microwave ovens, 6 over-the-range combination microwave ovens, and 2 built-in combination microwave ovens. DOE's testing showed that the countertop combination microwave ovens use similar display technologies as countertop microwave-only units (i.e., LED displays, LCDs, and VFDs), and had standby power consumption ranging from 1.2 W to 4.7 W, which is similar to the standby power consumption for countertop microwave-only units. As a result, DOE tentatively concludes that countertop combination microwave ovens would not warrant a product class separate from microwave-only ovens.

DOE's testing of built-in and over-the-range combination microwave ovens showed that the standby power consumption for these products ranged from 4.1 W to 8.8 W, which is higher than the standby power consumption for other microwave oven product types (i.e., countertop microwave-only, over-the-range microwave-only, and countertop combination microwave ovens). DOE's reverse-engineering analysis suggests that the additional features in built-in and over-the-range combination microwave ovens required to handle the thermal loads associated with their installation and to provide consumer utility, such as additional exhaust fan motors, convection fan motors and heaters, and additional lights, require a significant number of additional relays on the control board, and thus require a larger power supply for the control of such relays. While the relays themselves do not consume power in standby mode, they increase the total power supply requirements of the control board and thus increase the standby losses of the power supply. As a result, DOE believes that a separate product class should be established for built-in and over-the-range combination microwave ovens. DOE recognizes that built-in and over-the-range microwave-only units may similarly require some additional relays for exhaust fans and lights, and that countertop combination microwave ovens would require some additional relays for convection fans and heaters. However, DOE's product testing and reverse-engineering analyses indicated that these product types use similar-sized power supplies as those found in countertop microwave-only units, and as a result would not warrant a separate product class from countertop microwave-only units. Details of standby power testing for the determination of product classes is presented in chapter 5 of the SNOPR TSD.

In summary, DOE proposes to establish the following two product classes for microwave ovens:

Table IV.1 Microwave Oven Product Classes

Product Class
1. Microwave-Only Ovens and Countertop Combination Microwave Ovens
2. Built-in and Over-the-Range Combination Microwave Ovens

DOE determined that separate product classes for the purposes of setting energy conservation standards addressing standby mode and off mode energy use are warranted on the basis of different standby power performance. DOE did not evaluate whether the same product class distinction would also be appropriate for any active mode energy use standards because DOE eliminated the regulatory provisions establishing the cooking efficiency test procedure for microwave ovens in the July 2010 TP Final Rule. 75 FR 42579 (July 22, 2010). If DOE adopts amendments to the microwave oven test procedure to include provisions for measuring active mode cooking efficiency, DOE may reevaluate these product classes as part of a future microwave oven energy conservation standards rulemaking. At that time, DOE may consider dividing countertop combination microwave ovens and over-the-range/built-in microwave-only units into separate product classes to account for the energy performance of heating components other than the microwave portion.

B. Technology Assessment

Product teardowns performed by DOE for this and past rulemakings gave DOE an insight into the strategies a manufacturer could adopt to achieve higher energy conservation standards. In the October 2008 NOPR, DOE asked stakeholders to provide data and information that would help DOE evaluate the utility provided by specific features that contribute to microwave oven standby power. In addition, DOE conducted additional research on several microwave oven technologies that significantly affect standby power, including cooking sensors, display technologies, and control strategies and associated control boards. In the October 2008 NOPR, DOE determined that control strategies are available that enable manufacturers to make design tradeoffs between incorporating features that consumer standby power (such as displays or cooking sensors) and including a function to turn power off to those components during standby mode. 73 FR 62034, 62052 (Oct. 17, 2008).

As discussed above, DOE believes that the standby power characteristics for countertop combination microwave ovens and over-the-range microwave-only units are similar to that of counter-top microwave-only units, and therefore, the same technology options would apply to these products. Additional testing on over-the range combination microwave ovens conducted by DOE also showed that standby power in these products depends largely on the same factors. The following sections discuss each of these technology options.

1. Cooking Sensors

In the October 2008 NOPR, DOE reported that its teardown analysis had revealed one cooking sensor technology with no standby power consumption used in microwave ovens on the U.S. market: a piezoelectric steam sensor. DOE also found that infrared and weight sensors, which require little to no warm-up time or standby power, had been applied successfully in Japanese-market microwave ovens. Furthermore, DOE identified relative humidity sensors with no standby power consumption as a feasible microwave oven cooking sensor technology, but found no microwave ovens using these sensors at the time. Finally, DOE learned that a major microwave oven supplier to the U.S. market was preparing to introduce microwave ovens using a new type of absolute humidity sensor with no standby power requirement and no cost premium over that of a conventional absolute humidity sensor. 73 FR 62034, 62051 (Oct. 17, 2008). DOE requested input and data on the utility provided by specific microwave oven features, including in relevant part cooking sensors that do not require standby power. Id. at 62133.

AHAM agreed with DOE that some manufacturers in certain areas of the world have already started to incorporate some of the cooking sensor design options into microwave ovens. (AHAM, Public Meeting Transcript, No. 40.5 at pp. 78–79) AHAM expressed two concerns about these sensors: that reliability and accuracy of the sensors have not been fully proved through testing, and that there is limited availability of those sensors to microwave oven manufacturers due to intellectual property protections. (AHAM, Public Meeting Transcript, No. 40.5 at pp. 69–70) AHAM further requested that DOE provide data on the availability, reliability, and functionality of the cooking sensors that consume no standby power. AHAM stated that data collection for such sensors provides an additional rationale for postponing the rulemaking or not adopting a standby power standard for microwave ovens. (AHAM, No. 47 at p. 5)

Whirlpool agreed with DOE that cooking sensors with no standby power consumption are becoming available, though experience with them is limited. According to Whirlpool, there is a lack of necessary data regarding reliability, accuracy and intellectual property status. (Whirlpool, No. 50 at p. 7)

GE similarly commented that cooking sensors with no standby power consumption, while in limited use at that time, had not been fully tested and evaluated as appropriate alternatives. GE also requested that DOE provide data on the availability, reliability, and functionality of the sensors discussed in the October 2008 NOPR, relative to sensors currently in use. (GE, No. 48 at p. 3) GE also commented that absolute humidity sensors with standby power consumption offer greater resolution than relative humidity sensors with no standby power consumption and therefore offer consumer utility. (GE, Public Meeting Transcript, No. 40.5 at pp. 74–75) Furthermore, GE suggested that some of the sensor technologies described in the October 2008 NOPR, such as infrared and weight sensors, are not feasible alternatives to the absolute humidity sensors used today. For instance, infrared sensors are easily fouled by contaminants and condensation. GE commented that DOE should provide further information about absolute humidity sensors with no standby power consumption and no cost premium over that of a conventional absolute humidity sensor. GE stated that it needed to review performance parameters and any associated intellectual property issues associated with these sensors. (GE, No. 48, pp. 3–4)

DOE requested comment on whether any intellectual property or patent infringement issues are associated with the cooking sensor technologies discussed above; however, DOE did not receive any such data. In addition, DOE is not currently aware of any intellectual property or patent infringement issues for infrared sensors, weight sensors, piezoelectric sensors, or relative humidity sensors. With respect to the accuracy and reliability of low- and zero-standby power cooking sensors, DOE notes that a significant number of microwave oven models using the alternate cooking sensor technologies discussed above are available on the international market, and have been available for a number of years. As discussed above, DOE is also aware of one zero-standby power cooking sensor technology used in microwave ovens on the U.S. market. DOE is not aware of any data indicating that the reliability and accuracy associated with these low- and zero-standby power cooking sensors significantly differs from that of the absolute humidity sensors currently employed in microwave ovens on the U.S. market. DOE is also unaware of data showing that fouling of infrared cooking sensors, as commented by GE, would significantly differ from that of absolute humidity sensors, or data on the decreased accuracy due to fouling as compared to the fouling of absolute humidity sensors. DOE recognizes GE's concern regarding the use of relative humidity sensors in microwave ovens. Because DOE is not aware of any relative humidity cooking sensors used in microwave ovens currently on the market, DOE is not aware of any data regarding the accuracy of these sensors for detecting the state of the cooking load to adjust the cooking time. However, DOE notes that multiple other cooking sensor technology options exist that have been employed in microwave ovens in place of an absolute humidity cooking sensor. For these reasons, DOE tentatively concludes that the low- and zero-standby-power cooking sensor technologies discussed above are viable design options, and has analyzed them for this SNOPR. DOE requests data and information on the accuracy and reliability of low- and zero-standby power cooking sensors as compared to absolute humidity cooking sensors currently used in microwave ovens on the U.S. market, and whether these technologies would affect how consumers use their microwave ovens or their satisfaction in using them due to any lessening of the utility or the performance of microwaves imposed by the standard. DOE also seeks information on the current commercial availability of this technology, the likelihood of future adoption, and the potential impact on the lessening of competition amongst manufacturers. DOE also continues to request comment on whether any intellectual property or patent infringement issues are associated with the cooking sensor technologies discussed above.

With respect to GE's comment that DOE should provide further information on absolute humidity sensors with no standby power consumption and no cost premium over that of a conventional absolute humidity sensor, because DOE was made aware of this information during interviews with microwave oven manufacturers, DOE is unable to provide further information regarding this absolute humidity cooking sensor.

Edison Electric Institute (EEI) stated that due to the reduction in cooking time and thus energy consumption made possible by use of a cooking sensor, it is important to retain this feature in microwave ovens. (EEI, Public Meeting Transcript, No 40.5 at pp.71–72) Also, EEI expressed concern about the recovery time of a cooking sensor after a full microwave oven power-down and the impacts on consumer utility of a slow recovery time (EEI, Public Meeting Transcript, No. 40.5 at pp. 77–78) As discussed in the October 2008 NOPR, low- and zero-standby-power cooking sensor technologies require little to no warm-up time. 73 FR 62034, 62050–51 (Oct. 17, 2008). As a result, DOE believes that low- and zero-standby-power cooking sensor technologies can be used in microwave ovens without impacting consumer utility.

2. Display Technologies

DOE stated in the October 2008 NOPR that it would consider three display technologies for reducing microwave oven standby power consumption: LED displays, LCDs with and without backlighting, and VFDs. DOE stated that LED displays and LCDs consume less power than VFDs. DOE also stated that each identified display technology provides acceptable consumer utility, including brightness, viewing angle, and ability to display complex characters. 73 FR 62034, 62051 (Oct. 17, 2008). DOE requested input and data on the utility provided by specific microwave oven features, including, in relevant part, display technologies. Id. at 62133.

EEI commented that consumer utility is associated with an electronic display and timer rather than a mechanical timer. (EEI, Public Meeting Transcript, No. 40.5 at pp. 63–64). As discussed in the October 2008 NOPR, DOE was not aware of any microwave ovens currently available on the U.S. market using electromechanical controls (73 FR 62034, 62051 (Oct. 17, 2008)), and thus has considered only electronic controls (including displays) in determining standby power levels. In addition, DOE is not considering electromechanical controls as a design option to reduce standby power consumption.

AHAM, GE, and Whirlpool suggested that not all microwave oven display technologies considered by DOE will maintain consumer utility in all applications. Whirlpool stated that limiting the information displayed and/or reducing the size of the clock reduces standby power consumption at the expense of consumer utility. AHAM and Whirlpool expressed concerns about the reliability of LED displays, particularly in over-the-range microwave oven applications. According to AHAM, GE, and Whirlpool, for over-the-range microwave oven applications, VFDs are generally preferred over other display technologies such as backlit LCDs or LED displays, as VFDs: (1) have greater reliability when exposed to the higher heat encountered above a cooking surface; (2) allow a wider viewing angle and have greater visibility; and (3) are available in more sizes and colors as demanded by the consumers of higher-end products, also allowing a manufacturer to provide a "family look" to product suites. (AHAM, No. 47 at p. 5; AHAM, Public Meeting Transcript, No. 40.5 at pp. 70–71; GE, No. 48 at p. 3; GE, Public Meeting Transcript, No 40.5, p. 75; Whirlpool, No. 50 at pp. 6–7).

As discussed above, DOE's research suggests that multiple over-the-range microwave ovens with low power displays, including the LED and LCD types, are currently available on the U.S. market. DOE has also found that manufacturer temperature ratings for the three types of displays are comparable. Furthermore, DOE has found that LED displays and LCDs in both countertop and over-the-range microwave ovens offer acceptable consumer utility features, including brightness, viewing angle, and ability to display complex characters. DOE found no microwave oven display technologies with intermittent backlighting or other features that impair consumer utility. As a result, DOE believes that LED displays and LCDs can be integrated into any countertop or over-the-range microwave oven, with proper heat shielding and without significant loss of consumer utility.

3. Power Supply and Control Boards

In the October 2008 NOPR, DOE found several technologies available to increase power supply and control board efficiency that would reduce microwave oven standby power consumption. DOE found some microwave ovens on the U.S. market using switching power supplies with up to 75-percent conversion efficiencies and 0.2 W or less no-load standby losses, though these models came with a higher cost, higher part count, and greater complexity. DOE stated that switching power supplies are as yet unproven in long-term microwave oven applications, and the greater complexity of these power supplies may also lower overall reliability. DOE was also aware of high efficiency power supply and control board components that could be used to reduce standby power consumption, but these were not found on commercially available microwave ovens at the time. 73 FR 62034, 62051 (Oct. 17, 2008). DOE requested comments on the ability of switching or similar modern power supplies to operate successfully inside a microwave oven and on the impacts of the efficiency of such power supplies on microwave oven standby power. Id. at 62133.

AHAM commented that switching power supplies can operate successfully in microwave ovens, but that associated reliability is still relatively unknown. (AHAM, No. 47 at p. 6) Whirlpool cited limited data suggesting that the costs and potential reliability issues associated with switching power supplies do not support their economic viability. (Whirlpool, No. 50 at p. 8) Nevertheless, Whirlpool stated that it sells products with switching power supplies outside of the U.S. (Whirlpool, Public Meeting Transcript, No. 40.5 at pp. 81–82) DOE observes that switching power supplies are found in products such as computers, battery chargers, clothes washers, and clothes dryers, suggesting that the reliability and durability of switching power supplies has been proven in residential appliance applications. DOE notes that microwave ovens incorporating switching power supplies have been available for multiple years and are still used, as evidenced by such power supplies being observed in DOE's most recent test sample of combination microwave ovens. DOE is also unaware of data indicating that the reliability of switching power supplies is significantly worse than conventional linear power supplies over the lifetime of the product.

Whirlpool suggested that switching power supplies are modestly more efficient than conventional power supplies. (Whirlpool, No. 50 at p. 8) Pacific Gas and Electric (PG&E) commented that switching power supplies can have efficiency exceeding 90 percent and those in computers are routinely exceeding 95 percent. (PG&E, Public Meeting Transcript, No. 40.5 at p. 81) DOE believes that the application of power supplies is very different for computers and microwave ovens, and DOE research indicates that switching power supplies for appliance applications in sizes similar to those utilized in microwave ovens achieve no greater than 75-percent efficiency.[16] Furthermore, DOE notes that the most efficient power supplies available for consumer computer use typically do not exceed 92-percent efficiency.[17]

AHAM expressed concern that electromechanical controls may be necessary in order to meet standby power requirements. (AHAM, Public Meeting Transcript, No. 40.5 at p. 58) As discussed above, DOE is not aware of any microwave ovens currently on the market with electromechanical controls. As a result, DOE has considered only microwave ovens with electronic controls in determining standby power levels. DOE does not believe that electromechanical controls would be required to achieve any of the standby power levels presented in section IV.D.

4. Power-Down Options

In the October 2008 NOPR, DOE determined that control strategies are available that allowed microwave oven manufacturers to make design tradeoffs between incorporating power-consuming features such as displays or cooking sensors and including a function to cut power to those components during standby. DOE found that a large number of microwave ovens incorporating this automatic power-down feature were available in other markets such as Japan. 73 FR 62034, 62051–52 (Oct. 17, 2008). DOE requested input and data on these control strategies as well as comments on the viability

[16] Information on the design and efficiency of switch mode power supplies can be found at http://www.powerint.com/en/applications/major-appliances.

[17] Information can be found at http://www.plugloadsolutions.com/80PlusPowerSupplies.aspx

and cost of microwave oven control board circuitry that could accommodate transistors to switch off cooking sensors and displays. Id. at 62133.

AHAM commented that the industry lacks data on control board circuitry to allow for a function to cut off power during standby mode. According to AHAM, such features must be reliable in high-temperature environments. AHAM noted that DOE has allowed no time for manufacturers to evaluate the viability or feasibility of the proposed technologies. (AHAM, No. 47 at pp. 3, 6) DOE research has not identified any technical barrier that would prevent microwave oven manufacturers from successfully integrating such control board circuitry with proper heat shielding and other design elements. DOE is also aware of similar automatic power-down control technologies incorporated in products such as clothes washers and clothes dryers, which utilize an additional transformerless power supply to provide just enough power to maintain the microcontroller chip while the unit is powered down, resulting in very low standby power levels. Therefore, DOE continues to believe that an automatic power-down feature is technically feasible in microwave applications.

AHAM commented that it is concerned with a reduction in consumer utility and how the consumer interfaces with the unit. AHAM added that evaluating the impacts on consumer utility will require substantial consumer research. (AHAM, No. 47 at p. 6) AHAM suggested that an indicator light may be desirable in a microwave oven with the automatic power-down feature to communicate the product’s status to the user. (AHAM, Public Meeting Transcript, No. 40.5 at p. 59) Whirlpool stated that an automatic power-down feature in microwave ovens may cause consumer confusion and complaints and could require significant consumer education efforts. (Whirlpool, Public Meeting Transcript, No. 40.5 at pp. 65–66) Whirlpool commented that control technologies are available to dim or turn off a display after a period of inactivity has elapsed but that Whirlpool does not currently incorporate such a technology into its products. (Whirlpool, No. 50 at p. 7) Whirlpool and ASAP both commented that there could be a variety of ways to implement a power-down feature, including consumer-activated or fuzzy logic-based power response. (ASAP, Public Meeting Transcript, No. 40.5 at p. 79; Whirlpool, Public Meeting Transcript, No. 40.5 at p. 80) DOE has considered consumer utility issues in the determination of the proposed standby mode and off mode energy conservation standards. (See section V.C of today's supplemental notice and chapter 5 of the SNOPR TSD for additional discussion of this topic.) DOE welcomes further comments regarding consumer utility issues associated with each of the technology options, and in particular the low- and zero-standby power cooking sensors and display technologies, considered in this analysis.

The comment filed jointly (hereafter, the Joint Comment) by ASAP, American Council for an Energy-Efficient Economy, American Rivers, Natural Resources Defense Council, Northeast Energy Efficiency Partnerships, Northwest Power and Conservation Council, Southern California Gas Company, San Diego Gas and Electric Company, Southern California Edison, and Earthjustice (EJ), stated that DOE should analyze user-activated controls to turn the display on and off, in addition to automatic power-down features. According to these commenters, a microwave oven equipped with such controls would meet the EPCA definition of operating in standby or off mode, and would give consumers the ability to reduce energy use below the proposed standby power standard level. The Joint Comment asserted that this type of switch is similar to power switches found on many computers, copiers, printers, televisions, and other products sold outside of the U.S. (Joint Comment, No. 44 at p. 10)

ASAP requested clarification whether an on/off switch, particularly a consumer-activated one, would be considered as a design option. (ASAP, Public Meeting Transcript, No. 40.5 at pp. 66, 73–74) GE questioned whether a microwave oven would be in standby mode or off mode if the display is turned off. (GE, Public Meeting Transcript, No. 40.5 at p. 73)

Under the mode definitions adopted by the amended microwave oven test procedure (76 FR 12825, 12834–37 (Mar. 9, 2011)), a product for which an on/off switch has turned off the display would be considered to be in off mode, unless other energy consuming features associated with standby mode remain energized (i.e., features to facilitate the activation of other modes by remote switch, internal sensor, or timer; or continuous functions, including other information or status displays or sensor-based features). In the latter case, the microwave oven would remain in standby mode even with the display turned off.

DOE is not aware of any products incorporating a user-activated control to turn the display on or off. Further, DOE does not have information to evaluate how often consumers might make use of this feature. Therefore, at this time DOE is unable to analyze such a control as a design option. DOE agrees that such a feature, if provided, could result in decreased energy usage in standby mode or off mode, and remains open to consideration of such a design option in future rulemakings. DOE also notes that manufacturers would not be precluded from incorporating such a feature in their products under the proposed standards.

C. Engineering Analysis

The purpose of the engineering analysis is to characterize the relationship between the energy use and the cost of standby mode features of microwave ovens. DOE used this standby power/cost relationship as input to the payback period, LCC, and NIA analyses. The engineering analysis provides data that can be used to establish the manufacturer selling price of more efficient products. Those data include manufacturing costs and manufacturer markups.

DOE has identified three basic methods for generating manufacturing costs: (1) the design-option approach, which provides the incremental costs of adding to a baseline model design options that will improve its efficiency (i.e., lower its energy use in standby mode and off mode); (2) the efficiency-level approach, which provides the incremental costs of moving to higher energy efficiency levels (in this case, levels of reduced standby power), without regard to the particular design option(s) used to achieve such increases; and (3) the cost-assessment (or reverse engineering) approach, which provides "bottom-up" manufacturing cost assessments for achieving various levels of increased efficiency, based on detailed data on costs for parts and material, labor, shipping/packaging, and investment for models that operate at particular efficiency levels. DOE conducted the engineering analysis for this rulemaking using the efficiency-level approach. For this analysis, DOE relied on laboratory testing of representative microwave ovens. DOE supplemented the standby power data with data gained through reverse-engineering analysis and primary and secondary research, as appropriate. To identify microwave oven design options, DOE performed a reverse engineering analysis on a representative sample of microwave ovens. Details of the engineering analysis are in chapter 5 of the SNOPR TSD.

1. Energy Use Metric

In the October 2008 NOPR, DOE explored whether it would be technically feasible to combine the existing measure of energy efficiency during the cooking cycle per use with standby mode and off mode energy use over time to form a single metric, as required by EISA 2007. (42 U.S.C. 6295(gg)(2)(A)) DOE tentatively concluded that, although it may be mathematically possible to combine energy consumption into a single metric encompassing active, standby, and off modes, it is not technically feasible to do so due to the high variability in the cooking efficiency measurement based on the microwave oven test procedure at that time and because of the significant contribution of standby power to overall microwave oven energy use. Therefore, DOE proposed a separate metric to measure standby power as provided by EISA 2007. 73 FR 62034, 62042–43 (Oct. 17, 2008).

ASAP, EEI, the Joint Comment, and Whirlpool agree with DOE's determination that it is not technically feasible to integrate standby and off mode energy use into a single efficiency metric for microwave ovens. (ASAP, Public Meeting Transcript, No. 40.5 at pp. 53; EEI, Public Meeting Transcript, No. 40.5 at p. 55; Joint Comment, No. 44 at p. 10; Whirlpool, No. 50 at p. 4; Whirlpool, Public Meeting Transcript, No. 40.5 at p. 29) AHAM stated that an integrated energy descriptor, while technically feasible, is not practical. (AHAM, No. 47 at p. 4; AHAM, Public Meeting Transcript, No. 40.5 at pp. 27, 54–55) ASAP questioned whether there was any legal prohibition on a prescriptive standard for microwave oven standby power, especially since DOE was at that time proposing a prescriptive standard for standing pilots in gas cooking products. (ASAP, Public Meeting Transcript, No. 40.5 at pp. 64–65)

As noted previously, DOE eliminated the active mode cooking efficiency provisions in the July 2010 TP Final Rule after it determined that those provisions did not produce accurate and repeatable results. 75 FR 42579 (July 22, 2010). Therefore, the absence of active mode provisions results in a de facto separate energy use descriptor for microwave oven standby mode and off mode energy use.

2. Standby Power Levels

DOE is considering standby mode and off mode standards based on a maximum average standby power, in W, for microwave ovens. For the reasons noted previously, the standards do not include off mode power. For the October 2008 NOPR, DOE's analysis estimated the incremental manufacturing cost for microwave ovens having standby power consumption less than the baseline level of 4 W. For the purposes of that analysis, a baseline microwave oven was considered to incorporate an absolute humidity cooking sensor. To analyze the cost-energy use relationship for microwave oven standby power, DOE defined standby power levels expressed as a maximum average standby power in W. To analyze the impacts of standards, DOE defined the following four standby power levels for analysis: (1) the Federal Energy Management Program (FEMP) procurement efficiency recommendation; (2) the International Energy Agency's (IEA's) 1-Watt Plan; (3) a standby power level as a gap-fill between the FEMP Procurement Efficiency Recommendation and IEA 1-Watt Plan; and (4) the current maximum microwave oven standby technology (max-tech; i.e., lowest standby power) that DOE believes is or could be commercially available when the energy conservation standards become effective, based on a review of microwave ovens currently on the market worldwide. Table IV.2 provides the microwave oven standby power levels and the reference source for each level that DOE analyzed for the October 2008 NOPR. For more details on the determination of standby power levels, see chapter 5 of the SNOPR TSD.

Table IV.2 October 2008 NOPR Proposed Microwave Oven Standby Power Levels

Standby Power Level (TSL)	Source	Standby Power (W)
Baseline	Baseline	4.0
1	FEMP Procurement Efficiency Recommendation	2.0
2	Gap Fill	1.5
3	IEA 1-Watt Program	1.0
4	Max Tech	0.02

In the October 2008 NOPR, DOE requested comments and views of interested parties concerning the selection of microwave oven standby power levels for the engineering analysis. 73 FR 62034, 62133 (Oct. 17, 2008). As discussed in section V.A, due to the definition of only four standby power levels, a TSL was defined for each standby power level and thus standby power levels may also be referred to as TSLs.

AHAM commented that the microwave oven standby power TSLs are appropriate. In particular, AHAM asserted that much of the worldwide industry is moving towards the IEA 1-Watt Program, which corresponds to one of the TSLs. However, AHAM stated that DOE's engineering analysis based on these TSLs is incomplete and inaccurate. For example, none of the 32 units tested by DOE were over-the-range units, whereas six of the 21 units in the AHAM sample were over-the-range units. According to AHAM, it is important to include over-the-range microwave ovens in the analysis because most of these units likely include a VFD, which is the most reliable display type in high temperature conditions. (AHAM, No. 47 at p. 3; AHAM, Public Meeting Transcript, No. 40.5 at p. 83)

As previously discussed, DOE research found that multiple over-the-range microwave ovens are currently available on the market that incorporate low-power display technologies, including LEDs and LCDs. DOE has also found that manufacturer temperature ratings for the three types of displays are comparable, and that LED displays and LCDs in both countertop and over-the-range microwave ovens offer acceptable consumer utility features, including brightness, viewing angle, and ability to display complex characters. Due to these findings, DOE believes that the TSLs and the associated analyses are still valid.

Additionally, AHAM stated that each microwave oven standby power TSL should be set in a way that allows manufacturers a variety of pathways to reduce standby power consumption to that level. While some manufacturers are already starting to incorporate some of the standby power consumption-reducing design options identified by DOE, little or no data is available on some of the design trade-offs and reliability. (AHAM, Public Meeting Transcript, No. 40.5 at pp. 78–79) DOE believes that multiple pathways exist, based on the selection of the (1) display technology, (2) power supply/control boards, (3) cooking sensors, and (4) the possible incorporation of algorithms to automatically reduce standby power after a period of inactivity, as stated in the October 2008 NOPR.

Whirlpool commented that it is unaware of technologies that would allow microwave ovens equipped with VFDs to meet the 1-W standby power consumption limit of TSL 3 while keeping the display energized during standby mode. (Whirlpool, No. 50 at p. 7) GE stated that it has significant concerns about retaining all features associated with VFDs that impact consumer utility while reducing microwave oven standby power consumption to TSL 3. As a result, GE believes TSL 3 would reduce the utility or performance of microwave ovens. (GE, Public Meeting Transcript, No. 40.5 at p. 89) DOE has determined that microwave oven manufacturers can meet TSL 3 in microwave ovens with VFDs by incorporating an automatic power-down feature. In addition, DOE research suggests that LED displays and LCDs in both countertop and over-the-range microwave ovens offer acceptable consumer utility features, including brightness, viewing angle, and ability to display complex characters. Additional issues related to consumer utility are addressed in section V.C, which discusses the TSLs considered for proposed standby mode and off mode standards.

AHAM requested additional information about the functionality associated with the microwave oven max-tech level, including response time from power-down. (AHAM, Public Meeting Transcript, No. 40.5 at p. 84) EEI also requested information about the max-tech level, such as whether it has as many display features and includes all the features of the baseline model. (EEI, Public Meeting Transcript, No. 40.5 at p. 84)

As discussed in the October 2008 NOPR, the max-tech microwave oven standby power level of 0.02 W corresponds to a unit equipped with a default automatic power-down function that shuts off certain power-consuming components after a specified period of user inactivity. The standby power at max-tech was obtained from a microwave oven currently on the market in Korea which incorporates such a feature. 73 FR 62034, 62045 (Oct. 17, 2008). Although DOE does not have operational information on this specific model, DOE has analyzed the components necessary to achieve an automatic power-down function, and does not believe such a feature would limit the selection of display technologies or other features that provide consumer utility. DOE analysis suggests that response times for startup will be short enough (less than 1 second) to be acceptable to consumers.

For the reasons discussed above in section IV.A, DOE also analyzed a separate product class for over-the-range combination microwave ovens. DOE's analysis estimates the incremental manufacturing cost for built-in and over-the-range combination microwave ovens having standby power consumption less than the baseline value of 4.5 W. To determine that baseline level, DOE measured the standby power consumption of a representative sample of built-in and over-the-range combination microwave ovens currently on the market. For the purpose of this standby power analysis, a baseline built-in/over-the-range combination microwave oven is considered to incorporate an absolute humidity cooking sensor. In order to analyze the cost-energy use relationship for this product class, DOE defined each standby power level as a maximum average standby power in watts.

To determine the maximum average standby power at each level, DOE reverse-engineered a representative sample of built-in and over-the-range combination microwave ovens to analyze the various components that contribute to the standby power consumption of the unit. DOE also measured the standby power consumed by these components individually. In its analysis, DOE observed that the absolute humidity cooking sensor used in these combination microwave ovens on average consume 0.9 W of standby power. For Standby Power Level (SL) 1, DOE believes that standby power can be reduced by incorporating a zero-standby cooking sensor. For SL 2, DOE analyzed potential improvements to the power supply design. DOE noted that microwave ovens at the baseline standby energy use incorporate a linear power supply. DOE measured the standby power consumption of the power supply and found that the transformer used to step down the line input voltage contributes most significantly to the standby power consumption. DOE then performed a power budget analysis to determine the size of the transformer needed to operate a microwave at full load, and the results suggest that replacing the conventional linear power supply with a more efficient switch mode power supply will eliminate the need for a large transformer and effectively reduce the standby power associated with the power supply. DOE thus estimated the standby power for SL 2 based on the improvement associated with changing from a conventional linear power supply with an efficiency of 55 percent to a switch mode power supply with an efficiency of 75 percent. DOE developed this estimate for the efficiency of a switch mode power supply based on research of such power supply designs for appliance applications.[18] For SL 3, DOE analyzed the impact relays have in determining the size of a power supply. DOE compared the power budget of a control board with electromechanical relays to that with solid state relays, and observed that the power requirement of a control board, with similar input and load, is lower with solid state relays than with electromechanical relays. Therefore, DOE estimated the standby power at SL 3 based on design improvements associated with using more efficient components in a switch mode power supply that incorporates solid state relays. For SL 4, DOE analyzed an automatic function that turns off power to standby power consuming components after a certain period of inactivity and that uses a transformerless power supply to maintain the microcontroller chip while the microwave oven is not powered on. DOE estimated the standby power at SL 4 based on the standby power requirements of the controller microcontroller chip.

[18] Information on the design and efficiency of switch mode power supplies can be found at http://www.powerint.com/en/applications/major-appliances.

Table IV.3 provides the proposed standby power levels for the two product classes considered for today's SNOPR. Details of the engineering analysis are in chapter 5 of the SNOPR TSD.

Table IV.3 Proposed Microwave Oven Standby Power Levels

Standby Power Level	Standby Power (W)	
	Microwave-Only and Countertop Combination	Built-In and Over-the-Range Combination
Baseline	4.0	4.5
1	2.0	3.7
2	1.5	2.7
3	1.0	2.2
4	0.02	0.04

3. Manufacturing Costs

In this rulemaking DOE estimates a manufacturing cost for microwave ovens at each standby power level. The manufacturing costs are the basis of inputs for other analyses, including the LCC, national impact, and GRIM analyses.

For microwave oven standby mode and off mode energy use, DOE estimated a cost-energy use relationship (or "curve") in the form of the incremental manufacturing costs associated with incremental reductions in baseline standby power. In the October 2008 NOPR, DOE determined that microwave oven standby power depends on, among other factors, the display technology used, the associated power supplies and controllers, and the presence or lack of a cooking sensor. From testing and reverse engineering, DOE observed correlations between (1) specific components and technologies, or combinations thereof, and (2) measured standby power. DOE obtained preliminary incremental manufacturing costs associated with standby power levels by considering combinations of those components as well as other technology options identified to reduce standby power. In the October 2008 NOPR, DOE presented manufacturing cost estimates based on quotes obtained from suppliers, interviews with manufacturers, interviews with subject matter experts, research and literature review, and numerical modeling. 73 FR 62034, 62055 (Oct. 17, 2008). They are shown in Table IV.4.

Table IV.4 October 2008 NOPR Proposed Microwave Oven Standby Power Incremental Manufacturing Costs

Standby Power Level	Standby Power (W)	Incremental Cost (2007$)
Baseline	4.0	NA
1	2.0	$0.30
2	1.5	$0.67
3	1.0	$1.47
4	0.02	$5.13

Based on DOE's research, interviews with subject matter experts, and discussions with manufacturers, DOE believes that all consumer utility (display, cooking sensor, etc.) could be maintained by standby power consumption down to SL 3 (1.0 W). At the max-tech level, DOE would expect implementation of an automatic power-down feature that would, among other things, shut off the display after a period of inactivity, potentially impacting consumer utility.

DOE observed several different cooking sensor technologies. Follow-on testing after the December 2007 public meeting showed that some sensors are zero-standby (relative humidity) cooking sensors. During the MIA interview for the NOPR, one manufacturer indicated that its supplier of cooking sensors had developed zero-standby absolute humidity cooking sensors that would have the same manufacturing cost as the higher-standby power devices they would replace. Based on the number of available approaches to zero-standby cooking sensors from which manufacturers can choose, DOE believes that all manufacturers can and likely will implement zero-standby cooking sensors by the effective date of standby mode and off mode energy conservation standards, and maintain the consumer utility of a cooking sensor without affecting unit cost. DOE believes that a standard at standby power levels of 1 or 2 W would not affect consumer utility, because all display types could continue to be used. At SL 3 for VFDs and SL 4 for all display technologies, DOE analysis suggests the need for a separate controller (automatic power-down) that automatically turns off all other power-consuming components during standby mode. Such a feature would affect the consumer utility of having a clock display only if the consumer could not opt out of auto power-down.

DOE requested input and data from interested parties on the estimated incremental manufacturing costs, as well as the assumed approaches, to achieve each microwave oven standby power level. DOE also requested comment on whether any intellectual property or patent infringement issues are associated with the design options presented in the NOPR TSD to achieve each standby power level. 73 FR 62034, 62133 (Oct. 17, 2008).

AHAM questioned the source of the incremental cost data associated with each standby power level presented by DOE, since some microwave oven manufacturers cannot recall providing this information to DOE. AHAM commented on the need for incremental manufacturing costs to reflect both a one-time cost as well as the possibility of multiple paths to achieve each TSL. (AHAM, Public Meeting Transcript, No. 40.5 at p. 87) GE commented that the cost associated with upgrading power supplies to reach TSL 3 is a question. (GE, Public Meeting Transcript, No. 40.5 at pp. 75–76)

As described in chapter 5 of the TSD published with the October 2008 NOPR, DOE developed incremental cost estimates for each standby power level using the design-option approach. (One-time costs are evaluated as part of the MIA.) DOE estimated costs for each of the components and technologies based on quotes from component suppliers, interviews with manufacturers, interviews with subject matter experts, research and literature review, and numerical modeling. The incremental manufacturing costs for each standby power level were determined by considering different combinations of these components as well as other technology options identified to reduce standby power.

DOE is aware that manufacturers may employ a number of strategies to achieve the different standby power levels. The estimated manufacturing costs for each standby power level represent the approach DOE believes manufacturers would most likely use to achieve the standby power at each level. For each level, DOE assumed manufacturers would implement design options with the lowest associated manufacturing cost. If DOE determined there were multiple paths with similar costs to reach a certain level, it assumed manufacturers would be equally likely to choose either strategy.

Whirlpool commented that its market research suggests high costs associated with consumer education on proper operation of microwave ovens with automatic power-down features. Whirlpool clarified that the marketing costs it submitted for the ANOPR did not include these costs, estimated at $10 million, including retailer training, point-of-purchase material, product tags, telephone support, and possibly more. (Whirlpool, No. 50 at p. 7) AHAM also commented that DOE did not complete a rigorous analysis on manufacturing costs. According to AHAM, DOE obtained component costs, but did not account for the cost implications on appliance manufacturers. AHAM stated that this includes variables such as component reliability and/or utility, both of which will impact manufacturer cost. (AHAM, No. 47 at p. 6)

DOE considered any conversion costs associated with changes to consumer utility and reliability in the manufacturer impact analysis, discussed in section IV.G. However, as previously discussed, DOE found no reliability or consumer utility concerns with switching from VFD to LCD or LED displays. Through discussions with manufacturers and OEMs, DOE believes that zero-standby cooking sensors could be implemented with no effect on consumer utility or reliability. DOE is aware that an automatic power-down feature required at SL 3 for VFDs and at SL 4 for all display types could affect consumer utility, and considered these impacts in the selection of the proposed standards.

For the reasons described above, DOE believes the standby power levels and corresponding incremental manufacturing costs presented in the October 2008 NOPR remain fundamentally valid for the microwave-only and countertop combination microwave oven product class. DOE is unaware of any technologies that have become available since the publishing of the October 2008 NOPR that would alter the incremental cost for any standby power level. However, the costs presented in the October 2008 NOPR are in 2008 dollars. DOE scaled these costs to 2010 dollars using the producer price index (PPI) to reflect more current values.[19] The relevant PPI for microwave ovens is a subset of the household cooking appliance manufacturing industry, specifically for electric (including microwave) household ranges, ovens, surface cooking units, and equipment. Table IV.5 shows the revised incremental costs for each standby power level for Product Class 1, scaled to 2010 dollars.

Table IV.5 Microwave Oven Product Class 1 Standby Power Incremental Manufacturing Costs

Standby Power Level	Standby Power (W)	Incremental Cost (2010$)
Baseline	4.0	NA
1	2.0	$0.27
2	1.5	$0.60
3	1.0	$1.31
4	0.02	$4.58

As discussed in section IV.A, for today's SNOPR, DOE is proposing two product classes for microwave ovens. While the analysis presented in the October 2008 NOPR remains relevant for the microwave-only and countertop combination microwave oven product class, DOE conducted analyses on a test sample of 13 combination microwave ovens for this SNOPR to evaluate the built-in and over-the-range combination microwave oven product class. DOE again used the design-option approach to determine the

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[19] Information on the PPI databases can be found at http://www.bls.gov/ppi/data.htm. (Last accessed March 18, 2011.)

incremental manufacturing costs of combination microwave ovens for each standby power level.

DOE estimated the incremental cost associated with reductions in baseline standby power of built-in and over-the-range combination microwave ovens. DOE performed engineering teardowns and control board cost analyses to determine the cost of the baseline control board used in these units. DOE estimated the cost associated with each standby power level by using quotes from various component suppliers to determine the cost of the components used in each design option.

For SL 1, DOE estimated that the manufacturing cost of a zero-standby cooking sensor would be the same as that of the cooking sensor with high standby power. To estimate the manufacturing cost for SL 2, DOE used reverse engineering to determine the cost of the components used in a design of a switch mode power supply capable of delivering the same output power as the baseline conventional linear power supply. In its analysis for the manufacturing cost of SL 3, DOE determined the cost of the components used to design a control board with a switch mode power supply and solid state relays capable of driving the same loads as the electromechanical relays. DOE estimated the manufacturing cost for SL 4 based on the cost of the components needed to design an automatic power-down function that uses a transformerless power supply.

The results of these new analyses are summarized in Table IV.6. For the detailed cost-energy use analysis, including descriptions of design options and design changes to meet standby power levels, see chapter 5 of the SNOPR TSD.

Table IV.6 Microwave Oven Product Class 2 Standby Power Incremental Manufacturing Costs

Standby Power Level	Standby Power (W)	Incremental Cost (2010$)
Baseline	4.5	NA
1	3.7	$0
2	2.7	$2.29
3	2.2	$9.44
4	0.04	$5.18

D. Life-Cycle Cost and Payback Period Analysis

In response to the requirements of section 325(o)(2)(B)(i) of the Act, DOE conducted LCC and PBP analyses to evaluate the economic impacts of possible amended energy conservation standards for consumers of microwave ovens having standby mode and off mode features. (42 U.S.C. 6295(o)(2)(B)(i)) DOE conducted the analyses using a spreadsheet model developed in Microsoft (MS) Excel for Windows 2007. (See chapter 8 of the SNOPR TSD.)

The LCC represents the total consumer expense over the life of a product, including purchase and installation expense and operating costs (energy expenditures, repair costs, and maintenance costs). The PBP is the number of years it would take for the consumer to recover the increased costs of a higher-efficiency product through energy savings. To calculate the LCC, DOE discounts future operating costs to the time of purchase and sums them over the lifetime of the product. DOE forecasts the change in LCC and the change in PBP associated with a given efficiency level relative to the base-case product efficiency. The base-case forecast reflects the market in the absence of amended mandatory energy conservation standards. As part of the LCC and PBP analyses, DOE develops data that it uses to establish product prices, annual energy consumption, energy prices, maintenance and repair costs, product lifetime, and discount rates.

DOE developed a consumer sample for microwave ovens having standby mode and off mode features from EIA's 2005 Residential Energy Consumption Survey (RECS). It used this sample to establish the variability and uncertainty in microwave oven electricity use. The variability in electricity pricing was characterized by incorporating regional energy prices. DOE calculated the LCC associated with a baseline microwave oven having standby mode and off mode features. To calculate the LCC savings and PBP associated with products that could meet potential amended energy conservation standards, DOE substituted the baseline unit with more efficient designs.

Table IV.7 summarizes the approaches and data DOE used to derive the inputs to the LCC and PBP calculations for the October 2008 NOPR, and the changes it made for today's SNOPR. DOE did not introduce changes to the LCC and PBP analysis methodology described in the October 2008 NOPR. As the following sections discuss in more detail, however, DOE revised some of the inputs to the analysis. Chapter 8 of the

SNOPR TSD contains a detailed discussion of the methodology utilized for the LCC and PBP analysis as well as the inputs developed for the analysis.

Table IV.7 Summary of Inputs and Key Assumptions in LCC and PBP Analyses

Inputs	**October 2008 NOPR**	**Changes for the SNOPR**
Affecting Installed Costs		
Product Cost	Derived by multiplying manufacturer cost by manufacturer, distributor markups and sales tax.	Used experience curve fits to forecast a price scaling index to forecast product costs.
Affecting Operating Costs		
Annual Energy Use	Annual energy use determined from the annual usage (average daily use cycles).	No change.
Energy Prices	Electricity: Updated using EIA's 2006 Form 861 data. Variability: Regional energy prices determined for 13 regions	Electricity: Updated using EIA's 2009 Form 861 data. Variability: No change.
Energy Price Trends	Energy: Forecasts updated with EIA's Annual Energy Outlook 2008 (AEO 2008).	Reference Case, High Growth, and Low Growth forecasts updated with EIA's AEO 2010 May Release.
Repair and Maintenance Costs	Assumed no repair or maintenance costs.	No change.
Affecting Present Value of Annual Operating Cost Savings		
Product Lifetime	Estimated using survey results from RECS (1990, 1993, 1997, 2001, 2005) and the U.S. Census American Housing Survey (2005, 2007), along with historic data on appliance shipments.	No change.
Discount Rates	Variability: Characterized using Weibull probability distributions.	No change.
Affecting Installed and Operating Costs		
Effective Date of New Standard	2012.	2014.

1. Product Costs

To calculate the product costs paid by microwave oven purchasers, DOE multiplied the manufacturing selling prices developed from the engineering analysis by the supply chain markups it developed (along with sales taxes). DOE used the same supply chain markups for today's SNOPR that were developed for the October 2008 NOPR. See chapter 6 of the SNOPR TSD for additional information. For the October 2008 NOPR, DOE analyzed only countertop models of microwave ovens and considered installation costs to be zero. For today's SNOPR, DOE analyzed both countertop and over-the-range microwave ovens and considered installation costs to be zero.

On February 22, 2011, DOE published a Notice of Data Availability (NODA, 76 FR 9696) stating that DOE may consider improving regulatory analysis by addressing equipment price trends. Consistent with the NODA, DOE examined historical producer price indices (PPI) for electric cooking equipment generally and microwave ovens specifically and found a consistent, long-term declining real price trend. Consistent with the method proposed in the NODA, DOE used experience curve fits to develop a price scaling index to forecast product costs for this rulemaking.

DOE also considered the public comments that were received in response to the NODA and refined its experience curve trend forecasting estimates. Many commenters were supportive of DOE moving from an assumption-based equipment price trend forecasting method to a data-driven methodology for forecasting price trends. Other commenters were skeptical that DOE could accurately forecast price trends given the many variables and factors that can complicate both the estimation and the interpretation of the numerical price trend results and the relationship between price and cost. DOE evaluated these concerns and determined that retaining the assumption-based approach of a constant real price trend was not consistent with the historical data for the products covered in this rule (though this scenario does represent a reasonable upper bound on the future equipment price trend). DOE also performed an initial evaluation of the possibility of other factors complicating the estimation of the long-term price trend, and developed a range of potential price trend values that was consistent with the available data and justified by the amount of data that was available to DOE at this time. DOE recognizes that its price trend forecasting methods are likely to be modified as more data and information becomes available to enhance the statistical certainty of the trend estimate and the completeness of the model. Additional data should enable an improved evaluation of the potential impacts of more of the factors that can influence equipment price trends over time.

To evaluate the impact of the uncertainty of the price trend estimates, DOE performed price trend sensitivity calculations in the national impact analysis to examine the dependence of the analysis results on different analytical assumptions. DOE also included a constant real price trend assumption as a sensitivity scenario representing an upper bound on the forecast price trend.

A more detailed discussion of DOE's price trend modeling and calculations is provided in appendix 8-E of the SNOPR TSD.

2. Annual Energy Consumption

DOE determined the annual energy consumption of the standby mode and off mode of microwave ovens by estimating the number of hours of operation throughout the year and assuming that the unit would be in standby mode or off mode the rest of the time. DOE estimated the number of operating hours relative to the baseline of 71 hours calculated in the NOPR. DOE subtracted the number of calculated operating hours from the total number of hours in a year and multiplied by the standby mode and off mode power usage to determine yearly standby mode and off mode energy consumption.

3. Energy Prices

DOE derived average electricity prices for 13 geographic areas consisting of the nine U.S. Census divisions, with four large States (New York, Florida, Texas, and California) treated separately. DOE estimated residential electricity prices for each of the 13 geographic areas based on data from EIA Form 861, "Annual Electric Power Industry Report." DOE calculated an average residential electricity price by first estimating an average residential price for each utility, and then calculating a regional average price by weighting each utility having customers in a region by the number of residential customers served in that region. The calculations for today's SNOPR used the most recent available data (2009).

To estimate trends in electricity prices for the October 2008 NOPR, DOE used the price forecasts in EIA's AEO 2008. To arrive at prices in future years, DOE multiplied the average prices described above by the forecast of annual average price changes in AEO 2008. For today's supplemental notice, DOE updated its energy price forecasts using those in the AEO 2010 May Release. Because the AEO forecasts prices only to 2035, DOE followed past guidelines that EIA provided to the Federal Energy Management Program and used the average rate of change during 2020–2035 to estimate price trends beyond 2035.

The spreadsheet tools used to conduct the LCC and PBP analysis allow users to select energy price forecasts for either the AEO's High economic growth case or Low economic growth case to estimate the sensitivity of the LCC and PBP to different energy price forecasts.

DOE received comment regarding the inputs to the energy price forecasts. The Joint Comment recommended that DOE conduct a sensitivity analysis using a basket of other forecasts besides the AEO. (Joint Comment, No. 44 at p. 11) As mentioned above, DOE considered price forecasts from the AEO's High and Low economic growth cases to estimate the sensitivity of the LCC and PBP results to different energy price forecasts. The alternative forecasts from the AEO provide a suitable range to examine the sensitivity of LCC and PBP results to different energy price forecasts.

The Joint Comment also stated that to realistically depict energy prices in the future, DOE must consider the impact of carbon control legislation, because such legislation is likely. It also noted that there are regional cap-and-trade programs in effect in the Northeast (Regional Greenhouse Gas Initiative [RGGI]) and the West (Western Climate Initiative [WCI]) that will affect the price of electricity, which was not yet reflected in the AEO energy price forecasts. (Joint Comment, No. 44 at p. 12) EJ stated that caps likely will be in place by the time new standards become effective, so DOE should increase its electricity prices to reflect the cost of complying with emission caps. (EJ, Public Meeting Transcript, No. 40.5 at pp. 105–106)

In response, DOE believes that the shape of Federal carbon control legislation, and the ensuing cost to electricity generators of carbon mitigation, is too uncertain to incorporate into the energy price forecasts that DOE uses. The costs to electricity generators of carbon mitigation resulting from the regional programs are also uncertain over the forecast period for this rulemaking. That being said, EIA included the effect of the RGGI in its energy price forecasts for the AEO 2010 May Release. (WCI did not provide sufficient detail to EIA in order for them to model WCI's impact on energy price forecasts.) Therefore, the energy price forecasts used in today's supplemental notice include the impact of one of the two regional cap-and-trade programs in the United States.

4. Repair and Maintenance Costs

Repair costs are those associated with repairing or replacing components that have failed in an appliance; maintenance costs are associated with maintaining the operation of the product. For the October 2008 NOPR, DOE did not include repair or maintenance costs in its analyses. DOE maintained the same approach for this SNOPR.

5. Product Lifetime

For the October 2008 NOPR and today's SNOPR, DOE used a variety of sources to establish low, average, and high estimates for product lifetime. The average microwave oven lifetime used was 9.3 years. DOE used a Weibull probability distribution to characterize microwave oven lifetime.

6. Discount Rates

In the calculation of LCC, DOE applies discount rates to estimate the present value of future operating costs. DOE estimated a distribution of residential discount rates for microwave ovens. See chapter 8 in the SNOPR TSD for further details on the development of consumer discount rates.

To establish residential discount rates for the LCC analysis in the October 2008 NOPR and today's SNOPR, DOE identified all debt or asset classes that consumers might use to purchase household appliances, including household assets that might be affected indirectly. It estimated average percentage shares of the various debt or asset classes for the average U.S. household using data from the Federal Reserve Board's "Survey of Consumer Finances" (SCF) for 1989, 1992, 1995, 1998, 2001, 2004, and 2007. Using the SCF and other sources, DOE then developed a distribution of rates for each type of debt and asset to represent the rates that may apply in the year in which new 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, weighted by the shares of each class, is 5.1 percent. DOE used the same approach for today's supplemental notice.

7. Effective Date of New Standards

The effective date is the future date when parties subject to the requirements of a new energy conservation standard must begin compliance. For the NOPR, DOE assumed that any new standards adopted in this rulemaking would become effective in March 2012, 3 years after the month when it expected the final rule would be published in the Federal Register. For today's SNOPR, DOE expects that the final rule will be published in 2011, with new standards requiring compliance three years later. Thus, DOE calculated the LCC for appliance consumers as if they would purchase new products in 2014.

8. Product Energy Efficiency in the Base Case

For the LCC and PBP analysis, DOE analyzes higher efficiency levels relative to a base case (i.e., the case without new energy conservation standards). However, some consumers may already purchase products having efficiencies greater than the baseline product levels. Thus, to accurately estimate the percentage of consumers that would be affected by a particular standard level, DOE estimates the distribution of product efficiencies that consumers are expected to purchase under the base case. DOE refers to this distribution of product energy efficiencies as a base-case efficiency distribution. For the October 2008 NOPR and today's SNOPR, DOE used the current shares of available models at specific standby power levels to establish the base-case efficiency distributions.

Table IV.8 presents the market shares of the standby power levels in the base case for standby mode and off mode energy use of microwave ovens.

Table IV.8 Microwave Ovens: Base-Case Market Shares

	Product Class 1		Product Class 2	
Level	**Standby Power (W)**	**2005 Share (%)**	**Standby Power (W)**	**2005 Share (%)**
Baseline	4.00	46.2	4.50	100.0
TSL1*	2.00	34.6	3.70	0.0
TSL 2	1.50	19.2	2.70	0.0
TSL 3	1.00	0.0	2.20	0.0
TSL 4	0.02	0.0	0.04	0.0

* TSL = Trial Standard Level

9. Inputs to Payback Period Analysis

The PBP is the amount of time (expressed in years) it takes the consumer to recover the additional installed cost of a more efficient product through operating cost savings, compared to the baseline product. The simple payback period does not account for changes in operating expenses over time or the time value of money. The inputs to the PBP calculation are the total installed cost of the product to the consumer for each efficiency level and the annual (first-year) operating expenditures for each efficiency level. For the October 2008 NOPR and today's SNOPR, the PBP calculation uses the same inputs as the LCC analysis, except that energy price trends and discount rates are not needed.

10. Rebuttable-Presumption Payback Period

As noted above, EPCA, as amended (42 U.S.C. 6295(o)(2)(B)(iii)) establishes a rebuttable presumption that a standard is economically justified if the Secretary finds that "the additional cost to the consumer of purchasing a product complying with an energy conservation standard level will be less than three times the value of the energy savings during the first year that the consumer will receive as a result of the standard," as calculated under the test procedure in place for that standard. For each TSL, DOE determined the value of the first year's energy savings by calculating the quantity of those savings in accordance with DOE's test procedure, and multiplying that amount by the average energy price forecast for the year in which a new standard first would be effective—in this case, 2014.

DOE received comments addressing the topic of using a rebuttable-presumption payback period to establish the economic justification of an energy conservation standard. The Joint Comment and EJ stated that DOE's view that it is necessary to consider a full range of impacts because the rebuttable presumption criterion is insufficient for determining economic justification does not reflect the extent to which the rebuttable-presumption analysis constrains DOE's authority to reject standards based on economic impacts. (Joint Comment, No. 44 at appendix B, p. 1; EJ, Public Meeting Transcript, No. 40.5 at p. 130) The Joint Comment stated that in 42 U.S.C. 6295(o)(2)(B)(iii), Congress erected a significant barrier to DOE's rejection, on the basis of economic justifiability, of standard levels to which the rebuttable presumption applies. Further, EJ and the Joint Comment stated DOE's preference to proceed under the seven-factor test contained in 42 U.S.C. 6295(o)(2)(B)(i) is not pertinent. The Joint Comment agreed with DOE that analysis under the seven-factor test is necessary and typically has supported standards having paybacks longer than 3 years. However, the Joint Comment stated that DOE's decision making must reflect the expressed intent of Congress that the highest standard level resulting in cost recovery within 3 years constitutes the presumptive lowest standard level that DOE must adopt. (Joint Comment, No. 44 at appendix B, pp. 1–2)

In response, when examining potential standard levels DOE considers both the rebuttable-presumption payback criteria, as well as a full analysis that includes all seven relevant statutory criteria under 42 U.S.C. 6295(o)(2)(B)(i). DOE believes, however, that the commenters are misinterpreting the statutory provision in question. The Joint Comment and EJ state that DOE need not look beyond the results of the rebuttable-presumption analysis, but DOE believes that the statute contains no such restriction, and following this approach would potentially force the agency to ignore other relevant information that would bear on the selection of the most stringent standard level that meets all applicable statutory criteria. Similarly, DOE believes that the Joint Comment misreads the statute in calling for a level that meets the rebuttable-presumption test to serve as a minimum level when setting the final energy conservation standard. To do so would not only eliminate the "rebuttable" aspect of the presumption but also would lock in place a level that may not be economically justified based on a full review of statutory criteria. EPCA already obligates DOE to select the most stringent standard level that meets the applicable statutory criteria.

E. National Impact Analysis —National Energy Savings and Net Present Value Analysis

1. General

DOE's NIA assesses the national energy savings, as well as the national NPV, of total consumer costs and savings expected to result from new or amended standards at specific efficiency levels. DOE applied the NIA spreadsheet to calculate energy savings and NPV, using the annual energy consumption and total installed cost data from the LCC analysis. DOE forecasted the energy savings, energy cost savings, product costs, and NPV for the two product classes from 2014 to 2043. The forecasts provide annual and cumulative values for all four parameters. In addition, DOE incorporated into its NIA spreadsheet the capability to analyze sensitivity of the results to forecasted energy prices and product efficiency trends. Table IV.9 summarizes the approach and data DOE used to derive the inputs to the NES and NPV analyses for the October 2008 NOPR and the changes made in the analyses for today's SNOPR. A discussion of the 2008 inputs and the changes follows. (See chapter 10 of the SNOPR TSD for further details.)

Table IV.9 Approach and Data Used to Derive Inputs to the National Energy Savings and NPV Analyses

Inputs	2008 NOPR Description	Changes for the SNOPR
Shipments	Annual shipments from shipments model.	See Table IV.10
Compliance Date of Standard	2012.	2014.
Base-Case Forecasted Efficiencies	Shipment-weighted efficiency (SWEF) determined in 2005. SWEF held constant over forecast period.	No change.
Standards-Case Forecasted Efficiencies	Analyzed as one product class. Roll-up scenario used for determining SWEF in the year that standards become effective for each standards case. SWEF held constant over forecast period.	Analyzed as two product classes. Roll-up scenario used for determining SWEF in the year that standards become effective for each standards case. SWEF held constant over forecast period.
Annual Energy Consumption per Unit	Annual weighted-average values as a function of SWEF.	No change.
Total Installed Cost per Unit	Annual weighted-average values as a function of SWEF.	Incorporated learning rate to forecast product prices.
Energy Cost per Unit	Annual weighted-average values as a function of the annual energy consumption per unit and energy (and water) prices.	No change.
Repair Cost and Maintenance Cost per Unit	Incorporated changes in repair costs as a function of standby power.	No change.
Escalation of Energy Prices	AEO 2008 forecasts (to 2030); extrapolated to 2042.	Updated to AEO 2010 May release forecasts (to 2035); extrapolated to 2043.
Energy Site-to-Source Conversion	Conversion varies yearly and is generated by DOE/EIA's NEMS program (a time-series conversion factor; includes electric generation, transmission, and distribution losses).	No change.
Discount Rate	3 and 7 percent real.	No change.
Present Year	Future expenses discounted to 2007.	Future expenses discounted to 2011.

2. Shipments

The shipments portion of the NIA spreadsheet is a model that uses historical data as a basis for projecting future shipments of the products that are the subject of this rulemaking. In projecting microwave oven shipments, DOE accounted for two market segments: (1) new construction; and (2) replacement of failed products. Because shipments for new construction and replacements were not enough to account for all product shipments, DOE developed another market segment to calibrate its shipments model. In addition to normal replacements, DOE's shipments model also assumed that a small fraction of the stock would be replaced early. It also considered retired units not replaced. DOE used the non-replacement market segment to calibrate the shipments model to historical shipments data.

To estimate the impacts of prospective standards on product shipments (i.e., to forecast standards-case shipments), DOE considered the combined effects of changes in purchase price, annual operating cost, and household income on the magnitude of shipments.

Table IV.10 summarizes the approach and data DOE used to derive the inputs to the shipments analysis for the October 2008 NOPR, and the changes it made for today's SNOPR. The general approach for forecasting microwave shipments for today's SNOPR remains unchanged from the NOPR.

Table IV.10 Approach and Data Used to Derive Inputs to the Shipments Analysis

Inputs	2008 NOPR Description	Changes for the SNOPR
Number of Product Classes	One product class. Market share data provided by AHAM.	Two product classes: (1) all microwave oven-only and countertop microwave oven-combination; (2) over-the-range microwave oven-combination. Market share data provided by AHAM; 99% product class #1 and 1% product class #2. Product class market shares held constant over forecast period.
New Construction Shipments	Housing forecasts updated with EIA AEO 2009 April release forecasts for the Reference case, High growth case, and Low growth case.	No change in approach. Housing forecasts updated with EIA AEO 2010 forecasts for the Reference case, High growth case, and Low growth case.
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 revised to be based on Weibull lifetime distributions.	No change.
Retired Units not Replaced (i.e., non-replacements)	Used to calibrate shipments model to historical shipments data.	No change.
Historical Shipments	Data sources include AHAM data submittal and Appliance magazine.	No change.
Purchase Price, Operating Cost, and Household Income Impacts due to Efficiency Standards	Developed “relative price” elasticity, which accounts for the purchase price and the present value of operating cost savings divided by household income. Used purchase price and efficiency data specific to residential refrigerators, clothes washers, and dishwashers between 1980 and 2002 to determine a “relative price” elasticity of demand of -0.34.	No change.
Fuel Switching	Not applicable.	No change.

a. New Construction Shipments

To estimate shipments for new construction, DOE used forecasts of housing starts coupled with microwave oven saturation data. In other words, to forecast the shipments for new construction in any given year, DOE multiplied the housing forecast by the forecasted saturation of microwave ovens for new housing.

New housing comprises single- and multi-family units (also referred to as "new housing completions") and mobile home placements. DOE forecasted new housing based on EIA's AEO 2010 for 2005–2035. AEO 2010 provides three sets of forecasts: the Reference case, the High economic growth case, and the Low economic growth case. DOE used the forecasts from the Reference case for the NIA results reported in this notice. For the Reference case, the forecast shows a decline in housing completions from 2.2 million in 2005 to 1.7 million by 2030. For 2035–2043, DOE froze completions at the level in 2035.

b. Replacements and Non-replacements

To determine shipments for the replacement market, DOE used an accounting method that tracks the total stock of units by vintage. DOE estimated a stock of microwave ovens by vintage by integrating historical shipments starting from 1972. Over time, some units are retired and removed from the stock, triggering the shipment of a replacement unit. Depending on the vintage, a certain percentage of each type of unit will fail and need to be replaced. To determine when a microwave oven fails, DOE used data from RECS and AHS to estimate a product survival function. This function was modeled as a Weibull distribution. Based on this method, the average calculated microwave oven lifetime is 9.3 years. For a more complete discussion of microwave lifetimes, refer to section 8.2.3 of chapter 8 of the SNOPR TSD.

3. Purchase Price, Operating Cost, and Income Impacts

To estimate the combined effects of increases in product purchase price and decreases in product operating costs on microwave oven shipments, for the October 2008 NOPR DOE used a literature review and a statistical analysis on a limited set of appliance price, efficiency, and shipments data. DOE used purchase price and efficiency data specific to microwave ovens between 1980 and 2002 to conduct regression analyses. DOE's analysis suggested that the relative short-run price elasticity of demand is -0.34.

Because DOE's forecast of shipments and national impacts attributable to standards spans more than 30 years, DOE also considered how the relative price elasticity is affected once a new standard takes effect. After the purchase price changes, price elasticity becomes more inelastic over the years until it reaches a terminal value. For the October 2008 NOPR and today's SNOPR, DOE incorporated a relative price elasticity change that resulted in a terminal value of approximately one-third of the short-run elasticity. In other words, DOE determined that consumer purchase decisions, in time, become less sensitive to the initial change in the product's relative price.

4. Other Inputs

a. Forecasted Efficiencies

A key input to the calculations of NES and NPV are the energy efficiencies that DOE forecasts for the base case (without new standards). The forecasted efficiencies represent the annual shipment-weighted energy efficiency (SWEF) of the product under consideration during the forecast period (i.e., from the estimated effective date of a new standard to 30 years after that date). Because DOE had no data to reasonably estimate how microwave oven standby power levels might change during the next 30 years, it assumed that forecasted efficiencies will stay at the 2014 standby power levels until the end of the forecast period.

For its determination of the cases under alternative standard levels ("standards cases"), DOE used a "roll-up" scenario in the October 2008 NOPR to establish the SWEF for 2012. For today's SNOPR, DOE established the SWEF for 2014 and assumed that product efficiencies in the base case that do not meet the standard level under consideration would roll-up to meet the new standard level. DOE assumed that all product efficiencies in the base case that were above the standard level under consideration would not be affected by the standard.

DOE made the same assumption regarding forecasted standards-case efficiencies as for the base case; namely, that efficiencies will remain at the 2014 standby power level until the end of the forecast period. By maintaining the same rate of increase for forecasted efficiencies in the standards case as in the base case (i.e., no change), DOE retained a constant efficiency difference between the two cases throughout the forecast period. Although the no-change trends may not reflect what would happen to base-case and standards-case product efficiencies in the future, DOE believes that maintaining a constant efficiency difference between the base case and each standards case provides a reasonable estimate of the impact that standards would have on product efficiency. It is more important to accurately estimate the efficiency difference between the standards case and base case than to accurately estimate the actual product efficiencies in the standards and base cases. DOE retained the approach used in the October 2008 NOPR for today's SNOPR. Because the effective date of the standard is now assumed to be 2014, DOE applied the "roll-up" scenario in the year 2014 to establish the SWEF for each standards case.

b. Annual Energy Consumption

The annual energy consumption per unit depends directly on product efficiency. For the October 2008 NOPR and today's SNOPR, DOE used the SWEFs associated with the base case and each standards case, in combination with the annual energy use data, to estimate the shipment-weighted average annual per-unit energy consumption under the base case and standards cases. The national energy consumption is the product of the annual energy consumption per unit and the number of units of each vintage, which depends on shipments.

As noted above, DOE used a relative price elasticity to estimate standards-case shipments for microwave ovens. To avoid the inclusion of energy savings from any reduction in shipments attributable to a standard, DOE used the standards-case shipments projection and the standards-case stock to calculate the annual energy consumption in the base case. For microwave ovens, DOE assumed that any drop in shipments caused by standards would result in the purchase of used machines. DOE retained the use of the base-case shipments to determine the annual energy consumption in the base case for today's SNOPR.

c. Site-to-Source Energy Conversion

To estimate the national energy savings expected from appliance standards, DOE uses a multiplicative factor to convert site energy consumption (energy use at the location where the appliance is operated) into primary or source energy consumption (the energy required to deliver the site energy). For the October 2008 NOPR, DOE used annual site-to-source conversion factors based on the version of NEMS that corresponds to AEO 2008. For today's SNOPR, DOE used AEO 2010. For electricity, the conversion factors vary over time because of projected changes in generation sources (i.e., the types of power plants projected to provide electricity to the country). Because the AEO does not provide energy forecasts beyond 2035, DOE used conversion factors that remain constant at the 2035 values throughout the rest of the forecast.

d. Total Installed Costs and Operating Costs

The increase in total annual installed cost is equal to the difference in the per-unit total installed cost between the base case and standards case, multiplied by the shipments forecasted in the standards case.

In the NOPR analysis, DOE assumed that the manufacturer costs and retail prices of products meeting various efficiency levels remain fixed, in real terms, throughout the period of the analysis. As discussed in section IV.F.1, examination of historical price data for certain appliances that have been subject to energy conservation standards indicates that the assumption of constant real prices and costs may, in many cases, over-estimate long-term appliance price trends.

For the SNOPR, DOE applied a learning rate of 28.9 percent to forecast the prices of microwave ovens sold in each year in the forecast period (2014-2043). The learning rate expresses the change in price associated with a doubling in cumulative production. The price in each year is a function of the learning rate and the cumulative production of microwave ovens forecast in each year. DOE applied the same values to forecast prices for each product class at each considered efficiency level. Learning curve analysis characterizes the reduction in production cost mainly associated with labor-based performance improvement and higher investment in new capital equipment at the microeconomic level. Experience curve analysis tends to focus more on entire industries and aggregates over various casual factors at the macroeconomic level: "Experience curve" and "progress function" typically represent generalizations of the learning concept to encompass behavior of all inputs to production and cost (i.e., labor, capital, and materials)." The economic literature often uses these two terms interchangeably. The term "learning" is used here to broadly cover these general macroeconomic concepts. The "experience" curve developed for microwave ovens is based solely on shipments and PPI data specific to the United States. Because all microwave ovens are manufactured outside of the country, the changes observed in the PPI data are a result of efficiency gains realized in production outside of the country. In other words, "experience" is currently a dynamic of global production and distribution and is the cause for the changes observed in the PPI data.

To evaluate the impact of the uncertainty of the price trend estimates, DOE performed price trend sensitivity calculations to examine the dependence of the analysis results on different analytical assumptions. DOE considered four learning rate sensitivities: (1) a “high learning” rate (34.7 percent); (2) a “low learning” rate (21.3 percent); (3) a “no learning” rate (constant real prices); and (4) a “microwave oven only” rate. The “microwave oven only” is based on limited set of historical price data specifically for microwave ovens, and the learning rate is 39.6 percent.

The annual operating cost savings per unit include changes in energy, repair, and maintenance costs. DOE forecasted energy prices for the October 2008 NOPR based on AEO 2008; it updated the forecasts for the SNOPR using data from AEO 2010. For the October 2008 NOPR and today’s SNOPR, DOE assumed no increases in repair and maintenance costs for more efficient standby mode and off mode features of microwave ovens.

e. Discount Rates

DOE multiplies monetary values in future years by a discount factor to determine their present value. DOE estimated national impacts using both a 3-percent and a 7-percent real discount rate, in accordance with guidance provided by the Office of Management and Budget (OMB) to Federal agencies on the development of regulatory analysis (OMB Circular A-4 (Sept.17, 2003), section E, "Identifying and Measuring Benefits and Costs"). The Joint Comment stated that DOE should use a 2-percent to 3-percent real discount rate for national impact analyses. (Joint Comment, No. 44 at p. 11) It noted that societal discount rates are the subject of extensive academic research, and the weight of academic opinion is that the appropriate societal discount rate is 3 percent or less. It urged DOE to give primary weight to results based on the lower of the discount rates recommended by OMB.

In response, DOE notes that OMB Circular A-4 references an earlier Circular A-94, which states that a real discount rate of 7 percent should be used as a base case for regulatory analysis. The 7-percent rate is an estimate of the average before-tax rate of return to private capital in the U.S. economy. It approximates the opportunity cost of capital, and, according to Circular A-94, it is the appropriate discount rate whenever the primary effect of a regulation is to displace or alter the use of capital in the private sector. OMB later found that the average rate of return to capital remains near the 7-percent rate estimated in 1992. Circular A-4 also states that when regulation primarily and directly affects private consumption, a lower discount rate is appropriate. "The alternative most often used is sometimes called the social rate of time preference…the rate at which ‘society’ discounts future consumption flows to their present value.” It suggests that the real rate of return on long-term government debt may provide a fair approximation of the social rate of time preference, and states that during the past 30 years, this rate has averaged around 3 percent in real terms on a pre-tax basis. It concludes that “for regulatory analysis, [agencies] should provide estimates of net benefits using both 3 percent and 7 percent.” In accordance with the guidance from OMB Circular A-4 , DOE did not give primary weight to results derived using a 3-percent discount rate.

5. Effects of Standards on Energy Prices

The Joint Comment stated that the proposed standard’s mitigation effects on electricity prices should be documented and the value of reduced electricity bills to all consumers quantified as a benefit. (Joint Comment, No. 44 at p. 11) For the October 2008 NOPR, DOE examined the impact of reduced energy demand associated with possible cooking products standards on prices of electricity. DOE found that reductions in electricity demand resulting from possible standards for cooking products would produce no detectable change on the average user price of electricity in the United States. DOE concluded that microwave oven standby mode and off mode standards will not provide additional economic benefits resulting from lower energy prices. Thus, for today’s SNOPR DOE has made no change to its assumptions about the effects of microwave oven standards on energy prices.

F. Consumer Subgroup Analysis

In the October 2008 NOPR, DOE analyzed the potential effects of microwave oven standby mode and off mode standards on two subgroups: (1) low-income consumers, and (2) consumers living in senior-only households. DOE used the same approach for today's SNOPR.

G. Manufacturer Impact Analysis

DOE performed an MIA to estimate the financial impact of standby mode and off mode energy conservation standards on microwave oven manufacturers, and to calculate the impact of such standards on domestic employment and manufacturing capacity. The MIA has both quantitative and qualitative aspects. The quantitative part of the MIA primarily relies on the GRIM—an industry-cash-flow model customized for this rulemaking. The GRIM inputs are data characterizing the industry cost structure, shipments, and revenues. The key output is the industry net present value. Different sets of assumptions (scenarios) will produce different results. The qualitative part of the MIA addresses factors such as product characteristics, characteristics of particular firms, and market and product trends, and it also includes an assessment of the impacts of standards on subgroups of manufacturers. DOE outlined its methodology for the MIA in the October 2008 NOPR. 73 FR 62034, 62075–81 (Oct. 17, 2008). The complete MIA is presented in chapter 12 of the SNOPR TSD.

For today's SNOPR, DOE updated the MIA results based on several changes to other analyses that impact the MIA. DOE revised the analysis to account for the impacts on manufacturers resulting from standby mode and off mode standards for Product Class 1 (Microwave-Only Ovens and Countertop Combination Microwave Ovens) and Product Class 2 (Built-In and Over-the-Range Combination Microwave Ovens). As discussed in section IV.C.3, based on the engineering analysis, DOE included updated manufacturer production costs (MPCs) for Product Class 1 and new MPCs for Product Class 2. For the SNOPR DOE updated its engineering analysis to 2010$ using the PPI. DOE also incorporated price trends into the analysis. Incorporating prices trends rather than assuming prices remain fixed in real terms throughout the analysis also impacts the MIA results. DOE used the default prices trends in the NIA starting in the base year of the analysis (2011) and continuing through the end of the analysis period (2043). DOE also assumed that MPCs and MSPs were similarly impacted by price trends in both the base case and standards cases. See section IV.D.1 for a description of how DOE implemented prices trends into the analysis.

The total shipments and efficiency distributions were updated using the new estimates outlined in the SNOPR NIA. The MIA also uses the new analysis period in the NIA (2013–2043) and has updated the base year to 2011. See section IV.E for a description of the changes to the NIA.

To segment total product and capital conversion costs between Product Class 1 and Product Class 2, DOE used the same split between these two product classes as used in the NIA. DOE used the same per-platform costs at each standby power level for both product classes, but converted these product and capital conversion costs to 2010$ using the PPI. As described below, DOE also updated the product conversion costs in response to comments from interested parties.

As noted in section IV.C.2, Whirlpool commented that its market research suggests high costs associated with consumer education on proper operation of microwave ovens with automatic power-down features. Whirlpool clarified that the marketing costs it submitted for the ANOPR did not include these costs, estimated at $10 million, including retailer training, point-of-purchase material, product tags, telephone support, and possibly more. (Whirlpool, No. 50 at p. 7) AHAM also commented that DOE did not account for the all cost implications on appliance manufacturers, including variables such as component reliability and/or utility, both of which will impact manufacturer cost. (AHAM, No. 47 at p. 6)

As part of the MIA conducted for the October 2008 NOPR, DOE considered product and capital conversion costs associated with the analyzed TSLs. Product conversion costs are one-time investments in research, development, testing, and marketing, focused on making product designs comply with new energy conservation standards. DOE investigated available product information to estimate the number of product platforms that would need to be updated at each TSL to determine conversion costs for the entire industry. DOE also used manufacturer interviews to verify the estimates used to determine product conversion costs. For each TSL, DOE assumed that most of the product conversion costs would be used for product development expenses. To account for the majority of the cost to upgrade the designs of product platforms that did not meet the standby power requirements at each TSL, DOE estimated a per-platform cost for engineering time, reliability testing, and product development that varied depending on the complexity of the design options. In response to Whirlpool's comment, DOE notes that the normal product cycle of microwave ovens is less the 3-year period between the announcement and the compliance date of the final rule, and some of these marketing costs for rolling-out new products would have been incurred without standards. However, to conservatively account for any of these extraordinary marketing costs in that period, DOE also estimated for the SNOPR a per-platform cost where it analyzed a power-down design option to achieve the required standby power level. The marketing cost equaled half the estimated engineering expense per platform. Chapter 12 of the SNOPR TSD contains more detailed information on the product conversion costs for microwave oven manufacturers.

DOE also received a comment about the MIA results during the October 2008 NOPR public meeting. In response to a discussion about different possible design paths that might be taken by manufacturers to reach higher efficiencies, LG questioned why the range of impacts on INPV was great if DOE had trouble contacting some overseas manufacturers. (LG, Public Meeting Transcript, No. 40.5 at p. 167-169)

Additional information and interviewing a greater number of manufacturers would not affect the range of INPV impacts shown in the NOPR. Rather, the range of potential impacts on microwave oven manufacturers in the NOPR MIA analysis depended on two factors: the magnitude of the conversion costs and the ability of manufacturers to pass through the additional production costs to consumers at higher TSLs. The production cost at the max-tech standby power level (TSL 4) in the NOPR added $5.13 to the baseline MPC. If manufacturers could fully pass through these additional production costs to consumers for lower standby power, the additional cash flow from operations in the NOPR MIA analysis would still not be enough to overcome the substantial product and capital conversion costs, resulting in a loss of $35 million in INPV. If manufacturers could only pass through a portion of the increased production costs, the lower per-unit profit lowered cash flow from operations and resulted in a loss of $172 million in INPV. 73 FR 62034, 62096–99 (Oct. 17, 2008). Hence, feedback from manufacturers was valuable to determine the standby power conversion costs and to determine which scenarios were appropriate to calculate the potential impacts on INPV.

H. Employment Impact Analysis

DOE considers employment impacts in the domestic economy as one factor in selecting a proposed standard. Employment impacts include direct and indirect impacts. Direct employment impacts are changes in the number of employees for manufacturers of the products subject to standards, their suppliers, and related service firms. The MIA addresses those impacts. Indirect employment impacts from standards consist of the jobs created or eliminated in the national economy, other than in the manufacturing sector being regulated, due to: (1) reduced spending on energy by end users, (2) reduced spending on new energy supply by the utility industry, (3) increased consumer spending on the purchase of new products, and (4) the effects of those three factors throughout the economy.

One method for assessing the possible effects such shifts in economic activity may have on the demand for labor is to compare sectoral employment statistics developed by the Bureau of Labor Statistics (BLS). BLS regularly publishes its estimates of the number of jobs per million dollars of economic activity in different sectors of the economy, as well as the jobs created elsewhere in the economy by that same economic activity. Data from BLS indicate that expenditures in the utility sector generally create fewer jobs (both directly and indirectly) than do expenditures in other sectors of the economy.[20] There are many reasons for the differences, including wage differences and the fact that the utility sector is more capital-intensive and less labor-intensive than many other sectors. Energy conservation standards have the effect of reducing consumer utility bills. Because reduced consumer expenditures for energy likely lead to increased expenditures in other sectors of the economy, the general effect of energy conservation standards is to shift economic activity from a less labor-intensive sector (i.e., the utility sector) to more labor-intensive sectors (e.g., the retail and manufacturing sectors). Thus, based on the BLS data alone, DOE believes net national employment will increase due to shifts in economic activity resulting from new standby mode and off mode standards for microwave ovens.

In developing the October 2008 NOPR and today's SNOPR, DOE estimated indirect national employment impacts using an input/output model of the U.S. economy called Impact of Sector Energy Technologies version 3.1.1 (ImSET). ImSET is a special-

[20] See Bureau of Economic Analysis, "Regional Multipliers: A User Handbook for the Regional Input-Output Modeling System (RIMS II)," Washington, D.C., U.S. Department of Commerce, 1992.

purpose version of the U.S. Benchmark National Input-Output (I-O) model designed to estimate the national employment and income effects of energy-saving technologies. The ImSET software includes a computer-based I-O model having structural coefficients to characterize economic flows among 187 sectors most relevant to industrial, commercial, and residential building energy use.

DOE notes that ImSET is not a general equilibrium forecasting model, and understands the uncertainties involved in projecting employment impacts, especially changes in the later years of the analysis.[4] Because ImSET does not incorporate price changes, the employment effects predicted by ImSET may over-estimate actual job impacts over the long run for this rule. Because ImSET predicts small job impacts resulting from this rule, regardless of these uncertainties, the actual job impacts are likely to be negligible in the overall economy. DOE may consider the use of other modeling approaches for examining long run employment impacts. DOE also notes that the employment impacts estimated with ImSET for the entire economy differ from the employment impacts in the microwaves manufacturing sector estimated using the Government Regulatory Impact Model (GRIM) in chapter 12 of the TSD. The methodologies used and the sectors analyzed in the ImSET and GRIM models are different. Please see chapter 13 of the TSD for additional details on the range of results generated from the ImSET model.

EJ and the Joint Comment stated that DOE must consider its own projections that an increase in employment will result from the adoption of standards in weighing the economic costs and benefits of more stringent energy conservation standards. (EJ Comment, Public Meeting Transcript, No. 40.5 at p. 186; Joint Comment, No. 44 at p. 13) As described above, when evaluating alternative standard levels DOE considers the indirect employment impacts estimated using ImSet. Direct employment impacts on the manufacturers that produce microwave ovens are analyzed in the MIA, as discussed in section IV.G. For today's SNOPR, DOE made no change to its method for estimating employment impacts. EEI requested clarification on the methodology used to estimate the national employment impacts when the majority of microwave ovens are manufactured oversees. (EEI, Public Meeting Transcript at p. 185) The employment impacts analysis considers only the indirect employment impacts expected to result from appliance standards. The employment impacts in the affected appliance manufacturing industry are assessed in the MIA. For the purposes of the employment impacts analysis described in this section, the location of the manufacturing facilities is not relevant. For further details, see chapter 13 of the SNOPR TSD.

I. Utility Impact Analysis

The utility impact analysis estimates the change in the forecasted power generation capacity for the Nation that would be expected to result from adoption of new or amended standards. The analysis determines the changes to electricity supply as a result of electricity consumption savings due to standards. For the October 2008 NOPR and today's SNOPR, DOE used the NEMS-BT computer model to calculate these changes. The analysis output provides a forecast for the needed generation capacities at each TSL. The estimated net benefit of a standard is the difference between the generation capacities forecasted by NEMS-BT and the AEO Reference case. DOE obtained the energy savings inputs from the NIA. Those inputs reflect the effects of standby mode and off mode energy use reduction on electricity consumption of microwave ovens. Chapter 14 of the SNOPR TSD presents results of the utility impact analysis.

J. Emissions Analysis

In the emissions analysis, DOE estimated the reduction in power sector emissions of CO_2, NO_X, and Hg from energy conservation standards for microwave oven standby mode and off mode energy use. DOE used the NEMS–BT computer model, which is run similarly to the AEO NEMS, except that microwave oven standby mode and off mode energy use is reduced by the amount of energy saved at each TSL. The inputs of national energy savings come from the NIA spreadsheet model, while the output is the forecasted physical emissions. The net benefit of each TSL in today's proposed rule is the difference between the forecasted emissions estimated by NEMS–BT at each TSL and the AEO 2010 Reference case. NEMS–BT tracks CO_2 emissions using a detailed module that provides results with broad coverage of all sectors and inclusion of interactive effects. For today's SNOPR, DOE used AEO 2010. For the final rule, DOE intends to revise the emissions analysis using the most current version of NEMS.

SO_2 emissions from affected electric generating units (EGUs) are subject to nationwide and regional emissions cap and trading programs, and DOE has preliminarily determined that these programs create uncertainty about the standards' impact on SO_2

emissions. Title IV of the Clean Air Act sets an annual emissions cap on SO_2 for affected EGUs in all 50 States and the District of Columbia (D.C.). SO_2 emissions from 28 eastern States and D.C. are also limited under the Clean Air Interstate Rule (CAIR, 70 Fed. Reg. 25162 (May 12, 2005)), which created an allowance-based trading program that would gradually replace the Title IV program in those States and D.C. Although CAIR was remanded to EPA by the U.S. Court of Appeals for the District of Columbia Circuit (D.C. Circuit), see North Carolina v. EPA, 550 F.3d 1176 (D.C. Cir. 2008), it remained in effect temporarily, consistent with the D.C. Circuit's earlier opinion in North Carolina v. EPA, 531 F.3d 896 (D.C. Cir. 2008). On July 6, 2010, EPA issued the Transport Rule proposal, a replacement for CAIR (75 FR 45210 (Aug. 2, 2010)); and on July 6, 2011 EPA issued the final Transport Rule, entitled the Cross-State Air Pollution Rule. 76 FR 48208 (Aug. 8, 2011). On December 30, 2011, however, the D.C. Circuit stayed the new rules while a panel of judges reviews them, and told EPA to continue enforcing CAIR (see EME Homer City Generation v. EPA, No. 11-1302, Order at *2 (D.C. Cir. Dec. 30, 2011)). The AEO 2011 NEMS-BT used for today's NOPR assumes the implementation of CAIR.

The attainment of emissions caps typically is flexible among EGUs and is enforced through the use of emissions allowances and tradable permits. Under existing EPA regulations, any excess SO_2 emissions allowances resulting from the lower electricity demand caused by the imposition of an energy conservation standard could be used to permit offsetting increases in SO_2 emissions by any regulated EGU. However, if the standard resulted in a permanent increase in the quantity of unused emissions allowances, there would be an overall reduction in SO_2 emissions from the standards. While there remains some uncertainty about the ultimate effects of energy conservation standards on SO_2 emissions covered by the existing cap-and-trade system, the NEMS-BT modeling system that DOE uses to forecast emissions reductions currently indicates that no physical reductions in power sector emissions would occur for SO_2.

As discussed above, the version of NEMS-BT used for today's SNOPR assumes the implementation of CAIR, which established a cap on NO_X emissions in 28 eastern States and the District of Columbia. With CAIR in effect, the energy conservation standards for microwave oven standby mode and off mode energy use are expected to have little or no physical effect on these emissions in those States covered by CAIR, for the same reasons that they may have little effect on SO_2 emissions. However, the standards would be expected to reduce NO_X emissions in those 22 States not affected by the CAIR. For these 22 States, DOE used NEMS–BT to estimate NO_X emission reductions from the standards that are considered in today's SNOPR.

On December 21, 2011, EPA announced national emissions standards for hazardous air pollutants (NESHAPs) for mercury and certain other pollutants emitted from coal and oil-fired EGUs. (See http://epa.gov/mats/pdfs/20111216MATSfinal.pdf.) The NESHAPs do not include a trading program and, as such, DOE's energy conservation standards would likely reduce Hg emissions. For the emissions analysis for this rulemaking, DOE estimated mercury emissions reductions using NEMS-BT based on

AEO2010, which does not incorporate the NESHAPs. DOE expects that future versions of the NEMS-BT model will reflect the implementation of the NESHAPs.

K. Monetizing Carbon Dioxide and Other Emissions Impacts

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

For today's SNOPR, DOE is relying on a set of values for the SCC that was developed by an interagency process. A summary of the basis for those values is provided below, and a more detailed description of the methodologies used is provided as an appendix to chapter 16 of the SNOPR TSD.

1. Social Cost of Carbon

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

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

a. Monetizing Carbon Dioxide Emissions

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

When attempting to assess the incremental economic impacts of carbon dioxide emissions, the analyst faces a number of serious challenges. A recent report from the National Research Council[21] points out that any assessment will suffer from uncertainty, speculation, and lack of information about (1) future emissions of greenhouse gases, (2) the effects of past and future emissions on the climate system, (3) the impact of changes in climate on the physical and biological environment, and (4) the translation of these environmental impacts into economic damages. As a result, any effort to quantify and monetize the harms associated with climate change will raise serious questions of science, economics, and ethics and should be viewed as provisional.

Despite the serious limits of both quantification and monetization, SCC estimates can be useful in estimating the social benefits of reducing carbon dioxide emissions. Consistent with the directive quoted above, the purpose of the SCC estimates presented here is to make it possible for agencies to incorporate the social benefits from reducing carbon dioxide emissions into cost-benefit analyses of regulatory actions that have small, or "marginal," impacts on cumulative global emissions. Most Federal regulatory actions can be expected to have marginal impacts on global emissions.

For such policies, the agency can estimate the benefits from reduced (or costs from increased) emissions in any future year by multiplying the change in emissions in that year by the SCC value appropriate for that year. The net present value of the benefits can then be calculated by multiplying each of these future benefits by an appropriate

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[21] National Research Council. "Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use." National Academies Press: Washington, D.C. 2009.

discount factor and summing across all affected years. This approach assumes that the marginal damages from increased emissions are constant for small departures from the baseline emissions path, an approximation that is reasonable for policies that have effects on emissions that are small relative to cumulative global carbon dioxide emissions. For policies that have a large (non-marginal) impact on global cumulative emissions, there is a separate question of whether the SCC is an appropriate tool for calculating the benefits of reduced emissions. This concern is not applicable to this notice, and DOE does not attempt to answer that question here.

At the time of the preparation of this supplemental notice, the most recent interagency estimates of the potential global benefits resulting from reduced CO_2 emissions in 2010, expressed in 2010$, were $4.9, $22.3, $36.5, and $67.6 per metric ton avoided. For emissions reductions that occur in later years, these values grow in real terms over time. Additionally, the interagency group determined that a range of values from 7 percent to 23 percent should be used to adjust the global SCC to calculate domestic effects,[22] although preference is given to consideration of the global benefits of reducing CO_2 emissions.

It is important to emphasize that the interagency process is committed to updating these estimates as the science and economic understanding of climate change and its impacts on society improves over time. Specifically, the interagency group has set a

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

preliminary goal of revisiting the SCC values within 2 years or at such time as substantially updated models become available, and to continue to support research in this area. In the meantime, the interagency group will continue to explore the issues raised by this analysis and consider public comments as part of the ongoing interagency process.

b. Social Cost of Carbon Values Used in Past Regulatory Analyses

To date, economic analyses for Federal regulations have used a wide range of values to estimate the benefits associated with reducing carbon dioxide emissions. In the model year 2011 CAFE final rule, the Department of Transportation (DOT) used both a "domestic" SCC value of $2 per ton of CO_2 and a "global" SCC value of $33 per ton of CO2 for 2007 emission reductions (in 2007$), increasing both values at 2.4 percent per year. It also included a sensitivity analysis at $80 per ton of CO_2. See Average Fuel Economy Standards Passenger Cars and Light Trucks Model Year 2011, 74 FR 14196 (March 30, 2009) (Final Rule); Final Environmental Impact Statement Corporate Average Fuel Economy Standards, Passenger Cars and Light Trucks, Model Years 2011-2015 at 3-90 (Oct. 2008) (Available at: http://www.nhtsa.gov/fuel-economy). A domestic SCC value is meant to reflect the value of damages in the United States resulting from a unit change in carbon dioxide emissions, while a global SCC value is meant to reflect the value of damages worldwide.

A 2008 regulation proposed by DOT assumed a domestic SCC value of $7 per ton of CO_2 (in 2006$) for 2011 emission reductions (with a range of $0 to $14 for sensitivity analysis), also increasing at 2.4 percent per year. See Average Fuel Economy Standards, Passenger Cars and Light Trucks, Model Years 2011-2015, 73 FR 24352 (May 2, 2008) (Proposed Rule); Draft Environmental Impact Statement Corporate Average Fuel Economy Standards, Passenger Cars and Light Trucks, Model Years 2011-2015 at 3-58 (June 2008) (Available at: http://www.nhtsa.gov/fuel-economy). A regulation for packaged terminal air conditioners and packaged terminal heat pumps finalized by DOE in October of 2008 used a domestic SCC range of $0 to $20 per ton CO_2 for 2007 emission reductions (in 2007$). 73 FR 58772, 58814 (Oct. 7, 2008). In addition, EPA's 2008 Advance Notice of Proposed Rulemaking on Regulating Greenhouse Gas Emissions Under the Clean Air Act identified what it described as "very preliminary" SCC estimates subject to revision. 73 FR 44354 (July 30, 2008). EPA's global mean values were $68 and $40 per ton CO_2 for discount rates of approximately 2 percent and 3 percent, respectively (in 2006$ for 2007 emissions).

In 2009, an interagency process was initiated to offer a preliminary assessment of how best to quantify the benefits from reducing carbon dioxide emissions. To ensure consistency in how benefits are evaluated across agencies, the Administration sought to develop a transparent and defensible method, specifically designed for the rulemaking process, to quantify avoided climate change damages from reduced CO_2 emissions. The interagency group did not undertake any original analysis. Instead, it combined SCC estimates from the existing literature to use as interim values until a more comprehensive analysis could be conducted. The outcome of the preliminary assessment by the interagency group was a set of five interim values: global SCC estimates for 2007 (in

2006$) of $55, $33, $19, $10, and $5 per ton of CO_2. These interim values represent the first sustained interagency effort within the U.S. government to develop an SCC for use in regulatory analysis. The results of this preliminary effort were presented in several proposed and final rules and were offered for public comment in connection with proposed rules, including the joint EPA-DOT fuel economy and CO_2 tailpipe emission proposed rules.

c. Current Approach and Key Assumptions

Since the release of the interim values, the interagency group reconvened on a regular basis to generate improved SCC estimates, which were considered for this proposed rule. Specifically, the group considered public comments and further explored the technical literature in relevant fields. The interagency group relied on three integrated assessment models (IAMs) commonly used to estimate the SCC: the FUND, DICE, and PAGE models.[23] These models are frequently cited in the peer-reviewed literature and were used in the last assessment of the Intergovernmental Panel on Climate Change. Each model was given equal weight in the SCC values that were developed.

Each model takes a slightly different approach to model how changes in emissions result in changes in economic damages. A key objective of the interagency process was to enable a consistent exploration of the three models while respecting the different approaches to quantifying damages taken by the key modelers in the field. An extensive review of the literature was conducted to select three sets of input parameters

[23] The models are described in appendix 15-A of the SNOPR TSD.

for these models: climate sensitivity, socio-economic and emissions trajectories, and discount rates. A probability distribution for climate sensitivity was specified as an input into all three models. In addition, the interagency group used a range of scenarios for the socio-economic parameters and a range of values for the discount rate. All other model features were left unchanged, relying on the model developers' best estimates and judgments.

The interagency group selected four SCC values for use in regulatory analyses. Three values are based on the average SCC from three integrated assessment models, at discount rates of 2.5 percent, 3 percent, and 5 percent. The fourth value, which represents the 95th percentile SCC estimate across all three models at a 3-percent discount rate, is included to represent higher-than-expected impacts from temperature change further out in the tails of the SCC distribution. For emissions (or emission reductions) that occur in later years, these values grow in real terms over time, as depicted in Table IV.11.

Table IV.11 Social Cost of CO_2, 2010–2050 (in 2007 dollars per metric ton)

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

It is important to recognize that a number of key uncertainties remain, and that current SCC estimates should be treated as provisional and revisable since they will evolve with improved scientific and economic understanding. The interagency group also recognizes that the existing models are imperfect and incomplete. The National Research Council report mentioned above points out that there is tension between the goal of producing quantified estimates of the economic damages from an incremental ton of carbon and the limits of existing efforts to model these effects. There are a number of concerns and problems that should be addressed by the research community, including research programs housed in many of the agencies participating in the interagency process to estimate the SCC.

DOE recognizes the uncertainties embedded in the estimates of the SCC used for cost-benefit analyses. As such, DOE and others in the U.S. Government intend to periodically review and reconsider those estimates to reflect increasing knowledge of the science and economics of climate impacts, as well as improvements in modeling. In this context, statements recognizing the limitations of the analysis and calling for further research take on exceptional significance.

In summary, in considering the potential global benefits resulting from reduced CO_2 emissions, DOE used the most recent values identified by the interagency process, adjusted to 2010$ using the GDP price deflator. For each of the four cases specified, the values used for emissions in 2010 were $4.9, $22.3, $36.5, and $67.6 per metric ton avoided (values expressed in 2010$).[24] To monetize the CO_2 emissions reductions expected to result from amended standards for microwave ovens, DOE used the values identified in Table A1 of the "Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866," which is reprinted in appendix 16-A of the SNOPR TSD, appropriately escalated to 2010$. To calculate a present value of the stream of monetary values, DOE discounted the values in each of the four cases using the specific discount rate that had been used to obtain the SCC values in each case.

Several parties provided comments regarding the economic valuation of CO_2 for the October 2008 NOPR. Whirlpool does not support an attempt to value those emissions as part of this rulemaking. (Whirlpool, No. 50 at p. 8) DOE believes that, in keeping with Executive Order 12866, placing an economic value on avoided CO_2 emissions is necessary for a proper assessment of the costs and benefits of energy efficiency standards. For this SNOPR, DOE has updated its valuation of emission reductions based on the most recent recommendations from the interagency group. DOE has considered a wide range of values per ton of avoided CO_2. As stated previously, the estimates are presented with an acknowledgement of the many uncertainties involved and with a clear understanding that they should be updated over time to reflect increasing knowledge of the science and economics of climate impacts.

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[24] Table A1 presents SCC values through 2050. For DOE's calculation, it derived values after 2050 using the 3-percent per year escalation rate used by the interagency group.

2. Valuation of Other Emissions Reductions

DOE investigated the potential monetary benefit of reduced NO_X emissions from the TSLs it considered. As noted above, new or amended energy conservation standards would reduce NO_X emissions in those 22 States that are not affected by the CAIR. DOE estimated the monetized value of NO_X emissions reductions resulting from each of the TSLs considered for today's SNOPR based on environmental damage estimates found in the relevant scientific literature. Available estimates suggest a very wide range of monetary values, ranging from $370 per ton to $3,800 per ton of NO_X from stationary sources, measured in 2001$ (equivalent to a range of $450 to $4,623 per ton in 2010$).[25] In accordance with OMB guidance, DOE conducted two calculations of the monetary benefits derived using each of the economic values used for NO_X, one using a real discount rate of 3 percent and the other using a real discount rate of 7 percent.[26]

DOE is aware of multiple agency efforts to determine the appropriate range of values used in evaluating the potential economic benefits of reduced Hg emissions. DOE has decided to await further guidance regarding consistent valuation and reporting of Hg emissions before it once again monetizes Hg in its rulemakings.

[25] For additional information, refer to U.S. Office of Management and Budget, Office of Information and Regulatory Affairs, 2006 Report to Congress on the Costs and Benefits of Federal Regulations and Unfunded Mandates on State, Local, and Tribal Entities, Washington, D.C.

[26] OMB, Circular A-4: Regulatory Analysis (Sept. 17, 2003).

L. Discussion of Other Comments

1. Off Mode Power Consumption

In the October 2008 NOPR, DOE determined that a microwave oven would be considered to be in off mode if it is plugged in to a main power source, is not being used for an active function such as cooking or defrosting, and is not consuming power for any standby mode function. 73 FR 62034, 62042 (Oct. 17, 2008). Hypothetically, a microwave with mechanical controls and no display or cooking sensor but that consumes power for components such as a power supply when the unit is not activated would be considered to be in off mode. DOE believed no such microwave ovens were available on the market, and was unaware of any microwave ovens available that could operate in off mode. Therefore, DOE proposed no off-mode power consumption energy conservation standard. DOE requested input and data regarding off mode power for microwave ovens.

Despite DOE's test results indicating that no current microwave oven can operate in off mode, AHAM recommended that some level of power should be allowed in off mode for the following reasons:

1) Harmonization, particularly with Europe, who is implementing a 0.5 W standard on off mode in 2013;
2) Consistency in standby mode and off mode definitions among all NAECA-covered products;

3) Off mode and standby mode are linked, in that standby power requirements may result in previously unused features, such as a small LED indicating that power is running to the unit, but the unit is in standby mode; and

4) Power use and conversion concerns (i.e., harmonics[27]) may necessitate some protective capability, which falls into the definition of off mode.

AHAM urged DOE to consider adopting AHAM's proposed clarifications and examples for off mode power included in Exhibit 1. These guidelines allow for a single definition to be used for all products. (AHAM, No. 47 at p. 5)

Whirlpool commented that the addition of off mode to the proposed rule is very important to assure that all power consumption is properly accounted for. (Whirlpool, No. 50 at p. 4)

DOE generally agrees with the topics addressed in these comments. Consistency between covered products and international harmonization are important issues to be considered in energy conservation standards rulemakings, as is properly accounting for all power consumption. However, DOE received no comments indicating that any microwave ovens with off mode capability are currently available or expected to become available on the market. In the concurrent microwave oven test procedure rulemaking, DOE investigated the potential for microwave ovens with an on/off switch to operate in

[27] Harmonics are waveforms of voltage or current that are multiples of the fundamental main power frequency. Harmonics can cause disruption to equipment connected to the main power and lead to component failures.

off mode. DOE determined that microwave ovens with such a configuration would be capable of operating in off mode, but that operation in off mode due to the activation of an on/off switch would be associated with zero energy consumption. Therefore, DOE continues to propose no standard for off mode power in microwave ovens because it believes there would be no benefit associated with such a standard.

2. Proposed Standards for Microwave Oven Standby Mode and Off Mode Energy Use

For the October 2008 NOPR, DOE made the preliminary determination that a maximum standby power standard of 1.0 W for microwave ovens is technologically feasible and economically justified. 73 FR 62034, 62120 (Oct. 17, 2008). DOE requested comments and views of interested parties on the proposed standards for microwave ovens. Id. at 62133.

EEI stated that the proposed standard of 1.0 W is too aggressive because typical microwave ovens have standby power consumption of 2 to 4 W. This power is used for functions that consumers find useful (such as clocks and cooking sensors). EEI noted that DOE should work with AHAM to set a different standard that does not compromise functionality. EEI suggested a standard of 2.0 to 3.0 W, which should provide more flexibility to manufacturers and provide national energy savings. (EEI, No. 56 at p. 2)

As discussed in the October 2008 NOPR and this SNOPR, DOE is aware of various strategies manufacturers could employ to reduce standby power consumption while maintaining consumer utility. DOE's analysis in today's SNOPR indicates that a 1-

W standard for microwave-only ovens and countertop combination microwave ovens would be technically feasible and economically justified. DOE is not proposing a 1-W standard for built-in and over-the-range combination microwave ovens because such a level was not found to be technically feasible while maintaining consumer utility (i.e., automatic power-down would be necessary to meet that standby power level).

The Joint Comment and ASAP support the proposed standard. According to the Joint Comment, the proposal is in keeping with national and international efforts to limit product standby power. (Joint Comment, No. 44 at p. 10; ASAP, Public Meeting Transcript, No. 40.5 at p. 32)

AHAM stated that it believes all the TSLs are appropriate, including the TSL on which the proposed standard is based. AHAM stated that much of the world is moving towards the IEA 1-Watt Program. (AHAM, Public Meeting Transcript, No. 40.5 at p. 83) Nevertheless, AHAM stated its opposition to the proposed standard, due in part to the lack of sufficient time for manufacturers to evaluate the viability or feasibility of the proposed technologies. AHAM proposed that DOE issue a “no standard” standard on microwave ovens or postpone the current rulemaking on microwave oven standby power until a robust test procedure is published and data are collected using the clarified test procedure to define potential standby power requirements. If the “no standard” standard is issued, standby power may be addressed during the next cooking products rulemaking or through negotiation. (AHAM, No. 47 at pp. 3–4) AHAM also commented that the proposed standard’s effective date of 2012 is inconsistent with the timing in the rest of the world. (AHAM, Public Meeting Transcript, No. 40.5 at p. 27) GE recommended that DOE should postpone the microwave oven standby power rulemaking until a robust test procedure is published or, in the alternative, issue a “no standard” standard on microwave ovens. GE further stated that it believes there are critical gaps in the engineering analysis used to justify the proposed standard. (GE, No. 48 at p. 2) GE commented that if the microwave oven standby and off mode rulemaking is not postponed, DOE should issue a "no standard" standard on microwave ovens. (GE, No. 48 at p. 2)

Whirlpool commented that it does not support the proposed standard. (Whirlpool, No. 50 at p. 1) Further, Whirlpool stated that DOE’s rulemaking timeline should take into account international changes in microwave oven standards. According to Whirlpool, any changes in U.S. policy that coincided with changes in policy around the world would be significantly advantageous to manufacturers. (Whirlpool, Public Meeting Transcript, No. 40.5 at p. 29)

Since the publication of the October 2008 NOPR, DOE has amended the microwave oven test procedure for microwave ovens to measure standby mode and off mode power consumption. These amendments appear in the March 2011 TP Interim Final Rule. 76 FR 12825 (Mar. 9, 2011). The amendments incorporate by reference certain provisions of IEC Standard 62301 First Edition, 2005-06, which is an international test procedure addressing standby mode and off mode power measurement. In addition, in order to ensure that the amended test procedure adequately addresses the EISA 2007 requirement to consider the most recent version of IEC Standard 62301 (42

U.S.C. 6295(gg)(2)(A)), and recognizing that the IEC was expected to issue IEC Standard 62301 (Second Edition) in the same timeframe as DOE was planning to publish the amended test procedure, DOE issued the microwave oven test procedure on an interim final basis. The March 2011 TP Interim Final Rule offered a 180-day comment period, and to the extent necessary, DOE is considering appropriate adjustments based on comments received. Also since the publication of the October 2008 NOPR, DOE conducted further analyses in support of this energy conservation standards rulemaking, including the evaluation of combination microwave ovens.

In considering standards for today's SNOPR, DOE is proposing two product classes for microwave ovens: 1) microwave-only ovens and countertop combination microwave ovens; and 2) built-in and over-the-range combination microwave ovens. DOE believes the analyses conducted for microwave ovens in the October 2008 NOPR remains valid for the microwave-only oven and countertop combination microwave oven product class. However, these analyses have been updated to reflect more current results, where applicable. DOE conducted additional analyses for the built-in and over-the-range combination microwave oven product class. The approach and results for proposed standard levels for today's SNOPR are discussed in section IV.

3. Manufacturer Tax Credits Impact on Market Adoption of More Efficient Products

Whirlpool commented that the analysis cites dated studies which suggest that the consumer sees little economic benefit of manufacturer tax credits. Not covered in this analysis is that the tax credits provide manufacturers some of the cash flow necessary to invest in the development of ever more efficient products. Thus, the consumer sees significant benefit in the form of increasingly energy and water efficient products in the marketplace. (Whirlpool, No. 50 at p. 9)

As described in chapter 17 of the SNOPR TSD on the Regulatory Impact Analysis (RIA), DOE analyzed non-regulatory alternatives to minimum energy conservation standards, including manufacturer tax credits. The RIA assesses the national energy savings and economic impacts (i.e., NPV) of the non-regulatory alternatives relative to the national impacts from minimum energy conservation standards. In the case of manufacturer tax credits, DOE agrees that they provide manufacturers the financial means to develop and sell more efficient products and that the resulting consumer purchase price would be partially mitigated by the tax credits. However, DOE estimated that tax credits would be paid for by consumers in another form (such as additional taxes), and therefore did not include them as a consumer benefit for the purposes of calculating the national NPV. DOE did estimate that manufacturer tax credits will lead to an increase in the sales of more energy-efficient products. DOE determined, however, that the rate of adoption of more efficient products due to manufacturer tax credits is not as great as that from mandatory minimum energy conservation standards. For more details on DOE's analysis of manufacturer tax credits and all non-regulatory alternatives, refer to chapter 17 of the SNOPR TSD.

V. **Analytical Results**

A. Trial Standard Levels

DOE analyzed the benefits and burdens of a number of TSLs for the microwave oven standby mode and off mode energy use that are the subject of today's proposed rule. For the October 2008 NOPR, DOE based the TSLs on standby power levels explored in the November 2007 ANOPR, and selected the TSLs on consideration of economic factors and current market conditions. As discussed previously in section IV, given the small number of standby power levels analyzed, DOE maintained all four of the standby power levels to consider as TSLs.

Table V.1 shows the TSLs for microwave oven standby mode and off mode energy use. In all, DOE has considered four TSLs. TSL 1 corresponds to the first candidate standard level from each product class and represents the standby power level for each class with the least significant design change. TSL 4 corresponds to the max-tech efficiency levels. TSLs 2 and 3 are intermediate levels between TSL 1 and TSL 4.

Table V.1 Trial Standard Levels for Microwave Oven Standby Mode and Off Mode Energy Use

Trial Standard Level	**Standby Power (W)**	
	Product Class 1: Microwave-Only and Countertop Combination	**Product Class 2: Built-In and Over-the-Range Combination**
TSL 1	2.00	3.70
TSL 2	1.50	2.70
TSL 3	1.00	2.20
TSL 4	0.02	0.04

B. Economic Justification and Energy Savings

1. Economic Impacts on Consumers

a. Life-Cycle Cost and Payback Period

To evaluate the net economic impact of standards on consumers, DOE conducted LCC and PBP analyses for each TSL. In general, a higher-efficiency product would affect consumers in two ways: (1) annual operating expense would decrease; and (2) purchase price would increase. Section IV.D of this notice discusses the inputs DOE used for calculating the LCC and PBP.

The key outputs of the LCC analysis are a mean LCC savings relative to the baseline product design, as well as a probability distribution or likelihood of LCC reduction or increase, for each TSL and product class. The LCC analysis also estimates the fraction of consumers for which the LCC will decrease (net benefit), increase (net cost), or exhibit no change (no impact) relative to the base-case product forecast. No impacts occur when the product efficiencies of the base-case forecast already equal or exceed the efficiency at a given TSL.

Table V.2 and Table V.3 show the LCC and PBP results for both microwave oven product classes. Note that for built-in and over-the-range combination microwave ovens, 100 percent of consumers of such products in 2014 are assumed to be using a combination microwave oven in the base case. Any decrease in standby power would affect 100 percent of the market.

Table V.2 Microwave-Only Ovens and Countertop Combination Microwave Ovens: Life-Cycle Cost and Payback Period Results

		Life-Cycle Cost ($)			Life-Cycle Cost Savings				Payback Period (years)
						% Households with			
TSL	Standby Power (W)	Average Installed Price	Average Operating Cost	Average LCC	Average Savings $	Net Cost	No Impact	Net Benefit	Median
Baseline	4.00	$223	$31	$254	NA	0%	100%	0%	NA
1	2.00	$224	$15	$239	$7	0%	54%	46%	0.2
2	1.50	$224	$12	$236	$10	0%	19%	81%	0.4
3	1.00	$225	$8	$233	$13	0%	0%	100%	1.1
4	0.02	$230	$0	$230	$15	0%	0%	100%	2.4

Table V.3 Built-In and Over-the-Range Combination Microwave Ovens: Life-Cycle Cost and Payback Period Results

		Life-Cycle Cost ($)			Life-Cycle Cost Savings				Payback Period (years)
						% Households with			
TSL	Standby Power (W)	Average Installed Price	Average Operating Cost	Average LCC	Average Savings	Net Cost	No Impact	Net Benefit	Median
Baseline	4.50	$482	$35	$517	NA	0%	100%	0%	NA
1	3.70	$482	$29	$511	$6	0%	0%	100%	0.0
2	2.70	$486	$21	$506	$11	0%	0%	100%	1.9
3	2.20	$496	$17	$513	$4	21%	0%	79%	6.3
4	0.04	$490	$0	$490	$27	0%	0%	100%	1.8

b. Consumer Subgroup Analysis

Using the LCC spreadsheet model, DOE determined the impact of the standards on the following microwave oven consumer subgroups: senior-only households and low-income households. Table V.4 and Table V.5 compare the average LCC savings for senior-only households and low-income households with those for all households. The LCC impacts for senior-only and low-income households are essentially the same as they are for the general population.

Table V.4 Microwave-Only Ovens and Countertop Combination Microwave Ovens: Comparison of Average LCC Savings for Consumer Subgroups and All Households

TSL	Standby Power (W)	Senior-Only Households	Low-Income Households	All Households
1	2.00	$7	$7	$7
2	1.50	$10	$10	$10
3	1.00	$12	$12	$13
4	0.02	$15	$15	$15

Table V.5 Built-In and Over-the-Range Combination Microwave Ovens: Comparison of Average LCC Savings for Consumer Subgroups and All Households

TSL	Standby Power (W)	Senior-Only Households	Low-Income Households	All Households
1	3.70	$6	$6	$6
2	2.70	$10	$10	$11
3	2.20	$4	$4	$4
4	0.04	$27	$27	$27

c. Rebuttable-Presumption Payback

As discussed above, EPCA establishes a rebuttable presumption that, in essence, an energy conservation standard is economically justified if the increased purchase cost for 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)) DOE calculated a rebuttable-presumption payback period for each TSL to determine whether DOE could presume that a standard at that level is economically justified. Table V.6 shows the rebuttable-presumption payback periods for the microwave oven standby mode and off mode TSLs. Because only a single, average value is necessary for establishing the rebuttable-presumption payback period, rather than using distributions for input values, DOE used discrete values. As required by EPCA, DOE based the calculation on the assumptions in the DOE test procedures for microwave ovens. (42 U.S.C. 6295(o)(2)(B)(iii)) As a result, DOE calculated a single rebuttable-presumption payback value, and not a distribution of payback periods, for each TSL.

Table V.6 Rebuttable-Presumption Payback Periods for Microwave Oven Standby Mode and Off Mode

	Payback Period (years)	
TSL	**Microwave-Only Ovens and Countertop Combination Ovens**	**Built-In and Over-the-Range Combination Microwave Ovens**
1	0.2	0.0
2	0.3	1.8
3	0.6	5.6
4	1.6	1.6

With the exception of TSL 3 for built-in and over-the-range combination microwave ovens, all the TSLs in the above tables have rebuttable-presumption payback periods of less than 3 years. DOE believes that the rebuttable-presumption payback period criterion (i.e., a limited payback period) is not sufficient for determining economic justification. Therefore, DOE has considered a full range of impacts, including those to consumers, manufacturers, the Nation, and the environment. Section IV.D provides a complete discussion of how DOE considered the range of impacts to select its proposed standards.

2. Economic Impacts on Manufacturers

For the October 2008 NOPR, DOE used INPV to compare the financial impacts of different TSLs on microwave oven manufacturers. 73 FR 62034, 62096–99 (Oct. 17, 2008). The INPV is the sum of all net cash flows discounted by the industry's cost of capital (discount rate). DOE used the GRIM to compare the INPV of the base case (no new energy conservation standards) to that of each TSL for the microwave oven industry. To evaluate the range of cash-flow impacts on the microwave oven industry, DOE constructed different scenarios using different markups that correspond to the range of anticipated market responses. Each scenario results in a unique set of cash flows and corresponding industry value at each TSL. These steps allowed DOE to compare the potential impacts on the industry as a function of TSLs in the GRIM. The difference in INPV between the base case and the standards case is an estimate of the economic impacts that implementing that standard level would have on the entire industry. For today's supplemental notice, DOE continues to use the above methodology and presents the results in the subsequent sections. See chapter 12 for additional information on MIA methodology and results.

a. Industry Cash-Flow Analysis Results

To assess the lower end of the range of potential impacts for the microwave oven industry, DOE considered the scenario reflecting the preservation of gross margin percentage. As production cost increases with efficiency, this scenario implies manufacturers will be able to maintain gross margins as a percentage of revenues. To assess the higher end of the range of potential impacts for the microwave oven industry, DOE considered the scenario reflecting preservation of gross margin in absolute dollars. Under this scenario, DOE assumed that the industry can maintain its gross margin in absolute dollars after the compliance date of the energy conservation standard. The industry would do so by lowering their gross margin as a percentage of revenue so that the gross margin in absolute dollars does not increase above the base-case gross margin. Table V.7 through Table V.12 show MIA results for standby mode and off mode energy conservation standards using both markup scenarios described above for microwave oven manufacturers.

Table V.7 Product Class 1 Manufacturer Impact Analysis Under the Preservation of Gross Margin Percentage Markup Scenario

Preservation of Gross Margin Percentage Markup Scenario						
	Units	**Base Case**	**TSL**			
			1	**2**	**3**	**4**
Change in INPV	2010$ millions	1,103.4	1,076.6	1,058.6	1,050.6	1,013.9
Change in INPV	2010$ millions	-	(26.8)	(44.9)	(52.8)	(89.6)
	%	-	(2.4)	(4.1)	(4.8)	(8.1)
Product Conversion Costs	2010$ millions	-	39.2	70.5	89.1	172.3
Capital Conversion Costs	2010$ millions	-	3.9	4.3	4.7	7.8
Total Investment Required	2010$ millions	-	43.1	74.8	93.8	180.1

Parentheses indicate negative (-) values.

Table V.8 Product Class 1 Manufacturer Impact Analysis Under the Preservation of Gross Margin in Absolute Dollars Markup Scenario

Preservation of Gross Margin Percentage Markup Scenario						
	Units	Base Case	TSL			
			1	2	3	4
Change in INPV	2010$ millions	1,103.4	1,074.4	1,051.8	1,031.6	939.5
Change in INPV	2010$ millions	-	(29.0)	(51.7)	(71.9)	(163.9)
	%	-	(2.6)	(4.7)	(6.5)	(14.9)
Product Conversion Costs	2010$ millions	-	39.2	70.5	89.1	172.3
Capital Conversion Costs	2010$ millions	-	3.9	4.3	4.7	7.8
Total Investment Required	2010$ millions	-	43.1	74.8	93.8	180.1

Parentheses indicate negative (-) values.

Table V.9 Product Class 2 Manufacturer Impact Analysis Under the Preservation of Gross Margin Percentage Markup Scenario

Preservation of Gross Margin Percentage Markup Scenario						
	Units	Base Case	TSL			
			1	2	3	4
Change in INPV	2010$ millions	24.0	23.8	23.7	23.9	23.2
Change in INPV	2010$ millions	-	(0.3)	(0.4)	(0.1)	(0.9)
	%	-	(1.2)	(1.5)	(0.3)	(3.6)
Product Conversion Costs	2010$ millions	-	0.4	0.7	0.9	1.7
Capital Conversion Costs	2010$ millions	-	0.0	0.0	0.0	0.1
Total Investment Required*	2010$ millions	-	0.4	0.8	0.9	1.8

Parentheses indicate negative (-) values.
* The total values may differ from the sum of the product conversion costs and capital conversion costs due to the rounding to one decimal place.

Table V.10 Product Class 2 Manufacturer Impact Analysis Under the Preservation of Gross Margin in Absolute Dollars Markup Scenario

Preservation of Gross Margin Percentage Markup Scenario						
	Units	Base Case	TSL			
			1	2	3	4
Change in INPV	2010$ millions	24.0	23.8	23.3	22.3	22.3
Change in INPV	2010$ millions	-	(0.3)	(0.8)	(1.7)	(1.8)
	%	-	(1.2)	(3.1)	(7.1)	(7.3)
Product Conversion Costs	2010$ millions	-	0.4	0.7	0.9	1.7
Capital Conversion Costs	2010$ millions	-	0.0	0.0	0.0	0.1
Total Investment Required*	2010$ millions	-	0.4	0.8	0.9	1.8

Parentheses indicate negative (-) values.
* The total values may differ from the sum of the product conversion costs and capital conversion costs due to the rounding to one decimal place.

Table V.11 Manufacturer Impact Analysis Under the Preservation of Gross Margin Percentage Markup Scenario for Product Class 1 and 2 Combined

Preservation of Gross Margin Percentage Markup Scenario						
	Units	Base Case	TSL			
			1	2	3	4
Change in INPV	2010$ millions	1,127.5	1,100.4	1,082.2	1,074.5	1,037.0
Change in INPV	2010$ millions	-	(27.1)	(45.2)	(52.9)	(90.4)
	%	-	(2.4)	(4.0)	(4.7)	(8.0)
Product Conversion Costs	2010$ millions	-	39.6	71.2	90.0	174.0
Capital Conversion Costs	2010$ millions	-	4.0	4.4	4.7	7.9
Total Investment Required*	2010$ millions	-	43.5	75.5	94.7	181.9

Parentheses indicate negative (-) values.
* The total values may differ from the sum of the product conversion costs and capital conversion costs due to the rounding to one decimal place.

Table V.12 Manufacturer Impact Analysis Under the Preservation of Gross Margin in Absolute Dollars Markup Scenario for Product Class 1 and 2 Combined

Preservation of Gross Margin Percentage Markup Scenario						
	Units	Base Case	TSL			
			1	2	3	4
Change in INPV	2010$ millions	1,127.5	1,098.2	1,075.0	1,053.9	961.8
Change in INPV	2010$ millions	-	(29.3)	(52.4)	(73.6)	(165.7)
	%	-	(2.6)	(4.6)	(6.5)	(14.7)
Product Conversion Costs	2010$ millions	-	39.6	71.2	90.0	174.0
Capital Conversion Costs	2010$ millions	-	4.0	4.4	4.7	7.9
Total Investment Required*	2010$ millions	-	43.5	75.5	94.7	181.9

Parentheses indicate negative (-) values.
* The total values may differ from the sum of the product conversion costs and capital conversion costs due to the rounding to one decimal place.

TSL 1 represents an improvement in standby power from the baseline level of 4.0 W to 2.0 W for Product Class 1 and an improvement in standby power from the baseline level of 4.5 W to 3.7 W for Product Class 2. At TSL 1, the impact on INPV and cash flow varies depending on the manufacturers' ability to pass on increases in MPCs to their customers. DOE estimated the impacts in INPV at TSL 1 to range -$27.1 million to -$29.3 million, or a change in INPV of -2.4 percent to -2.6 percent. At this level, the industry cash flow decreases by approximately 14.0 percent, to $72.3 million, compared to the base-case value of $84.2 million in the year leading up to the standards.

TSL 2 represents an improvement in standby power from the baseline level of 4.0 W to 1.5 W for Product Class 1 and an improvement in standby power from the baseline level of 4.5 W to 2.7 W for Product Class 2. At TSL 2, the impact on INPV and cash flow would be similar to TSL 1 and depend on whether manufacturers can fully recover the increases in MPCs from their customers. DOE estimated the impacts in INPV at TSL 2 to range from -$45.2 million to -$52.4 million, or a change in INPV of -4.0 percent to -4.6 percent. At this level, the industry cash flow decreases by approximately 24.0 percent, to $64.0 million, compared to the base-case value of $84.2 million in the year leading up to the standards.

TSL 3 represents an improvement in standby power from the baseline level of 4.0 W to 1.0 W for Product Class 1 and an improvement in standby power from the baseline level of 4.5 W to 2.2 W for Product Class 2. At TSL 3, the impact on INPV and cash flow continues to vary depending on the manufacturers and their ability to pass on increases in MPCs to their customers. DOE estimated the impacts in INPV at TSL 3 to range from approximately -$52.9 million to -$73.6 million, or a change in INPV of -4.7 percent to -6.5 percent. At this level, the industry cash flow decreases by approximately 29.9 percent, to $59.0 million, compared to the base-case value of $84.2 million in the year leading up to the standards.

TSL 4 represents an improvement in standby power from the baseline level of 4.0 W to 0.02 W for Product Class 1 and an improvement in standby power from the baseline level of 4.5 W to 0.04 W for Product Class 2. At TSL 4, DOE estimated the impacts in INPV to range from approximately -$90.4 million to -$165.7 million, or a change in INPV of -8.0 percent to -14.7 percent. At this level, the industry cash flow decreases by approximately 57.3 percent, to $35.9 million, compared to the base-case value of $84.2 million in the year leading up to the standards. At higher TSLs, manufacturers have a harder time fully passing on larger increases in MPCs to their customers. At TSL 4, the conversion costs are higher than the other TSLs because the design of all microwave platforms must be more significantly altered.

For new standby mode and off mode energy conservation standards, conversion costs increase at higher TSLs as the complexity of further lowering standby power increases, substantially driving up engineering time and also increasing the testing and product development time. If the increased production costs are fully passed on to consumers (the preservation of gross margin percentage scenario), the operating revenue from higher prices is still not enough to overcome the negative impacts from the substantial conversion costs. The incremental costs are small for each TSL, meaning the positive impact on cash flows is small compared to the conversion costs required to achieve these efficiencies. As a result of the small incremental costs and large conversion expenses, INPV is negative for all TSLs under the preservation of gross margin percentage scenario. If the incremental costs are not fully passed along to customers (the preservation of gross margin (absolute dollars) scenario), the negative impacts on INPV are amplified at each TSL.

b. Employment Impacts

DOE discussed the domestic employment impacts on the microwave oven industry in the October NOPR. DOE concluded that since more than 95 percent of microwave ovens are already imported and the employment impacts in the GRIM are small, the actual impacts on domestic employment would depend on whether any U.S.

manufacturer decided to shift remaining U.S. production to lower-cost countries. 73 FR 62034, 62101–02 (Oct. 17, 2008).

c. Impacts on Manufacturing Capacity

As stated in the NOPR, minor tooling changes would be necessary at all TSLs for standby mode and off mode standards. For all standby power levels, the most significant conversion costs are the research and development, testing, and certification of products with more-efficient components, which does not affect production line capacity. Thus, DOE believes manufacturers will be able to maintain manufacturing capacity levels and continue to meet market demand under new energy conservation standards. 73 FR 62034, 62103 (Oct. 17, 2008).

d. Impacts on Subgroups of Manufacturers

DOE used the results of the industry characterization to group manufacturers exhibiting similar characteristics. However, DOE did not identify any manufacturer subgroups for microwave ovens that would justify a separate manufacturer subgroup.

e. Cumulative Regulatory Burden

During previous stages of this rulemaking DOE identified a number of requirements with which manufacturers of these microwave ovens must comply and which take effect within 3 years of the anticipated compliance date of the proposed new standards. DOE discusses these and other requirements, and includes the full details of the cumulative regulatory burden, in chapter 12 of the SNOPR TSD.

3. National Impact Analysis

a. Significance of Energy Savings

To estimate the energy savings through 2043 attributable to potential standards for microwave oven standby mode and off mode, DOE compared the energy consumption of those products under the base case to their energy consumption under each TSL. Table V.13 presents the forecasted NES for each TSL for microwave oven standby mode and off mode. The savings were calculated using the approach described in section IV.E.

Table V.13 Cumulative National Energy Savings for Microwave Oven Standby Mode and Off Mode Power in 2014–2043

TSL	Microwave-Only Ovens and Countertop Combination Ovens (quads)	Built-In and Over-the-Range Combination Microwave Ovens (quads)	Total* (quads)
1	0.21	0.00	0.21
2	0.30	0.00	0.30
3	0.41*	0.01*	0.41
4	0.62	0.01	0.63

* The total values may differ from the sum of the product class sub-totals due to the rounding to two decimal places.

Chapter 10 of the SNOPR TSD provides additional details on the NES values reported in Table V.13, and also presents tables that show the magnitude of the energy savings discounted at rates of 3 percent and 7 percent. Discounted energy savings represent a policy perspective in which energy savings realized farther in the future are less significant than energy savings realized in the nearer term.

b. Net Present Value of Consumer Costs and Benefits

DOE estimated the cumulative NPV to the Nation of the total costs and savings for consumers that would result from particular standard levels for microwave oven standby mode and off mode. In accordance with the OMB's guidelines on regulatory analysis,[28] DOE calculated NPV using both a 7-percent and a 3-percent real discount rate. The 7-percent rate is an estimate of the average before-tax rate of return on private capital in the U.S. economy, and reflects the returns on real estate and small business capital as well as corporate capital. DOE used this discount rate to approximate the opportunity cost of capital in the private sector, because recent OMB analysis has found the average rate of return on capital to be near this rate. DOE used the 3-percent rate to capture the potential effects of standards on private consumption (e.g., through higher prices for products and reduced purchases of energy). This rate represents the rate at which society discounts future consumption flows to their present value. This rate can be approximated by the real rate of return on long-term government debt (i.e., yield on Treasury notes minus annual rate of change in the Consumer Price Index), which has averaged about 3 percent on a pre-tax basis for the past 30 years.

Table V.14 shows the consumer NPV results for each TSL DOE considered for both product classes of microwave ovens, using both a 7-percent and a 3-percent discount rate. In each case, the impacts, i.e., discounted operating cost savings and discounted incremental equipment costs, cover the lifetime of products purchased in 2014–2043. For

[28] OMB Circular A-4, section E (Sept. 17, 2003). Available at: http://www.whitehouse.gov/omb/circulars_a004_a-4. (Last accessed March 18, 2011.)

Product Class 1 (microwave-only and countertop combination microwave ovens), the benefit-to-cost ratio is greater than or equal to nine for TSLs 1, 2, and 3 and greater than three for TSL 4, irrespective of discount rate. For Product Class 2 (built-in and over-the-range combination microwave ovens), TSLs 2 and 4 have benefit-to-cost ratios of approximately five, irrespective of discount rate, while TSL 1, which incurs no additional cost relative to the baseline, has a limitless benefit-to-cost ratio. At TSL3, the benefits are 30 percent and 50 percent greater than the costs at discount rates of 7-percent and 3-percent, respectively. See chapter 10 of the SNOPR TSD for more detailed NPV results.

Table V.14 Cumulative Net Present Value of Consumer Benefits for Microwave Oven Standby Mode and Off Mode for Units Sold 2014–2043

TSL	Net Present Value (billion 2010$)					
	Microwave-Only Ovens and Countertop Combination Microwave Ovens		Built-In and Over-the-Range Combination Microwave Ovens		Total*	
	7% Discount Rate	3% Discount Rate	7% Discount Rate	3% Discount Rate	7% Discount Rate	3% Discount Rate
1	1.01	1.97	0.01	0.02	1.02	1.98
2	1.41	2.75	0.02	0.03	1.42	2.78
3	1.81	3.58	0.01	0.02	1.82	3.59
4	2.21	4.53	0.04	0.08	2.25	4.60

* The total values may differ from the sum of the product class sub-totals due to the rounding to two decimal places.

The NPV results presented in Table V.14 are based on a learning rate of 28.9 percent, which is referred to as the “default” learning rate. DOE investigated the impact of different learning rates for product prices for the TSLs considered for microwave oven standby mode and off mode. DOE considered four learning rate sensitivities: (1) a “high learning” rate (37.0 percent); (2) a “low learning” rate (19.2 percent); (3) a “no learning” rate (constant real prices); and (4) a "microwave oven only" rate. The "microwave oven only" is based on limited set of historical price data specifically for microwave ovens. DOE also analyzed a sensitivity based on the "chained price index--other consumer durable goods except ophthalmic" that was forecasted for use in *AEO2010*. This index is the most disaggregated category that includes appliances. Refer to appendix 8-E of the SNOPR TSD for details on the development of the above learning sensitivities.

Table V.15 provides the annualized NPV of consumer benefits at a 3-percent discount rate, combined with the annualized present value of monetized benefits from CO_2 and NO_X emissions reductions, for each of the TSLs for the "default" learning rate and the sensitivity cases. Table V.16 provides the annualized NPVs using a 7-percent discount rate for consumer NPV. Section V.B.6 provides a complete description and summary of the monetized benefits from CO_2 and NO_X emissions reductions. For most of the TSLs, the difference between the default results and the sensitivities is insignificant.

Table V.15 Microwave Oven Standby Mode and Off Mode: Annualized Net Present Value of Consumer Benefits (3 Percent Discount Rate) and Annualized Present Value of Monetized Benefits from CO_2 and NO_X Emissions Reductions for Products Shipped in 2014-2043*

Trial Standard Level	**Default** LR =28.9%	**Low Learning** LR =19.2%	**High Learning** LR =37.0%	**No Learning** LR = 0% (constant real prices)	**Microwave Ovens Only** LR = 39.6%	**AEO2010 Chained Price Index Forecast**
	Billion 2010$					
1	0.12	0.12	0.12	0.12	0.12	0.12
2	0.17	0.17	0.17	0.17	0.17	0.17
3	0.22	0.22	0.22	0.22	0.22	0.22
4	0.29	0.29	0.30	0.27	0.30	0.30

* The economic benefits from reduced CO_2 emissions were calculated using a SCC value of $22.3/metric ton in 2010 (in 2010$) for CO_2, increasing at 3% per year, and a discount rate of 3%. The economic

benefits from reduced NO_X emissions were calculated using a value of $2,537/ton (in 2010$), which is the average of the low and high values used in DOE's analysis, and a 3-percent discount rate. Because the discounted equipment cost increases at each TSL are very small relative to the discounted operating cost savings and the discounted monetized benefits of the emission reductions, the NPV as a function of learning rate does not change appreciably. In fact, the learning rate has a significant effect only on the NPV for TSL 4 where discounted equipment cost increases are relatively more significant.

Table V.16 Microwave Oven Standby Mode and Off Mode: Annualized Net Present Value of Consumer Benefits (7 Percent Discount Rate) and Annualized Present Value of Monetized Benefits from CO_2 and NO_X Emissions Reductions for Products Shipped in 2014-2043*

Trial Standard Level	**Default** LR =28.9%	**Low Learning** LR =19.2%	**High Learning** LR =37.0%	**No Learning** LR = 0% (constant real prices)	**Sensitivity (Microwave Ovens Only)** LR = 39.6%	**AEO2010 Chained Price Index Forecast**
	Billion 2010$					
1	0.10	0.10	0.10	0.10	0.10	0.10
2	0.14	0.14	0.14	0.14	0.14	0.14
3	0.18	0.18	0.18	0.18	0.19	0.18
4	0.24	0.23	0.24	0.22	0.25	0.24

* The economic benefits from reduced CO_2 emissions were calculated using a SCC value of $22.3/metric ton in 2010 (in 2010$) for CO_2, increasing at 3% per year, and a discount rate of 3%. The economic benefits from reduced NO_X emissions were calculated using a value of $2,537/ton (in 2010$), which is the average of the low and high values used in DOE's analysis, and a 7-percent discount rate. Because the discounted equipment cost increases at each TSL are very small relative to the discounted operating cost savings and the discounted monetized benefits of the emission reductions, the NPV as a function of learning rate does not change appreciably. In fact, the learning rate has a significant effect only on the NPV for TSL 4 where discounted equipment cost increases are relatively more significant.

c. Indirect Impacts on Employment

DOE develops estimates of the indirect employment impacts of proposed standards on the economy in general. As discussed above, DOE expects energy conservation standards for microwave ovens to reduce energy bills for consumers of those products, and the resulting net savings to be redirected to other forms of economic activity. Those shifts in spending and economic activity could affect the demand for labor. As described in section IV.H, to estimate those effects, DOE used an input/output model of the U.S. economy. DOE estimated the indirect employment impacts for the TSLs for both product classes of microwave ovens that DOE considered in this rulemaking. DOE understands that there are uncertainties involved in projecting employment impacts, especially changes in the later years of the analysis. Therefore, DOE generated results for intermediate timeframes, such as 2015, where these uncertainties are reduced.

The results suggest the proposed standards are likely to have negligible impact on the net demand for labor in the economy. The net change in jobs is so small that it would be imperceptible in national labor statistics and might be offset by other, unanticipated effects on employment. Chapter 13 of the SNOPR TSD presents the detailed results.

4. Impact on Utility or Performance of Product

For the reasons stated in section III.D.1.d, DOE believes that for purposes of 42 U.S.C. 6295(o)(2)(B)(i)(IV), the standby power level considered in this supplemental notice does not reduce the utility or performance of the microwave oven products under consideration in this rulemaking.

5. Impact of Any Lessening of Competition

In weighing the promulgation of any proposed standards, DOE is required to consider any lessening of competition that is likely to result from the adoption of those standards. The determination of the likely competitive impacts stemming from a proposed standard is made by the Attorney General, who transmits this determination, along with an analysis of the nature and extent of the impact, to the Secretary of Energy. (42 U.S.C. 6295(o)(2)(B)(i)(VI) and (B)(ii))

The Attorney General's determination for the October 2008 NOPR included cooking products but did not mention microwave oven standards. (DOJ, No. 53 at pp. 1–2). To assist the Attorney General in making such a determination for the proposed standby mode and off mode standards, DOE has provided the Attorney General with copies of this notice and the TSD for review. DOE will consider the Attorney General's opinion on the proposed rule in preparing the final rule.

6. Need of the Nation to Conserve Energy

Improving the energy consumption of microwave oven standby mode and off mode, where economically justified, would likely improve the security of the Nation's energy system by reducing overall demand for energy. Reduced electricity demand may also improve the reliability of the electricity system. As a measure of this reduced demand, Table V.17 presents the estimated reduction in national generating capacity for the TSLs that DOE considered in this rulemaking.

Table V.1717 Reduction in National Installed Electricity Generation Capacity under Microwave Oven Standby Mode and Off Mode Trial Standard Levels

	Gigawatts	
TSL	**2030**	**2043**
1	0.190	0.196
2	0.274	0.284
3	0.377	0.390
4	0.581	0.601

Energy savings from more stringent microwave oven standby mode and off mode standards would also produce environmental benefits in the form of reduced emissions of air pollutants and greenhouse gases associated with electricity production. Table V.18 provides DOE's estimate of cumulative CO_2 and NO_X emissions reductions that would result from the TSLs considered in this rulemaking. (Hg emission impacts are negligible and therefore not reported here.) In the environmental assessment (chapter 15 of the SNOPR TSD), DOE reports estimated annual changes in CO_2, NO_X, and Hg emissions attributable to each TSL.

Table V.18 Cumulative Emissions Reductions under Microwave Oven Standby Mode and Off Mode Trial Standard Levels in 2014–2043

	TSL			
	1	**2**	**3**	**4**
CO_2 (Mt)	15.84	22.88	31.48	48.46
NO_X (1,000 tons)	12.88	18.61	25.60	39.42

Mt = million metric tons. Values for NO_x emissions reductions refer to short tons.

As discussed in section IV.J of this supplemental notice, DOE has not reported SO_2 emissions reductions from power plants because there is uncertainty about the effect of energy conservation standards on the overall level of SO_2 emissions in the United States due to SO_2 emissions caps. DOE also did not include NO_X emissions reduction from power plants in States subject to CAIR because an energy conservation standard would not affect the overall level of NO_X emissions in those States due to the emissions caps mandated by CAIR.

DOE also estimated monetary benefits likely to result from the reduced emissions of CO_2 and NO_X that DOE estimated for each of the TSLs considered for microwave oven standby mode and off mode. In order to make this calculation similar to the calculation of the NPV of consumer benefit, DOE considered the reduced emissions expected to result over the lifetime of products shipped in 2014–2043. Thus, the emissions reductions extend past 2043.

As discussed in section IV.K, DOE used values for the SCC developed by an interagency process. The four values for CO_2 emissions reductions resulting from that process (expressed in 2010$) are $4.9/ton (the average value from a distribution that uses a 5-percent discount rate), $22.3/ton (the average value from a distribution that uses a 3-percent discount rate), $36.5/ton (the average value from a distribution that uses a 2.5-percent discount rate), and $67.6/ton (the 95th-percentile value from a distribution that uses a 3-percent discount rate). These values correspond to the value of emission reductions in 2010; the values for later years are higher due to increasing damages as the magnitude of climate change increases. For each of the four cases, DOE calculated a present value of the stream of annual values using the same discount rate as was used in the studies upon which the dollar-per-ton values are based. Table V.19 presents the global values of CO_2 emissions reductions at each TSL. DOE calculated domestic values as a range from 7 percent to 23 percent of the global values, and these results are presented in chapter 16 of the SNOPR TSD.

Table V.19 Estimates of Present Value of CO_2 Emissions Reductions Under Microwave Oven Standby Mode and Off Mode Trial Standard Levels for Products Sold in 2014–2043

TSL	Million 2010$			
	5% discount rate, average*	**3% discount rate, average***	**2.5% discount rate, average***	**3% discount rate, 95th percentile***
1	$70	$349	$589	$1,066
2	$101	$505	$851	$1,539
3	$139	$694	$1,170	$2,118
4	$213	$1,069	$1,801	$3,259

***** Columns are labeled by the discount rate used to calculate the SCC and whether it is an average value or drawn from a different part of the distribution.

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

DOE also estimated a range for the cumulative monetary value of the economic benefits associated with NO_X emissions reductions anticipated to result from new standby mode and off mode standards for microwave ovens. The dollar-per-ton values that DOE used are discussed in section IV.K. Table V.20 presents the cumulative present values for each TSL calculated using 7-percent and 3-percent discount rates.

Table V.20 Estimates of Present Value of NO_X Emissions Reductions Under Microwave Oven Standby Mode and Off Mode Trial Standard Levels for Products Sold in 2014–2043

TSL	**3% discount rate** Million 2010$	**7% discount rate** Million 2010$
1	3.74 to 38.46	1.92 to 19.76
2	5.41 to 55.56	2.78 to 28.55
3	7.44 to 76.44	3.82 to 39.28
4	11.45 to 117.7	5.89 to 60.5

The NPV of the monetized benefits associated with emissions reductions can be viewed as a complement to the NPV of the consumer savings calculated for each TSL considered in this rulemaking. Table V.21 and Table V.22 presents the NPV values that result from adding the estimates of the potential economic benefits resulting from reduced CO_2 and NO_X emissions in each of four valuation scenarios to the NPV of consumer savings calculated for each TSL considered in this rulemaking, at both a 7-percent and 3-percent discount rate. The CO_2 values used in the columns of each table correspond to the four scenarios for the valuation of CO_2 emission reductions presented in section IV.K.

Table V.21 Results of Adding Net Present Value of Consumer Savings (at 7-Percent Discount Rate) to Net Present Value of Monetized Benefits from CO_2 and NO_X Emissions Reductions for Microwave Oven Standby Mode and Off Mode

TSL	Consumer NPV at 7% Discount Rate added with:			
	SCC Value of \$4.9/metric ton CO_2* and Low Value for NO_X** billion 2010\$	SCC Value of \$22.3/metric ton CO_2* and Medium Value for NO_X** billion 2010\$	SCC Value of \$36.5/metric ton CO_2* and Medium Value for NO_X** billion 2010\$	SCC Value of \$67.6/metric ton CO_2* and High Value for NO_X** Billion 2010\$
1	1.09	1.38	1.62	2.10
2	1.52	1.94	2.29	2.99
3	1.96	2.53	3.01	3.98
4	2.47	3.35	4.08	5.57

* These label values represent the global SCC in 2010, in 2010\$. The present values have been calculated with scenario-consistent discount rates.
** Low Value corresponds to \$450 per ton of NO_X emissions. Medium Value corresponds to \$2,537 per ton of NO_X emissions. High Value corresponds to \$4,623 per ton of NO_X emissions.

Table V.22 Results of Adding Net Present Value of Consumer Savings (at 3-Percent Discount Rate) to Net Present Value of Monetized Benefits from CO_2 and NO_X Emissions Reductions for Microwave Oven Standby Mode and Off Mode

TSL	Consumer NPV at 7% Discount Rate added with:			
	SCC Value of \$4.9/metric ton CO_2* and Low Value for NO_X** billion 2010\$	SCC Value of \$22.3/metric ton CO_2* and Medium Value for NO_X** billion 2010\$	SCC Value of \$36.5/metric ton CO_2* and Medium Value for NO_X** billion 2010\$	SCC Value of \$67.6/metric ton CO_2* and High Value for NO_X** Billion 2010\$
1	2.06	2.35	2.59	3.09
2	2.89	3.31	3.66	4.37
3	3.74	4.33	4.81	5.79
4	4.83	5.74	6.47	7.98

* These label values represent the global SCC in 2010, in 2010\$. The present values have been calculated with scenario-consistent discount rates.
** Low Value corresponds to \$450 per ton of NO_X emissions. Medium Value corresponds to \$2,537 per ton of NO_X emissions. High Value corresponds to \$4,623 per ton of NO_X emissions.

Although adding the value of consumer savings to the values of emission reductions provides a valuable perspective, two issues should be considered. First, the national operating cost savings are domestic U.S. consumer monetary savings that occur as a result of market transactions, while the value of CO_2 reductions is based on a global value. Second, the assessments of operating cost savings and the SCC are performed with different methods that use quite different time frames for analysis. The national operating cost savings is measured for the lifetime of products shipped in 2014–2043. The SCC values, on the other hand, reflect the present value of future climate-related impacts resulting from the emission of one ton of CO_2 in each year. These impacts continue well beyond 2100.

7. Other Factors

The Secretary of Energy, in determining whether a standard is economically justified, may consider any other factors that the Secretary deems to be relevant. (42 U.S.C. 6295(o)(2)(B)(i)(VI))) DOE has not considered other factors in development of the proposed standards in this SNOPR.

C. Proposed Standard

When considering proposed standards, the new or amended energy conservation standard that DOE adopts for any type (or class) of covered product shall 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 to the greatest extent practicable, in light of 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 today’s SNOPR, DOE considered the impacts of standards at each TSL, beginning with the maximum technologically feasible level, to determine whether that level was economically justified. Where the max-tech level was not justified, DOE then considered the next most efficient level and undertook the same evaluation until it reached the highest efficiency level that is both technologically feasible and economically justified and saves a significant amount of energy.

To aid the reader in understanding the benefits and/or burdens of each TSL, Table V.24 summarizes the quantitative analytical results for each TSL, based on the assumptions and methodology discussed herein. In addition to the quantitative results presented in the table, DOE also considers other burdens and benefits that affect economic justification. These include the impacts on identifiable subgroups of consumers, such as low-income households and seniors, who may be disproportionately affected by a national standard. Section V.B.1 presents the estimated impacts of each TSL for these subgroups.

In addition to the quantitative results, DOE also considered harmonization of microwave oven standby mode and off mode standards with international standby power programs such as Korea’s e-standby program,[29] Australia’s standby program,[30] and

[29] Refer to: http://www.kemco.or.kr/new_eng/pg02/pg02100300.asp. (Last accessed March 18, 2011.)

Japan's Top Runner Program.[31] Those programs seek to establish standby power ratings through the International Energy Agency's (IEA) 1-Watt Program, which seeks to lower standby power below 1 W for microwave ovens.[32] Korea published a mandatory standby power standard of 1 W that became effective in 2010 and Australia will publish mandatory standby power standards of 1 W by 2012. In accordance with Japan's Top Runner Program, Japanese appliance manufacturers made a voluntary declaration to reduce standby power of microwave ovens that lack a timer to as close to zero as possible and that of microwave ovens that have a timer to 1 W or lower.

DOE also notes that the economics literature provides a wide-ranging discussion of how consumers trade off upfront costs and energy savings in the absence of government intervention. Much of this literature attempts to explain why consumers appear to undervalue energy efficiency improvements. This undervaluation suggests that regulation that promotes energy efficiency can produce significant net private gains (as well as producing social gains by, for example, reducing pollution). There is evidence that consumers undervalue future energy savings as a result of (1) a lack of information; (2) a lack of sufficient salience of the long-term or aggregate benefits; (3) a lack of sufficient savings to warrant delaying or altering purchases (for example, an inefficient ventilation fan in a new building or the delayed replacement of a water pump); (4) excessive focus on the short term, in the form of inconsistent weighting of future energy cost savings relative to available returns on other investments; (5) computational or other

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[30] Refer to: http://www.energyrating.gov.au/standby.html. (Last accessed March 18, 2011.)
[31] Refer to: http://www.eccj.or.jp/top_runner/index.html. (Last accessed March 18, 2011.)
[32] IEA Energy Information Centre. Standby Power Use and the IEA "1-Watt Plan." Available at: http://www.iea.org/subjectqueries/standby.asp. (Last accessed March 18, 2011.)

difficulties associated with the evaluation of relevant tradeoffs; and (6) a divergence in incentives (that is, renter versus owner; builder vs. purchaser). Other literature indicates that with less than perfect foresight and a high degree of uncertainty about the future, consumers may trade off these types of investments at a higher than expected rate between current consumption and uncertain future energy cost savings.

In its current regulatory analysis, potential changes in the benefits and costs of a regulation due to changes in consumer purchase decisions are included in two ways: (1) If consumers forego a purchase of a product in the standards case, this decreases sales for product manufacturers and the cost to manufacturers is included in the MIA, and (2) DOE accounts for energy savings attributable only to products actually used by consumers in the standards case; if a regulatory option decreases the number of products used by consumers, this decreases the potential energy savings from an energy conservation standard. DOE provides detailed estimates of shipments and changes in the volume of product purchases in chapter 9 of the SNOPR TSD.

While DOE is not prepared at present to provide a fuller quantifiable framework for estimating the benefits and costs of changes in consumer purchase decisions due to an energy conservation standard, DOE seeks comments on how to more fully assess the potential impact of energy conservation standards on consumer choice and how to quantify this impact in its regulatory analysis in future rulemakings.

1. Benefits and Burdens of TSLs Considered for Microwave Ovens

Table V.23 summarizes the quantitative impacts estimated for each TSL for microwave ovens. The efficiency levels contained in each TSL are described in section V.A.

Table V.23 Summary of Results for Trial Standard Levels for Microwave Oven Standby Mode and Off Mode Energy Use

Category	TSL 1	TSL 2	TSL 3	TSL 4
National Energy Savings (quads)	0.21	0.30	0.41	0.63
NPV of Consumer Benefits (2010$ billion)				
7% discount rate	1.02	1.42	1.82	2.25
3% discount rate	1.98	2.78	3.59	4.60
Manufacturer Impacts				
Industry NPV (2010$ million)	(27.1) to (29.3)	(45.2) to (52.4)	(52.9) to (73.6)	(90.4) to (165.7)
Industry NPV (% change)	(2.4) to (2.6)	(4.0) to (4.6)	(4.7) to (6.5)	(8.0) to (14.7)
Cumulative Emissions Reduction				
CO_2 (Mt)	15.84	22.88	31.48	48.46
NO_x (thousand tons)	12.88	18.61	25.60	39.42
Value of Emissions Reductions				
CO_2 (2010$ million)*	70 to 1,066	101 to 1,539	139 to 2,118	213 to 3,259
NO_X – 3% discount rate (2010$ million)	3.74 to 38.5	5.41 to 55.6	7.44 to 76.4	11.5 to 118
NO_X – 7% discount rate (2010$ million)	1.92 to 19.8	2.78 to 28.6	3.82 to 39.3	5.89 to 60.5
Consumer Mean LCC Savings (2010$)				
Product Class 1	7	10	13	15
Product Class 2	6	11	4	27
Consumer Median PBP (years)				
Product Class 1	0.2	0.4	1.1	2.4
Product Class 2	0.0	1.9	6.3	1.8
Distribution of Consumer LCC Impacts				
Product Class 1				
Net Cost (%)	0	0	0	0
No Impact (%)	54	19	0	0
Net Benefit (%)	46	81	100	100
Product Class 2				
Net Cost (%)	0	0	21	0
No Impact (%)	0	0	0	0
Net Benefit (%)	100	100	79	100
Reduction in Generation Capacity in 2043 (GW)	0.196	0.284	0.390	0.601

Parentheses indicate negative (-) values. For NPVs, a negative value means a decrease in NPV.
* Range of the economic value of CO_2 reductions is based on estimates of the global benefit of reduced CO_2 emissions.

First, DOE considered TSL 4, the max-tech level for microwave oven standby mode and off mode energy use. TSL 4 likely would save 0.63 quads of energy through

2043, an amount DOE considers significant. Under TSL 4, the estimated NPV of consumer benefit is $2.25 billion, using a discount rate of 7 percent, and $4.60 billion, using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 4 are 48.46 Mt of CO_2 and 39.42 thousand tons of NO_X, with a negligible impact on Hg emissions. The estimated monetary value of the CO_2 emissions reductions at TSL 4 ranges from $213 million to $3,259 million. Total generating capacity in 2043 is estimated to decrease by 0.601 GW.

DOE projects that at TSL 4 for microwave-only ovens and countertop combination microwave ovens (Product Class 1), the average microwave oven consumer would experience a decrease in LCC of $15. DOE also estimates that all consumers who purchase these microwave ovens would realize some LCC savings. The median payback period at TSL 4 is projected to be 2.4 years, substantially shorter than the lifetime of the product. DOE projects that at TSL 4 for built-in and over-the-range combination microwave ovens (Product Class 2), the average microwave oven consumer would experience a decrease in LCC of $27, and all consumers who purchase these microwave ovens would realize some LCC savings. The median payback period at TSL 4 is projected to be 1.8 years, substantially shorter than the lifetime of the product.

Although DOE estimates that all microwave oven consumers would benefit economically from TSL 4, the reduction in standby power consumption at TSL 4 would result in the loss of certain functions that provide utility to consumers, specifically the continuous clock display. Because it is uncertain how greatly consumers value this function, DOE is concerned that TSL 4 may result in significant loss of consumer utility.

For manufacturers of microwave ovens, DOE estimated a decrease in INPV that ranges from $90.4 million to $165.7 million. DOE recognizes that TSL 4 poses the risk of large negative impacts if manufacturers' expectations about reduced profit margins are realized. In particular, if the high end of the range of impacts is reached, as DOE expects, TSL 4 could result in a net loss of 14.7 percent in INPV to microwave oven manufacturers.

After carefully considering the analysis and weighing the benefits and burdens of TSL 4, the Secretary has reached the following initial conclusion: At TSL 4, the benefits of energy savings, NPV of consumer benefit, positive consumer LCC impacts, and emissions reductions would be outweighed by the potential burden on consumers from loss of product utility and the large capital conversion costs that could result in a reduction in INPV for manufacturers.

DOE then considered TSL 3. Primary energy savings are estimated to be 0.41 quads of energy through 2043, which DOE considers significant. Under TSL 3, the estimated NPV of consumer benefit is $1.82 billion, using a discount rate of 7 percent, and $3.59 billion, using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 3 are 31.48 Mt of CO_2 and 25.60 thousand tons of NO_X, with a negligible impact on Hg emissions. The estimated monetary value of the CO_2 emissions reductions at TSL 3 ranges from $139 million to $2,118 million. Total generating capacity in 2043 under TSL 3 is estimated to decrease by 0.390 GW.

For microwave-only ovens and countertop combination microwave ovens, DOE projects that at TSL 3 the average consumer would experience a decrease in LCC of $13, and all consumers who purchase these microwave ovens would realize some LCC savings. At TSL 3 the median payback period is projected to be 1.1 years, substantially shorter than the lifetime of the product. In addition, DOE estimates that the reduction in standby power consumption under TSL 3 (to no greater than 1.0 W) would not impact consumer utility. The continuous clock display that would be lost under TSL 4 would be retained at TSL 3.

For built-in and combination microwave ovens, DOE projects that at TSL 3 the average consumer would experience a decrease in LCC of $4, and 79 percent of consumers who purchase these microwave ovens would realize some LCC savings. At TSL 3 the median payback period is projected to be 6.3 years, shorter than the lifetime of the product.

For manufacturers of microwave ovens, DOE estimated that the projected decrease in INPV under TSL 3 would range from $52.9 million to $73.6 million. DOE recognizes the risk of large negative impacts at TSL 3 if manufacturers' expectations about reduced profit margins are realized. In particular, if the high end of the range of impacts is reached, as DOE expects, TSL 3 could result in a net loss of 6.5 percent in INPV to microwave oven manufacturers.

After considering the analysis and weighing the benefits and the burdens, DOE has tentatively concluded that the benefits of energy savings, NPV of consumer benefit, positive consumer LCC impacts, and emissions reductions would outweigh the capital conversion costs that could result in a reduction in INPV for manufacturers. In particular, the Secretary has concluded that TSL 3 would save a significant amount of energy and is technologically feasible and economically justified. Therefore, DOE today proposes to adopt the energy conservation standards for microwave oven standby mode and off mode at TSL 3. Table V.24 presents the proposed standby mode and off mode energy conservation standards for microwave ovens.

Table V.23 Proposed Energy Conservation Standards for Microwave Oven Standby and Off Mode

Product Classes	Proposed Energy Conservation Standard
Microwave-Only Ovens and Countertop Combination Microwave Ovens	Maximum Standby Power = 1.0 watt
Built-In and Over-the-Range Combination Microwave Ovens	Maximum Standby Power = 2.2 watts

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

The benefits and costs of today's proposed standards can also be expressed in terms of annualized values. The annualized monetary values are the sum of (1) the annualized national economic value, expressed in 2010$, of the benefits from operating products that meet the proposed standards (consisting primarily of operating cost savings from using less energy, minus increases in equipment purchase costs, which is another way of representing consumer NPV), and (2) the monetary value of the benefits of emission reductions, including CO_2 emission reductions.[33] The value of the CO_2 reductions is calculated using a range of values per metric ton of CO_2 developed by a recent interagency process. The monetary costs and benefits of cumulative emissions reductions are reported in 2010$ to permit comparisons with the other costs and benefits in the same dollar units.

Although combining the values of operating savings and CO_2 reductions provides a useful perspective, two issues should be considered. First, the national operating savings are domestic U.S. consumer monetary savings that occur as a result of market transactions while the value of CO_2 reductions is based on a global value. Second, the assessments of operating cost savings and SCC are performed with different methods that use different time frames for analysis. The national operating cost savings is measured for the lifetime of products shipped in 2014–2043. The SCC values, on the other hand,

[33] DOE used a two-step calculation process to convert the time-series of costs and benefits into annualized values. First, DOE calculated a present value in 2011, the year used for discounting the NPV of total consumer costs and savings, for the time-series of costs and benefits using discount rates of 3 and 7 percent for all costs and benefits except for the value of CO_2 reductions. For the latter, DOE used a range of discount rates, as shown in Table V.26. From the present value, DOE then calculated the fixed annual payment over a 30-year period, starting in 2011, that yields the same present value. The fixed annual payment is the annualized value. Although DOE calculated annualized values, this does not imply that the time-series of cost and benefits from which the annualized values were determined would be a steady stream of payments.

reflect the present value of future climate-related impacts resulting from the emission of one ton of CO_2 in each year. These impacts continue well beyond 2100.

Table V.25 shows the annualized values for the proposed standards for microwave oven standby mode and off mode energy use. The results for the primary estimate are as follows. Using a 7-percent discount rate for benefits and costs other than CO_2 reductions, for which DOE used a 3-percent discount rate along with the SCC series corresponding to a value of $22.3/ton in 2010, the cost of the standards proposed in today's rule is $20.3 million per year in increased product costs, while the annualized benefits are $167 million in reduced product operating costs, $35.4 million in CO_2 reductions, and $1.74 million in reduced NO_X emissions. In this case, the net benefit amounts to $184 million per year. Using a 3-percent discount rate for all benefits and costs and the SCC series corresponding to a value of $22.3/ton in 2010, the cost of the standards proposed in today's rule is $21.6 million per year in increased product costs, while the annualized benefits are $205 million in reduced operating costs, $35.4 million in CO_2 reductions, and $2.14 million in reduced NO_X emissions. In this case, the net benefit amounts to $221 million per year.

Table V.24 Annualized Benefits and Costs of Proposed Standards (TSL 3) for Microwave Ovens Sold in 2014–2043

	Discount Rate	Primary Estimate*	Low Benefits Estimate*	High Benefits Estimate*
		Monetized (million 2010$/year)		
Benefits				
Operating Cost Savings	7%	167	150	185
	3%	205	182	229
CO_2 Reduction at $4.9/t**	5%	9.02	8.49	9.55
CO_2 Reduction at $22.3/t**	3%	35.4	33.3	37.6
CO_2 Reduction at $36.5/t**	2.5%	55.9	52.5	59.3
CO_2 Reduction at $67.6/t**	3%	108.0	101.5	114.6
NO_X Reduction at $2,537/t**	7%	1.74	1.65	1.82
	3%	2.14	2.02	2.26
Total†	7% plus CO_2 range	178 to 277	160 to 253	196 to 301
	7%	204	185	224
	3%	243	217	269
	3% plus CO_2 range	216 to 315	193 to 286	241 to 346
Costs				
Incremental Product Costs	7%	20.32	23.39	20.25
	3%	21.59	25.48	21.48
Total Net Benefits				
Total†	7% plus CO_2 range	157 to 256	137 to 230	176 to 281
	7%	184	162	204
	3%	221	192	247
	3% plus CO_2 range	195 to 294	167 to 260	219 to 324

* The Primary, Benefits, and High Benefits Estimates utilize forecasts of energy prices and housing starts from the AEO 2010 Reference case, Low Economic Growth case, and High Economic Growth case, respectively. In addition, the Low estimate uses incremental product costs that reflects constant prices (no learning rate) for product prices, and the High estimate uses incremental product costs that reflects a declining trend (high learning rate) for product prices.

** The CO_2 values represent global values (in 2010$) of the social cost of CO_2 emissions in 2010 under several scenarios. The values of $4.9, $22.3, and $36.5 per ton are the averages of SCC distributions calculated using 5%, 3%, and 2.5% discount rates, respectively. The value of $67.6 per ton represents the 95th percentile of the SCC distribution calculated using a 3% discount rate. The value for NO_X (in 2010$) is the average of the low and high values used in DOE's analysis.

† Total Benefits for both the 3% and 7% cases are derived using the SCC value calculated at a 3% discount rate, which is $22.3/ton in 2010 (in 2010$). In the rows labeled as "7% plus CO_2 range" and "3% plus CO_2 range," the operating cost and NO_X benefits are calculated using the labeled discount rate, and those values are added to the full range of CO_2 values.

VI. Additional Technical Corrections to 10 CFR 430.32

In today's SNOPR, DOE is also proposing the following technical corrections to the language contained in 10 CFR 430.32. DOE notes that the title of 10 CFR 430.32, "Energy and water conservation standards and their effective dates" contains dates required for compliance with energy and water conservation standards rather than the effective dates of such standards. As a result, DOE is proposing to revise the title of 10 CFR 430.32 to read "Energy and water conservation standards and their compliance dates." DOE also notes that the current energy conservation standards for cooking products found at 10 CFR 430.32(j)(1)-(2) should be revised to more accurately reflect the date required for compliance with energy conservation standards. DOE is proposing to revise the language in 10 CFR 430.32(j)(1)-(2) to state that products manufactured on or after the compliance date must meet the required energy conservation standard.

VII. Procedural Issues and Regulatory Review

A. Review Under Executive Order 12866 and 13563

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

(1) There is a lack of consumer information and/or information processing capability about energy efficiency opportunities in the home appliance market.

(2) There is asymmetric information (one party to a transaction has more and better information than the other) and/or high transactions costs (costs of gathering information and effecting exchanges of goods and services).

(3) There are external benefits resulting from improved energy efficiency of microwave ovens that are not captured by the users of such equipment. These benefits include externalities related to environmental protection and energy security that are not reflected in energy prices, such as reduced emissions of greenhouse gases.

In addition, DOE has determined that today's regulatory action is an "economically significant regulatory action" under section 3(f)(1) of Executive Order 12866. Accordingly, section 6(a)(3) of the Executive Order requires that DOE prepare a regulatory impact analysis (RIA) on today's rule and that OIRA review this rule. DOE presented to OIRA for review the draft rule and other documents prepared for this rulemaking, including the RIA, and has included these documents in the rulemaking record. The assessments prepared pursuant to Executive Order 12866 can be found in the TSD for this rulemaking, available at www1.eere.energy.gov/buildings/appliance_standards/residential/cooking_products.html.

DOE has also reviewed this regulation pursuant to Executive Order 13563, issued on January 18, 2011 (76 FR 3281, Jan. 21, 2011). Executive Order 13563 is supplemental to and explicitly reaffirms the principles, structures, and definitions governing regulatory review established in Executive Order 12866. To the extent permitted by law, agencies are required by Executive Order 13563 to: (1) propose or adopt a regulation only upon a reasoned determination that its benefits justify its costs (recognizing that some benefits and costs are difficult to quantify); (2) tailor regulations to impose the least burden on society, consistent with obtaining regulatory objectives, taking into account, among other things, and to the extent practicable, the costs of cumulative regulations; (3) select, in choosing among alternative regulatory approaches, those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity); (4) to the extent feasible, specify performance objectives, rather than specifying the behavior or manner of compliance that regulated entities must adopt; and (5) identify and assess available alternatives to direct regulation, including providing economic incentives to encourage the desired behavior, such as user fees or marketable permits, or providing information upon which choices can be made by the public.

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

B. Review Under the Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 et seq.) requires preparation of an initial regulatory flexibility analysis (IRFA) for any rule that by law must be proposed for public comment, unless the agency certifies that the rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. As required by Executive Order 13272, "Proper Consideration of Small Entities in Agency Rulemaking," 67 FR 53461 (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 (www.gc.doe.gov).

For manufacturers of microwave ovens, the Small Business Administration (SBA) has set a size threshold, which defines those entities classified as "small businesses" for the purposes of the statute. DOE used the SBA's small business size standards to determine whether any small entities would be subject to the requirements of the rule. 65 FR 30836, 30850 (May 15, 2000), as amended at 65 FR 53533, 53545 (Sept. 5, 2000) and codified at 13 CFR part 121. The size standards are listed by North American Industry Classification System (NAICS) code and industry description and are available at http://www.sba.gov/content/table-small-business-size-standards. DOE used the size standards the SBA published on November 5, 2010, as amended, to determine whether any small entities would be required to comply with the rule. Microwave oven manufacturing is classified under NAICS 335221, "Manufacturers of Household Cooking Appliances." The SBA sets a threshold of 750 employees or less for an entity to be considered as a small business for this category.

The microwave oven industry consists of seven manufacturers that have a market share greater than 3 percent. Most are large, foreign companies that import microwave ovens into the United States. There are U.S. facilities that partly assemble microwave ovens. However, no domestic facilities are small businesses. Furthermore none of the microwave oven manufacturers are small business manufacturers. Thus, DOE did not conduct an initial regulatory flexibility analysis.

C. Review Under the Paperwork Reduction Act

Manufacturers of microwave ovens must certify to DOE that their product complies with any applicable energy conservation standard. In certifying compliance, manufacturers must test their product according to the DOE test procedure for microwave ovens, including any amendments adopted for that test procedure. DOE has established regulations for the certification and recordkeeping requirements for all covered consumer products and commercial equipment, including microwave ovens. 75 FR 56796 (Sept. 16, 2010). 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 20 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

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

D. Review Under the National Environmental Policy Act of 1969

Pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S.C. 4321 et seq.), DOE has determined that the proposed rule fits within the category of actions included in Categorical Exclusion (CX) B5.1 and otherwise meets the requirements for application of a CX. (See 10 CFR 1021.410(b) and Appendix B to Subpart D) The proposed rule fits within this category of actions because it is a rulemaking that establishes energy conservation standards for consumer products or industrial equipment, and for which none of the exceptions identified in CX B5.1(b) apply. Therefore, DOE has made a CX determination for this rulemaking, and DOE does not need to prepare an Environmental Assessment or Environmental Impact Statement for this proposed rule. DOE's CX determination for this proposed rule is available at http://cxnepa.energy.gov.

E. Review Under Executive Order 13132

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

F. Review Under Executive Order 12988

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

G. Review Under the Unfunded Mandates Reform Act of 1995

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA) requires each Federal agency to assess the effects of Federal regulatory actions on State, local, and Tribal governments and the private sector. Pub. L. No. 104-4, sec. 201 (codified at 2 U.S.C. 1531). For a proposed regulatory action likely to result in a rule that may cause the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector of $100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish a written statement that estimates the resulting costs, benefits, and other effects on the national economy. (2

U.S.C. 1532(a), (b)) The UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal governments on a proposed "significant intergovernmental mandate," and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect small governments. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. 62 FR 12820; also available at http://www.gc.doe.gov.

Although today's proposed rule does not contain a Federal intergovernmental mandate, it may require expenditures of $100 million or more on the private sector. Specifically, the proposed rule will likely result in a final rule that could require expenditures of $100 million or more. Such expenditures may include (1) investment in research and development and in capital expenditures by microwave oven manufacturers in the years between the final rule and the compliance date for the new standard, and (2) incremental additional expenditures by consumers to purchase higher-efficiency microwave ovens, starting in 2014.

Section 202 of UMRA authorizes an agency to respond to the content requirements of UMRA in any other statement or analysis that accompanies the proposed rule. 2 U.S.C. 1532(c). The content requirements of section 202(b) of UMRA relevant to a private sector mandate substantially overlap the economic analysis requirements that apply under section 325(o) of EPCA and Executive Order 12866. The

SUPPLEMENTARY INFORMATION section of this supplemental notice of proposed rulemaking and the "Regulatory Impact Analysis," chapter 17 of the TSD for this supplemental proposed rule, respond to those requirements.

Under section 205 of UMRA, the Department is obligated to identify and consider a reasonable number of regulatory alternatives before promulgating a rule for which a written statement under section 202 is required. 2 U.S.C. 1535(a). DOE is required to select from those alternatives the most cost-effective and least burdensome alternative that achieves the objectives of the rule unless DOE publishes an explanation for doing otherwise or the selection of such an alternative is inconsistent with law. As required by 42 U.S.C. 6295(h) and (o), today's proposed rule would establish energy conservation standards for microwave oven standby mode and off mode that are designed to achieve the maximum improvement in energy use that DOE has determined to be both technologically feasible and economically justified. A full discussion of the alternatives considered by DOE is presented in chapter 17 of the TSD for today's supplemental proposed rule.

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

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

I. Review Under Executive Order 12630

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

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

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

K. Review Under Executive Order 13211

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

DOE has tentatively concluded that today's regulatory action, which sets forth energy conservation standards for microwave oven standby mode and off mode, is not a significant energy action because the proposed standards are not likely to have a significant adverse effect on the supply, distribution, or use of energy, nor has it been designated as such by the Administrator at OIRA. Accordingly, DOE has not prepared a Statement of Energy Effects on the proposed rule.

L. Review Under the Information Quality Bulletin for Peer Review

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

In response to OMB's Bulletin and as more fully set forth in the October 2008 NOPR, DOE conducted formal in-progress peer reviews of the energy conservation standards development process and analyses and has prepared a Peer Review Report pertaining to the energy conservation standards rulemaking analyses. Generation of this report involved a rigorous, formal, and documented evaluation using objective criteria and qualified and independent reviewers to make a judgment as to the technical/scientific/business merit, the actual or anticipated results, and the productivity and management effectiveness of programs and/or projects. The "Energy Conservation Standards Rulemaking Peer Review Report" dated February 2007 has been disseminated and is available at the following Web site: http://www1.eere.energy.gov/buildings/appliance_standards/peer_review.html.

VIII. **Public Participation**

A. Attendance at Public Meeting

The time, date, and location of the public meeting are listed in the DATES and ADDRESSES sections at the beginning of this document. If you plan to attend the public meeting, please notify Ms. Brenda Edwards at (202) 586-2945 or Brenda.Edwards@ee.doe.gov. As explained in the ADDRESSES section, foreign nationals visiting DOE Headquarters are subject to advance security screening procedures.

In addition, you can attend the public meeting via webinar. Webinar registration information, participant instructions, and information about the capabilities available to webinar participants will be published on the following website https://www1.gotomeeting.com/register/507099585. Participants are responsible for ensuring their systems are compatible with the webinar software.

B. Procedure for Submitting Prepared General Statements for Distribution

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

C. Conduct of Public Meeting

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

The public meeting will be conducted in an informal, conference style. DOE will present summaries of comments received before the public meeting, allow time for prepared general statements by participants, and encourage all interested parties to share their views on issues affecting this rulemaking. Each participant will be allowed to make a general statement (within time limits determined by DOE), before the discussion of specific topics. DOE will 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 public meeting will accept additional comments or questions from those attending, as time permits. The presiding official will announce any further procedural rules or modification of the above procedures that may be needed for the proper conduct of the public meeting.

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

D. Submission of Comments

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

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

However, your contact information will be publicly viewable if you include it in the comment 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. Persons viewing comments will see only first and last names, organization names, correspondence containing comments, and any documents submitted with the comments.

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

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

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

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

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

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

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

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

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

E. Issues on Which DOE Seeks Comment

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

1. Input and data regarding off mode power for microwave ovens;

2. Input and data on the utility provided by specific features that contribute to microwave oven standby power. In particular, DOE seeks information on any lessening of the utility or the performance of microwave display technologies and low- and zero-standby power cooking sensors as compared to absolute humidity cooking sensors currently used in microwave ovens on the U.S. market.
3. Input and data on control strategies available to enable manufacturers to make design tradeoffs between incorporating standby-power-consuming features such as displays or cooking sensors and including a function to turn power off to these components during standby mode. DOE also seeks comment on the viability and cost of microwave oven control board circuitry that could accommodate transistors to switch off cooking sensors and displays;
4. Whether switching or similar modern power supplies can operate successfully inside a microwave oven and the associated efficiency impacts on standby power;
5. Input and data on the estimated incremental manufacturing costs, as well as the assumed approaches to achieve TSL 3 for microwave oven standby mode and off mode. DOE also seeks comment on whether any intellectual property or patent infringement issues are associated with the design options presented in the SNOPR TSD to achieve TSL 3. In particular, DOE seeks comment on any lessening of competition due to intellectual property or patent infringement issues associated with low- and zero-standby power cooking sensors;

6. Input and data on the estimated market share of microwave ovens at the standby power consumption stipulated by TSL 3.
7. Information on any utility or performance impacts to built-ins at the standard level proposed by DOE.

IX. **Approval of the Office of the Secretary**

The Secretary of Energy has approved publication of today's proposed rule.

List of Subjects in

10 CFR Part 429

10 CFR Part 430

Administrative practice and procedure, Confidential business information, Energy conservation, Household appliances, Reporting and recordkeeping requirements, and Small businesses.

Issued in Washington, D.C., on

____

Henry Kelly
Acting Assistant Secretary
Energy Efficiency and Renewable Energy

For the reasons stated in the preamble, DOE proposes to amend parts 429 and 430, of title 10 of the Code of Federal Regulations, as set forth below.

PART 429 -- CERTIFICATION, COMPLIANCE, AND ENFORCEMENT FOR CONSUMER PRODUCTS AND COMMERCIAL AND INDUSTRIAL EQUIPMENT

1. The authority citation for part 429 continues to read as follows:

Authority: 42 U.S.C. 6291–6317.

2. In § 429.23 revise paragraph (b)(2) to read as follows:

§ 429.23 Conventional cooking tops, conventional ovens, microwave ovens.

* * * * *

(b) * * *

(2) Pursuant to §429.12(b)(13), a certification report shall include the following public product-specific information: For conventional cooking tops and conventional ovens: the type of pilot light and a declaration that the manufacturer has incorporated the applicable design requirements. For microwave ovens, the average standby power in watts.

PART 430—ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS

1. The authority citation for part 430 continues to read as follows:

Authority: 42 U.S.C. 6291–6309; 28 U.S.C. 2461 note.

2. In § 430.23 revise paragraph (i)(3) to read as follows:

§ 430.23 Test procedures for the measurement of energy and water consumption.

* * * * *

(i) * * *

(3) The standby power for microwave ovens shall be determined according to 3.2.4 of appendix I to this subpart. The standby power shall be rounded off to the nearest 0.1 watt.

* * * * *

3. In § 430.32 revise the heading and paragraph (j) to read as follows:

§ 430.32 Energy and water conservation standards and their compliance dates.

* * * * *

(j) Cooking Products (1) Gas cooking products with an electrical supply cord manufactured on or after January 1, 1990, shall not be equipped with a constant burning pilot light.

(2) Gas cooking products without an electrical supply cord manufactured on or after April 9, 2012, shall not be equipped with a constant burning pilot light.

(3) Microwave-only ovens and countertop combination microwave ovens manufactured on or after [*date 3 years after final rule* ***Federal Register*** *publication*] shall have an average standby power not more than 1.0 watt. Built-in and over-the-range combination microwave ovens manufactured on or after [*date 3 years after final rule* ***Federal Register*** *publication*] shall have an average standby power not more than 2.2 watts.

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