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Energy Conservation Program: Energy Conservation Standards for Residential Clothes Washers; Final Rule and Proposed Rule

DEPARTMENT OF ENERGY

10 CFR Parts 429 and 430

[Docket Number EERE–2008–BT–STD–0019]

RIN 1904–AB90

Energy Conservation Program: Energy Conservation Standards for Residential Clothes Washers

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

ACTION: Direct final rule.

SUMMARY: The Energy Policy and Conservation Act of 1975 (EPCA), as amended, prescribes energy conservation standards for various consumer products and certain commercial and industrial equipment, including residential clothes washers. EPCA also requires the U.S. Department of Energy (DOE) to determine whether amended standards would be technologically feasible and economically justified, and would save a significant amount of energy. In this direct final rule, DOE is adopting amended energy conservation standards for residential clothes washers. It has determined that the amended energy conservation standards for these products would result in significant conservation of energy, and are technologically feasible and economically justified. A notice of proposed rulemaking that proposes identical energy efficiency standards is published elsewhere in today's **Federal Register**. If DOE receives adverse comment and determines that such comment may provide a reasonable basis for withdrawing the direct final rule, this final rule will be withdrawn and DOE will proceed with the proposed rule.

DATES: The effective date of this rule is September 28, 2012 unless adverse comment is received by September 18, 2012. If adverse comments are received that DOE determines may provide a reasonable basis for withdrawal of the final rule, a timely withdrawal of this rule will be published in the **Federal Register**. If no such adverse comments are received, compliance with the amended standards established for residential clothes washers in today's final rule will be required on March 7, 2015 and January 1, 2018, as set forth in Table I.1 in **SUPPLEMENTARY INFORMATION**.

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

A link to the docket web page can be found at: *www.regulations.gov/#!docketDetail;D=EERE-2008-BT-STD-0019.* The *regulations.gov* web page contains instructions on how to access all documents, including public comments, in the docket.

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SUPPLEMENTARY INFORMATION:

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I. Summary of the Direct Final Rule and Its Benefits

Title III, Part B [1] of the Energy Policy and Conservation Act of 1975 (EPCA or the Act), Public Law 94–163 (42 U.S.C. 6291–6309, as codified), established the Energy Conservation Program for Consumer Products Other Than Automobiles. Pursuant to EPCA, any new or amended energy conservation standard that DOE prescribes for certain products, such as residential clothes washers, shall be designed to achieve the maximum improvement in energy efficiency that is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A)) Furthermore, the new or amended standard must result in a significant conservation of energy. (42 U.S.C. 6295(o)(3)(B)) In accordance with these and other statutory provisions discussed in this notice, DOE is adopting amended energy conservation standards for residential clothes washers. The amended standards, which are a minimum allowable integrated modified energy factor (IMEF) and maximum allowable integrated water factor (IWF), are shown in Table I–1. One set of amended standards applies to all products listed in Table I–1 manufactured in, or imported into, the United States on or after March 7, 2015. A second set of amended standards applies to the two top-loading product classes for products manufactured in, or imported into, the United States on or after January 1, 2018.

TABLE I–1—AMENDED ENERGY CONSERVATION STANDARDS FOR RESIDENTIAL CLOTHES WASHERS (COMPLIANCE STARTING 2015 AND 2018)

Product class	Compliance date: March 7, 2015		Compliance date: January 1, 2018	
	Minimum IMEF *	Maximum IWF †	Minimum IMEF *	Maximum IWF †
1. Top-loading, Compact (less than 1.6 ft^3 capacity)	0.86	14.4	1.15	12.0
2. Top-loading, Standard	1.29	8.4	1.57	6.5
3. Front-loading, Compact (less than 1.6 ft^3 capacity)	1.13	8.3	N/A	
4. Front-loading, Standard	1.84	4.7	N/A	

* IMEF (integrated modified energy factor) is calculated as the clothes container capacity in cubic feet divided by the sum, expressed in kilowatt-hours (kWh), of: (1) The total weighted per-cycle hot water energy consumption; (2) the total weighted per-cycle machine electrical energy consumption; (3) the per-cycle energy consumption for removing moisture from a test load; and (4) the per-cycle standby and off mode energy consumption.

† IWF (integrated water consumption factor) is calculated as the sum, expressed in gallons per cycle, of the total weighted per-cycle water consumption for all wash cycles divided by the clothes container capacity in cubic feet.

These standard levels are equivalent to those proposed in a comment submitted by groups representing manufacturers; energy and environmental advocates; and consumer groups. This collective set of comments, titled ''Agreement on Minimum Federal Efficiency Standards, Smart Appliances, Federal Incentives and Related Matters for Specified Appliances'' (the ''Joint Petition'' [2]), recommends specific energy conservation standards for residential clothes washers that, in the commenters' view, would satisfy the EPCA requirements in 42 U.S.C. 6295(o). The amended standards that DOE is adopting in today's direct final rule are the clothes washer efficiencies recommended in the Joint Petition (shown in Table I–2), evaluated according to DOE's clothes washer test procedure at appendix J2 and expressed in integrated energy and water use metrics.

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

[2] DOE Docket No. EERE–2008–BT–STD–0019, Comment 35.

TABLE I–2—JOINT PETITION RECOMMENDED ENERGY CONSERVATION STANDARDS FOR RESIDENTIAL CLOTHES WASHERS

Product class	Compliance date: 2015		Compliance date: 2018	
	Minimum MEF*	Maximum WF†	Minimum MEF*	Maximum WF†
1. Top-loading, Compact (less than 1.6 ft^3 capacity)	1.26	14.0	1.81	11.6
2. Top-loading, Standard	1.72	8.0	2.0	6.0
3. Front-loading, Compact (less than 1.6 ft^3 capacity)	1.72	8.0	N/A	
4. Front-loading, Standard	2.20	4.5	N/A	

*MEF (modified energy factor) is calculated as the clothes container capacity in cubic feet divided by the sum, expressed in kilowatt-hours (kWh), of: (1) The total weighted per-cycle hot water energy consumption; (2) the total weighted per-cycle machine electrical energy consumption; and (3) the per-cycle energy consumption for removing moisture from a test load.

†WF (water consumption factor) is calculated as the sum, expressed in gallons per cycle, of the total weighted per-cycle water consumption for the cold wash/cold rinse cycle divided by the clothes container capacity in cubic feet.

As discussed further in III.A.1, DOE did not maintain the top-loading semi-automatic and suds-saving product classes, and therefore did not consider these product classes in its analysis. DOE also added a front-loading, compact product class.

A. Benefits and Costs to Consumers

Table I–3 presents DOE's evaluation of the economic impacts of today's standards on consumers of residential clothes washers, as measured by the average life-cycle cost (LCC) savings and the median payback period. The impacts on consumers, as measured by the average LCC savings, are positive for all product classes.

TABLE I–3—IMPACTS OF TODAY'S STANDARDS ON CONSUMERS OF RESIDENTIAL CLOTHES WASHERS

Product class	Average LCC savings (*2010$*)	Median payback period (*years*)
Top-Loading, Standard*	268/366	0.4/0.9
Front-Loading, Standard	37	1.3
Top-Loading, Compact*	159/312	0.5/2.1
Front-Loading, Compact	54	0.8

*The first value refers to the standards in 2015, and the second value refers to the standards in 2018.

B. Impact on Manufacturers

The industry net present value (INPV) is the sum of the discounted cash flows to the industry from the base year through the end of the analysis period (2015 to 2044). Using a real discount rate of 8.5 percent, DOE estimates that the industry net present value (INPV) for manufacturers of clothes washers is $2,586 million in 2010$. Under today's standards, DOE expects that manufacturers may lose up to 33 percent of their INPV, which is approximately $859 million. Additionally, based on DOE's interviews with the manufacturers of clothes washers, DOE does not expect any plant closings or significant loss of employment.

C. National Benefits

DOE's analyses indicate that today's standards would save a significant amount of energy and water over 30 years (2015–2044)—an estimated 2.04 quads of energy and 3.03 trillion gallons of water. In addition, DOE expects the energy savings from today's standards to eliminate the need for approximately 1.30 gigawatts (GW) of generating capacity by 2044.

The cumulative national net present value (NPV) of total consumer costs and savings of today's standards in 2010$ ranges from $13.01 billion (at a 7-percent discount rate) to $31.29 billion (at a 3-percent discount rate). This NPV expresses the estimated total value of future operating-cost savings minus the estimated increased product costs for products purchased in 2015–2044, discounted to 2011.

In addition, today's standards would have significant environmental benefits. The energy savings would result in cumulative greenhouse gas emission reductions of approximately 113 million metric tons (Mt) of carbon dioxide (CO_2) from 2015 through 2044. During this period, the standards would also result in emissions reductions [3] of approximately 94.1 thousand tons of nitrogen oxides (NO_X) and 0.269 ton of mercury (Hg).[4] DOE estimates that the net present monetary value of the CO_2 emissions reductions is between $530 and $8,450 million, expressed in 2010$ and discounted to 2011. 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 derivation of these Social Cost of Carbon (SCC) values is discussed in section IV.M.1. DOE also estimates that the net present monetary value of the NO_X emissions reductions, expressed in 2010$ and discounted to 2011, is $12 to $122 million at a 7-percent discount rate, and $28 to $286 million at a 3-percent discount rate.[5]

[3] DOE calculates emissions reductions relative to the most recent version of the *Annual Energy Outlook* (*AEO*) Reference case forecast. As noted in section 15.2 of the direct final rule TSD chapter 15, 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 recently finalized transport rule, the Cross-State Air Pollution rule issued on July 6, 2011, do not appear in the forecast at this time.

[4] Results for NO_X and Hg are presented in short tons. One short ton equals 2,000 lbs.

[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 emissions reductions in its rulemakings.

The benefits and costs of today's standards, for products sold in 2015–2044, 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 the product (consisting primarily of operating cost savings from using less energy, minus increases in equipment purchase and installation costs, which is another way of representing consumer NPV, plus (2) the annualized monetary value of the benefits of emission reductions, including CO_2 emission reductions.[6]

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 CO_2 savings 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 2015–2044. The SCC values, on the other hand, reflect the present value of some future climate-related impacts resulting from the emission of one metric ton of carbon dioxide in each year. These impacts continue well beyond 2100.

Table I–4 shows the annualized values for today's standards for residential clothes washers, 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 for clothes washers in today's rule is $185 million per year in increased equipment costs, while the annualized benefits are $1,234 million per year in reduced equipment operating costs, $141.7 million in CO_2 reductions, and $5.4 million in reduced NO_X emissions. In this case, the net benefit amounts to $1.20 billion 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 for clothes washers in today's rule is $212 million per year in increased equipment costs, while the benefits are $1,808 million per year in reduced operating costs, $141.7 million in CO_2 reductions, and $8.0 million in reduced NO_X emissions. In this case, the net benefit amounts to $1.75 billion per year.

TABLE I–4—ANNUALIZED BENEFITS AND COSTS OF AMENDED STANDARDS FOR RESIDENTIAL CLOTHES WASHERS FOR PRODUCTS SOLD IN 2015–2044

	Discount rate	Primary estimate*	Low net benefits estimate*	High net benefits estimate*
		Monetized (million 2010$/year)		
Benefits				
Operating Cost Savings	7%	1234	1101	1379.
	3%	1808	1587	2042.
CO_2 Reduction at $4.9/t**	5%	34.5	31.7	37.4.
CO_2 Reduction at $22.3/t**	3%	142	130	154.
CO_2 Reduction at $36.5/t**	2.5%	226	207	246.
CO_2 Reduction at $67.6/t**	3%	431	396	469.
NO_X Reduction at $2,537/t**	7%	5.40	5.03	5.82.
	3%	8.01	7.39	8.68.
Total†	7% plus CO_2 range	1274 to 1671	1137 to 1502	1423 to 1854.
	7%	1381	1236	1539.
	3% plus CO_2 range	1851 to 2248	1626 to 1991	2089 to 2520.
	3%	1958	1725	2205.
Costs				
Incremental Product Costs	7%	185	258	200.
	3%	212	309	230.
Total Net Benefits				
Total†	7% plus CO_2 range	1088 to 1485	880 to 1244	1223 to 1654.
	7%	1196	978	1339.
	3% plus CO_2 range	1639 to 2036	1317 to 1682	1859 to 2291.
	3%	1746	1416	1976.

*The Primary, Low Benefits, and High Benefits Estimates utilize forecasts of energy prices and housing starts (which affect product shipments) from the *AEO2010* Reference case, Low Economic Growth case, and High Economic Growth case, respectively. In addition, incremental product costs reflect a declining trend using the default product price trend in the Primary Estimate and the High Benefits Estimate, and constant product prices in the Low Benefits Estimate. Because product prices are constant in the Low Benefits Estimate, the incremental product costs are higher than in the other two estimates. Although the price trends in the Primary Estimate and the High Benefits Estimate are the same, the incremental product costs are higher in the High Benefits Estimate because this case assumes High Economic Growth and thus has more product shipments. The approach used for forecasting product prices is explained in section IV.F.1.

[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 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 three and seven 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–3. From the present value, DOE then calculated the fixed annual payment over a 30-year period 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 is a steady stream of payments.

** 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.

D. Conclusion

Based on the analyses culminating in this final rule, DOE found the benefits to the nation of the standards (energy savings, water savings, favorable consumer LCC savings and payback period, positive NPV of consumer benefit, and emission reductions) outweigh the burdens (profit margin impacts that could result in a reduction in INPV for manufacturers). DOE has concluded that the standards in today's final rule represent the maximum improvement in energy efficiency that is technologically feasible and economically justified, and would result in significant conservation of energy. DOE further notes that residential clothes washers achieving these standard levels are already commercially available.

II. Introduction

The following section briefly discusses the statutory authority underlying today's final rule, as well as some of the relevant historical background related to the establishment of standards for residential clothes washers.

A. Authority

Title III, Part B of the Energy Policy and Conservation Act of 1975 (EPCA or the Act), Public Law 94–163 (42 U.S.C. 6291–6309, as codified) established the Energy Conservation Program for Consumer Products Other Than Automobiles,[7] a program covering most major household appliances (collectively referred to as ''covered products''), which includes the residential clothes washers that are the subject of this rulemaking. (42 U.S.C. 6292(a)(7)) EPCA prescribed energy conservation standards for these products (42 U.S.C. 6295(g)(9)(a)), and directed DOE to conduct three cycles of rulemakings to determine whether to amend these standards. (42 U.S.C. 6295(g)(4)(A), (g)(4)(B), and (g)(9)(B)) DOE also notes that under 42 U.S.C. 6295(m), DOE must also periodically review its energy conservation standards for covered products.

Pursuant to EPCA, DOE's energy conservation program for covered products consists essentially of four parts: (1) Testing; (2) labeling; (3) the establishment of Federal energy conservation standards; and (4) certification and enforcement procedures. The Federal Trade Commission (FTC) is primarily responsible for labeling, and DOE implements the remainder of the program. Subject to certain criteria and conditions, DOE is required to develop test procedures to measure the energy efficiency, energy use, or estimated annual operating cost of each covered product. (42 U.S.C. 6293) Manufacturers of covered products must use the prescribed DOE test procedure as the basis for certifying to DOE that their products comply with the applicable energy conservation standards adopted under EPCA and when making representations to the public regarding the energy use or efficiency of those products. (42 U.S.C. 6293(c) and 6295(s)) Similarly, DOE must use these test procedures to determine whether the products comply with standards adopted pursuant to EPCA. *Id.* The DOE test procedures for residential clothes washers appear at title 10 of the Code of Federal Regulations (CFR) part 430, subpart B, appendices J1 and J2. Until the compliance date of the amended energy and water conservation standards established in today's direct final rule, absent withdrawal of the rule by DOE pursuant to 42 U.S.C. 6295(p)(4), manufacturers must use the test procedures at appendix J1 to certify compliance. Subsequently, manufacturers must use the test procedures at appendix J2. Similarly, DOE will use the test procedure at appendix J1 for enforcement purposes until the compliance date of these amended energy and water conservation standards, and will subsequently use appendix J2. See section III.B for a detailed discussion of the test procedure amendments.

DOE must follow specific statutory 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, DOE may not adopt any standard that would not result in the significant conservation of energy. (42 U.S.C. 6295(o)(3)) In deciding whether an amended standard is economically justified, DOE must determine whether the benefits of the standard exceed its burdens. (42 U.S.C. 6295(o)(2)(B)(i)) DOE must make this determination after receiving comments on the proposed standard, and by, to the greatest extent practicable, considering 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)(I)–(VII))

EPCA allows DOE to issue a final rule (hereinafter referred to as a ''direct final rule'') establishing an energy conservation standard on receipt of a statement submitted jointly by interested persons that are fairly representative of relevant points of view (including representatives of manufacturers of covered products, States, and efficiency advocates) as determined by the Secretary, that contains recommendations with respect to an energy conservation standard that are in accordance with the provisions of 42 U.S.C. 6295(o). A notice of proposed rulemaking (NOPR) that proposes an identical energy efficiency standard must be published simultaneously with the final rule, and DOE must provide a public comment period of at least 110 days. 42 U.S.C. 6295(p)(4) Not later than

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

120 days after issuance of the direct final rule, if one or more adverse comments or an alternative joint recommendation are received relating to the direct final rule, the Secretary must determine whether the comments or alternative recommendation may provide a reasonable basis for withdrawal under 42 U.S.C. 6295(o) or other applicable law. If the Secretary makes such a determination, DOE must withdraw the direct final rule and proceed with the simultaneously published notice of proposed rulemaking. DOE must publish in the **Federal Register** the reason why the direct final rule was withdrawn. *Id.*

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

EPCA also 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 may, however, grant waivers of Federal preemption for particular State laws or regulations, in accordance with the procedures and other provisions set forth under 42 U.S.C. 6297(d)).

Any final rule for new or amended energy conservation standards promulgated after July 1, 2010, must address standby mode and off mode energy use. (42 U.S.C. 6295(gg)(3)) Specifically, when DOE adopts a standard for a covered product after that date, it must, if justified by the criteria for adoption of standards under EPCA (42 U.S.C. 6295(o)), incorporate standby mode and off mode energy use into the standard, or, if that is not feasible, adopt a separate standard for such energy use for that product. (42 U.S.C. 6295(gg)(3)(A)–(B)) The current standard for residential clothes washers is based on modified energy factor (MEF), a metric that does not incorporate standby or off mode energy use. On March 7, 2012, DOE published a final rule revising the clothes washer test procedure (hereafter, the March 2012 TP final rule). 77 FR 13888. Use of the new test procedure in 10 CFR 430 subpart B appendix J2 will be required for clothes washers manufactured on or after the compliance date of the 2015 standard in this direct final rule. The revised test procedure establishes an ''integrated modified energy factor'' (IMEF), a metric that incorporates energy use in standby and off modes. The revised test procedure also includes updates to the active mode provisions of the test procedure, which affect the calculation of IMEF, and establishes an ''integrated water factor'' (IWF). In this final rule, DOE prescribes amended energy conservation standards based on IMEF and IWF.

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.

We emphasize as well that Executive Order 13563 requires agencies ''to use the best available techniques to quantify anticipated present and future benefits and costs as accurately as possible.'' In its guidance, the Office of Information and Regulatory Affairs has emphasized that such techniques may include ''identifying changing future compliance costs that might result from technological innovation or anticipated behavioral changes.'' For the reasons stated in the preamble, DOE believes that today's direct final rule is consistent with these principles, including that, to the extent permitted by law, agencies adopt a regulation only upon a reasoned determination that its benefits justify its costs and select, in choosing among alternative regulatory approaches, those approaches that maximize net benefits.

Consistent with E.O. 13563, and the range of impacts analyzed in this rulemaking, the energy conservation standards adopted herein by DOE achieve maximum net benefits.

B. Background

1. Current Standards

In a final rule published on January 12, 2001 (2001 Final Rule), DOE prescribed amended energy conservation standards for residential clothes washers. 66 FR 3314. EPCA, as amended by EISA 2007, revised the energy conservation standards for

residential clothes washers by establishing a maximum water factor value, effective January 1, 2011. These standards are set forth in Table II–1.

TABLE II–1—ENERGY CONSERVATION STANDARDS FOR RESIDENTIAL CLOTHES WASHERS ESTABLISHED IN THE 2001 FINAL RULE AND EISA 2007

Product class	MEF ft^3/kWh/cycle	WF gal/cycle/ft^3
Top-Loading, Compact (less than 1.6 ft^3 capacity)	* 0.65	N/A
Top-Loading, Standard	* 1.26	** 9.5
Front-Loading ...	* 1.26	** 9.5
Top-Loading, Semi-Automatic	N/A	N/A
Suds-Saving	N/A	N/A

* *Source:* 2001 Final Rule (66 FR 3314).
** *Source:* EISA 2007 (42 U.S.C. 6295(g)(9)).

The EPCA amendments in EISA 2007 also require DOE to publish a final rule no later than December 31, 2011 determining whether to amend the standards in effect for clothes washers manufactured on or after January 1, 2015. (42 U.S.C. 6295(g)(9)) Today's final rule fulfills this statutory requirement.

The EISA 2007 amendments further require that any final rule for new or amended energy conservation standards promulgated after July 1, 2010, address standby mode and off mode energy use. (42 U.S.C. 6295(gg)(3)) Specifically, when DOE adopts a standard for a covered product after that date, it must, if justified by the criteria for adoption of standards under EPCA (42 U.S.C. 6295(o)), incorporate standby mode and off mode energy use into the standard, or, if that is not feasible, adopt a separate standard for such energy use for that product. (42 U.S.C. 6295(gg)(3)(A)–(B)) Today's standards are based on an ''integrated modified energy factor'' (IMEF), which incorporates energy use in standby mode and off mode, and an ''integrated water factor'' (IWF), which more accurately represents consumer usage patterns compared to the current water factor metric.

2. History of Standards Rulemaking for Residential Clothes Washers

The National Appliance Energy Conservation Act of 1987 (NAECA), Public Law 100–12 (March 17, 1989), amended EPCA and required that all rinse cycles of clothes washers manufactured after January 1, 1988 include an unheated water option, but stated that such clothes washers may have a heated water rinse option. NAECA further required that DOE conduct two cycles of rulemakings to determine if amended standards are justified. (42 U.S.C. 6295(g)(2) and (4)).

To complete the first rulemaking cycle required by NAECA, DOE published an advance notice of proposed rulemaking (ANOPR) on May 18, 1988 (53 FR 17712), a NOPR on August 9, 1989 (54 FR 32744), and a final rule on May 14, 1991 (May 1991 final rule). 56 FR 22279. The May 1991 final rule mandated performance-based energy conservation standards for top-loading compact and standard clothes washers based on a minimum energy factor (EF) for products manufactured on or after May 14, 1994.

To complete the second rulemaking cycle required by NAECA, the Department published an ANOPR on November 14, 1994 to consider amending the energy conservation standards for clothes washers, dishwashers, and clothes dryers. 59 FR 56423. DOE published a supplemental ANOPR for clothes washers on November 19, 1998 (63 FR 64343), a NOPR on October 5, 2000 (65 FR 59550), and a final rule on January 12, 2001 revising the energy conservation standards. 66 FR 3314.

As mentioned in the ''Background'' section, EISA 2007 amended EPCA to revise the energy conservation standards for residential clothes washers by establishing a maximum water factor, effective January 1, 2011. (42 U.S.C. 6295(g)(9)) EPCA, as amended by EISA 2007, further requires that DOE publish a final rule no later than December 31, 2011, to determine whether to amend the standards in effect for clothes washers manufactured on or after January 1, 2015. (42 U.S.C. 6295(g)(9)(B)(i)).

DOE initiated the current rulemaking on August 28, 2009 by publishing a notice announcing the availability of the framework document, the ''Energy Conservation Standards Rulemaking Framework Document for Residential Clothes Washers.'' In this notice, DOE also announced a public meeting and requested public comment on the matters raised in the framework document. 74 FR 44306 (Aug. 28, 2009). The framework document described the procedural and analytical approaches that DOE anticipated using to evaluate energy conservation standards for clothes washers and identified various issues to be resolved in conducting this rulemaking. The framework document is available at *http://www1.eere.energy.gov/buildings/appliance_standards/residential/clothes_washers_framework.html*.

DOE held a public meeting on September 21, 2009, where it presented the contents of the framework document; described the analyses it planned to conduct during the rulemaking; sought comments from interested parties on these subjects; and, in general, sought to inform interested parties about, and facilitate their involvement in, the rulemaking. Interested parties discussed the following major issues at the public meeting: Test procedure revisions; product classes; technology options; approaches to the engineering, life-cycle cost, payback period and national impact analyses; efficiency levels analyzed in the engineering analysis; and the approach for estimating typical energy and water consumption. At the meeting and during the period for commenting on the framework document, DOE received many comments that helped it identify and resolve issues involved in this rulemaking.

In response to the framework document, DOE received the Joint Petition, a comment submitted by groups representing manufacturers (the Association of Home Appliance Manufacturers (AHAM), Whirlpool Corporation (Whirlpool), General Electric Company (GE), Electrolux, LG Electronics, Inc. (LG), BSH Home Appliances (BSH), Alliance Laundry Systems (ALS), Viking Range, Sub-Zero Wolf, Friedrich A/C, U-Line, Samsung, Sharp Electronics, Miele, Heat Controller, AGA Marvel, Brown Stove, Haier, Fagor America, Airwell Group, Arcelik, Fisher & Paykel, Scotsman Ice, Indesit, Kuppersbusch, Kelon, and DeLonghi); energy and environmental advocates (American Council for an Energy Efficient Economy (ACEEE), Appliance Standards Awareness Project (ASAP), Natural Resources Defense Council (NRDC), Alliance to Save Energy (ASE), Alliance for Water Efficiency (AWE), Northwest Power and Conservation Council (NPCC), and Northeast Energy Efficiency Partnerships (NEEP)); and consumer groups (Consumer Federation of America (CFA) and the National Consumer Law Center (NCLC)) (collectively, the ''Joint Petitioners''). The Joint Petitioners recommended specific energy conservation standards for residential clothes washers that, in their view, would satisfy the EPCA requirements in 42 U.S.C. 6295(o). Earthjustice submitted a comment

affirming its support for the joint petition. (Earthjustice, No. 38 at p. 1). [8]

After careful consideration of the Joint Petition containing a consensus recommendation for amended energy conservation standards for residential clothes washers, the Secretary has determined that this ''Consensus Agreement'' has been submitted by interested persons who are fairly representative of relevant points of view on this matter. Congress provided some guidance within the statute itself by specifying that representatives of manufacturers of covered products, States, and efficiency advocates are relevant parties to any consensus recommendation. (42 U.S.C. 6295(p)(4)(A)) As delineated above, the Consensus Agreement was signed and submitted by a broad cross-section of the manufacturers who produce the subject products, their trade associations, and environmental, energy efficiency, and consumer advocacy organizations. Although States were not signatories to the Consensus Agreement, they did not express any opposition to it. Moreover, DOE does not read the statute as requiring absolute agreement among all interested parties before the Department may proceed with issuance of a direct final rule. By explicit language of the statute, the Secretary has discretion to determine when a joint recommendation for an energy or water conservation standard has met the requirement for representativeness (*i.e.,* ''as determined by the Secretary''). Accordingly, DOE will consider each consensus recommendation on a case-by-case basis to determine whether the submission has been made by interested persons fairly representative of relevant points of view.

Pursuant to 42 U.S.C. 6295(p)(4), the Secretary must also determine whether a jointly-submitted recommendation for an energy or water conservation standard is in accordance with 42 U.S.C. 6295(o) or 42 U.S.C. 6313(a)(6)(B), as applicable. This determination is exactly the type of analysis which DOE conducts whenever it considers potential energy conservation standards pursuant to EPCA. DOE applies the same principles to any consensus recommendations it may receive to satisfy its statutory obligation to ensure that any energy conservation standard that it adopts achieves the maximum improvement in energy efficiency that is technologically feasible and economically justified and will result in significant conservation of energy. Upon review, the Secretary determined that the Consensus Agreement submitted in the instant rulemaking comports with the standard-setting criteria set forth under 42 U.S.C. 6295(o). Accordingly, the consensus agreement levels were included as trial standard level (TSL) 3 in today's rule for residential clothes washers. The details of the efficiency levels comprising TSL 3 and the other TSLs considered for the direct final rule are discussed in section VI.A.

In sum, because the relevant criteria under 42 U.S.C. 6295(p)(4) have been satisfied, the Secretary has determined that it is appropriate to adopt amended energy conservation standards for residential clothes washers through this direct final rule.

As required by the same statutory provision, DOE is also simultaneously publishing a NOPR which proposes the identical standard levels contained in this direct final rule and is providing for a 110-day public comment period. DOE will consider whether any comment received during this comment period is sufficiently ''adverse'' as to provide a reasonable basis for withdrawal of the direct final rule and continuation of this rulemaking under the NOPR. Typical of other rulemakings, it is the substance, rather than the quantity, of comments that will ultimately determine whether a direct final rule will be withdrawn. To this end, the substance of any adverse comment(s) received will be weighed against the anticipated benefits of the Consensus Agreement and the likelihood that further consideration of the comment(s) would change the results of the rulemaking. DOE notes that to the extent an adverse comment had been previously raised and addressed in the rulemaking proceeding, such a submission will not typically provide a basis for withdrawal of a direct final rule.

3. Issues on Which DOE Seeks Comment

As stated previously, in promulgating today's direct final rule pursuant to 42 U.S.C. 6295(p)(4), DOE carefully considered the Joint Petition submitted to DOE, which contained a consensus recommendation for amended energy conservation standards for residential clothes washers. For the reasons stated in this direct final rule, the Secretary determined that the ''Consensus Agreement'' was submitted by interested persons who are fairly representative of relevant points of view on this matter. The Secretary also determined, for the reasons set forth in this direct final rule, that the standards contained in the Consensus Agreement comport with the standard-setting criteria set forth under 42 U.S.C. 6295(o). Therefore, the Secretary promulgates this direct final rule establishing the amended energy conservation standards for residential clothes washers.

As required by the same statutory provision, DOE is also simultaneously publishing a NOPR and providing for a 110-day public comment period. Should DOE determine to proceed with the NOPR, or to gather additional data for future energy conservation standards activities for residential clothes washers, DOE will consider any comments and data received on the direct final standards. Although comments are welcome on all aspects of this rulemaking, DOE is particularly interested in comments on the following:

(1) Impacts of the standards that may lessen or improve the utility or performance of the covered products. These impacts may include increased cycle times to wash clothes, ability to achieve good wash performance (*e.g.,* cleaning and rinsing), increased longevity of clothing, improved ergonomics of washer use, increase in noise, and other potential impacts.

(2) The 2015 and 2018 compliance dates for the proposed standards and whether these compliance dates adequately consider the typical clothes washer model design cycle for manufacturers.

(3) Whether repair costs for residential clothes washers would increase at the efficiency levels indicated in today's rule due to any changes in the design and materials and components used in order to comply with the new efficiency standards.

(4) Where there would be any anticipated changes in the consumption of complementary goods (*e.g.,* laundry detergent, stain removers, fabric softeners) that may result from the proposed standards.

(5) Whether DOE should incorporate the cost of risers or storage drawers (also referred to as pedestals) into the baseline installation costs for front-loading machines.

Changes in the Utility of the Products

DOE has prepared a technical support document (TSD) that analyzed the effect of this rule on, among other things, life cycle costs, payback periods and other consumer-related impacts. However, there are other facets of consumer welfare that are not explicitly captured in this analysis, including washing

[8] A notation in the form ''Earthjustice, No. 38 at p. 1'' identifies a written comment that DOE has received and has included in the docket of the standards rulemaking for residential clothes washers (Docket No. EERE–2008–BT–STD–0019). This particular notation refers to a comment (1) submitted by Earthjustice, (2) in document number 38 in the docket of that rulemaking, and (3) appearing on page 1 of document number 38.

performance, increased longevity of clothing, and noise. While information gathered in the course of this rulemaking did not demonstrate a linkage between these topics and efficiency standards, DOE is seeking comment and information on how consumers value changes in these attributes and if those values should be incorporated into DOE analysis.

Also, although it is outside the scope of this rule, DOE may consider seeking information on whether to account for wash performance and fabric care in test procedures for clothes washers.

2015 and 2018 Compliance Dates

Recognizing that this direct final rule, including the compliance dates, is based on a consensus agreement including virtually all manufacturers of residential clothes washers, DOE is seeking comment on redesign timelines anticipated by the manufacturers and how the 2015 and 2018 compliance dates may affect those timelines. DOE's manufacturer impact analysis is based on information provided by the manufacturer and supports the positions that manufacturers will need to make only minor redesign to comply with the 2015 standards, though the 2018 standards could require more substantial redesigns. Accepting that manufacturers fully considered their cost implications prior to entering voluntarily the consensus agreement, DOE assumes that manufacturers would not have agreed to compliance dates they could not meet or that imposed prohibitive costs. However, depending on how the redesign timeline and the compliance dates coincide, the cost estimates may be affected, for example, due to sunk cost, as well as the anticipated market shares of front-loading versus top-loading clothes washers.

The TSD, which is available at the rulemaking Web site at *www1.eere.energy.gov/buildings/appliance_standards/residential/clothes_washers.html,* provides an overview of the activities DOE undertook in developing standards for clothes washers. It presents and describes in detail each analysis DOE performed, including descriptions of inputs, sources, methodologies, and results. These analyses are as follows:

- A *market and technology assessment* addresses the scope of this rulemaking, identifies the clothes washer product classes, characterizes the markets for the products, and reviews techniques and approaches for improving their efficiency.
- A *screening analysis* reviews technology options to improve the efficiency of residential clothes washers and weighs those options against DOE's four prescribed screening criteria.
- An *engineering analysis* develops the relationship between increased manufacturer price and increased efficiency.
- A *markups analysis* establishes markups for converting manufacturer prices to customer product costs.
- An *energy use analysis* generates energy-use estimates for residential clothes washers as a function of efficiency levels.
- A *life-cycle cost analysis* calculates the effects of standards on individual customers and compares the life-cycle costs (LCC) and payback period (PBP) of products with and without higher efficiency standards.
- A *shipments analysis* forecasts shipments with and without higher efficiency standards.
- A *national impact analysis* forecasts the national energy savings (NES), and the national net present value of total consumer costs and savings, expected to result from specific, potential energy conservation standards for residential clothes washers.
- A *consumer subgroup analysis* discusses the effects of standards on different subgroups of consumers.
- A *manufacturer impact analysis* discusses the effects of standards on the finances and profitability of product manufacturers.
- An *employment impact analysis* discusses the indirect effects of standards on national employment.
- A *utility impact analysis* discusses the effects of standards on electric and gas utilities.
- An *emissions analysis* discusses the effects of standards on three pollutants—sulfur dioxide (SO_2), nitrogen oxides (NO_X), and mercury—as well as carbon emissions.
- A *regulatory impact analysis* discusses the impact of non-regulatory alternatives to efficiency standards.

Finally, the comments received since publication of the framework document, including the Joint Petition, have contributed to DOE's proposed resolution of the issues in this rulemaking. This direct final rule addresses these comments and responds to the issues they raised.

III. General Discussion

A. Product Classes and Scope of Coverage

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

DOE received several comments from interested parties regarding the product classes and their organization. Specifically, DOE received comments regarding the criteria used as a basis for creating product classes; the potential elimination of top-loading semiautomatic and suds-saving product classes; and whether combination washer/dryers are covered products. DOE's responses to these comments are discussed in the following sections.

Existing energy conservation standards divide residential clothes washers into five product classes based on location of access, capacity, and other features such as suds saving.

- Top-loading, compact (less than 1.6 cubic feet capacity);
- Top-loading, standard (1.6 cubic feet or greater capacity);
- Top-loading, semiautomatic;
- Front-loading; and
- Suds-saving.

AWE stated that DOE's practice of considering separate product classes should be analyzed, and that by making exceptions for old technologies by creating their own product class, DOE hinders innovation and the establishment of more progressive standards. AWE further stated that some manufacturers have already demonstrated that efficiency levels can be obtained without sacrificing performance. According to AWE, DOE should move to performance-based standards and to eliminate technology-based standards unless it can be demonstrated that the full life-cycle consumer economic impacts would favor continuation of product classes. (AWE, No. 12 at p. 2) Pursuant to 42 U.S.C. 6295(q), DOE must set different energy conservation standards for groups of covered products if such products consume a different kind of energy than other products within the same type or class, or if such products have a capacity or other performance-related feature that justifies a different standard. In determining whether a different standard is justified, EPCA requires DOE to consider utility to the consumer and any other appropriate factors. DOE is required to establish standards that achieve the maximum improvement in energy and water efficiency that is both technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A)) As explained below, DOE has adhered to these statutory requirements in establishing the product classes in today's rulemaking.

1. Elimination of Existing Product Classes

DOE sought comment in the framework document as to whether it should retain the top-loading semi-automatic and suds-saving product classes because it is unaware of any such residential clothes washers on the market. DOE also noted that its test procedures at appendices J1 and J2 do not measure the possible energy savings associated with suds-saving because DOE is not aware of methodology to measure such savings over sequential operating cycles as necessary to capture the benefit of suds-saving. AHAM, ALS, GE, Samsung, and Whirlpool supported the elimination of top-loading semi-automatic and suds-saving product classes. (AHAM, Public Meeting Transcript, No. 7 at pp. 42, 72; [9] ALS, Public Meeting Transcript, No. 7 at p. 39; GE, Public Meeting Transcript, No. 7 at p. 41; GE, No. 20 at p. 1; [10] Samsung, No. 25 at p. 3; Whirlpool, Public Meeting Transcript, No. 7 at p. 41) AHAM, ALS, GE, and Whirlpool stated that these products are no longer available on the market. (AHAM, No. 16 at p. 3; ALS, No. 13 at p. 2; GE, No. 20 at p. 1; Whirlpool, No. 22 at p. 3) AWE stated that suds-saving is not a new or proprietary technology, but that it is starting to make a comeback. AWE further stated DOE should consider suds saving in its analysis. (AWE, No. 12 at p. 3) In its research, DOE did not identify any suds-saving residential clothes washers on the market in the United States. For this reason, and in accordance with general support among interested parties, DOE is eliminating the top-loading semi-automatic and suds-saving product classes in this final rule.

2. Product Class Differentiation by Method of Access

In the framework document, DOE also sought comment as to whether the method of loading clothes washers, or any other characteristic commonly associated with traditional top-loading or front-loading clothes washers are ''features'' within the meaning of 42 U.S.C. 6295(o)(4) in EPCA and whether the availability of such feature(s) would likely be affected by eliminating the separate classes for these product types previously established by DOE. More specifically, DOE invited comments on whether one or more of the characteristics commonly associated with different types of clothes washers, such as method of loading, presence or absence of agitators, ability to interrupt cycles and possibly others, provide consumer utility that should, under existing law, be recognized and protected by DOE in separate product classes.

a. Single Product Class

ACEEE, ASAP, Electrolux Home Products (EHP), NEEP, Pacific Gas and Electric Company (PG&E), and Samsung, along with PG&E, Southern California Gas Company (SCG), and Southern California Edison (SCE), jointly (hereafter ''California Utilities'') and ASAP, NRDC, and NCLC, jointly (hereafter, ''Joint Comment'' [11]), supported a single product class for all standard-size clothes washers, eliminating the differentiation based on method of loading. According to BSH, the California Utilities, Earthjustice, the Joint Comment, and NEEP, a single product class would not lessen utility or performance under EPCA. ASAP and the California Utilities commented that a single product class would not eliminate top-loaders from the market, and AWE noted that there are high efficiency top-loading clothes washers available. ASAP and the Joint Comment stated that there are at least 35 clothes washer models from four manufacturers on the current ENERGY STAR list. BSH commented that with the current differentiation between top-loading and front-loading clothes washers, consumers may assume that a high efficiency top-loader is more efficient than a ''worst-in-class'' front-loader if they are both ENERGY STAR rated, even though the reverse may be true. The California Utilities noted that there are currently 10–15 top-loading residential clothes washers in the California Energy Commission (CEC) database that are Consortium for Energy Efficiency (CEE) Tier 2 or better, and top-loading horizontal-axis clothes washers with efficiencies comparable to front-loading clothes washers are prevalent in some European markets. Samsung noted that utility rebates and certain energy labeling programs do not differentiate by clothes washer axis. (ACEEE, Public Meeting Transcript, No. 7 at p. 46; ASAP, Public Meeting Transcript, No. 7 at pp. 34–35, p. 45; AWE, No. 12 at p. 2; BSH, No. 11 at p. 2; California Utilities, No. 19 at pp. 1, 3; EHP, No. 18 at p. 2; Earthjustice, Public Meeting Transcript, No. 7 at p. 42; Earthjustice, No. 17 at p. 1; Joint Comment, No. 15 at p. 4; NEEP, No. 21 at pp. 1–2; PG&E, Public Meeting Transcript, No. 7 at p. 43; Samsung, No. 25 at p. 3)

According to EHP, NEEP, and Samsung, the method of access for loading clothing is not a feature that provides utility to the consumer. EHP stated that manner of access was merely a convenience. BSH commented that the vast majority of clothes washers are sold with dryers, and clothes dryers are front-loading. (BSH, No. 11 at p. 2; EHP, No. 18 at p. 2; NEEP, No. 21 at p. 1; Samsung, No. 25 at p. 3)

b. Multiple Product Classes

AHAM, ALS, and GE stated that they support the proposed product classes, which maintain the distinction between top-loading and front-loading residential clothes washers. (AHAM, No. 24 at p. 2; ALS, Public Meeting Transcript, No. 7 at p. 39; GE, No. 20 at p. 1) ALS and GE commented that ''top-loading'' is a feature within the meaning of EPCA, although ALS believes that ''vertical-axis'' and ''horizontal-axis'' are better terms because a horizontal-axis clothes washer can be configured to be top-loading. (ALS, No. 13 at p. 3; GE, No. 20 at p. 1)

AHAM and Whirlpool stated that multiple product classes for residential clothes washers would be consistent with classes that DOE has defined for other products. AHAM stated that multiple product classes were defined for refrigerator-freezers primarily on the basis of door placement. Whirlpool commented that multiple refrigerator-freezer classes reflect consumer choice and utility, while room air conditioner product classes also reflect consumer choice and utility as well as home configuration. (AHAM, No. 24 at p. 2; Whirlpool, No. 22 at p. 3)

GE commented that, in contrast to front-loading residential clothes washers, the vast majority of top-loading products are manufactured in the United States and provide an important source of U.S. jobs in these manufacturing locations. According to

[9] A notation in the form ''AHAM, Public Meeting Transcript, No. 7 at pp. 42, 72'' identifies an oral comment that DOE received during the September 21, 2009, framework public meeting and which was recorded in the public meeting transcript in the docket for the standards rulemaking for residential clothes washers (Docket No. EERE–2008–BT–STD–0019), maintained in the Resource Room of the Building Technologies Program. This particular notation refers to a comment (1) made by the Association of Home Appliance Manufacturers (AHAM) during the public meeting, (2) recorded in document number 7, which is the public meeting transcript that is filed in the docket of this rulemaking, and (3) which appears on pages 42 and 72 of document number 7.

[10] In its written comment, document number 19 in the docket of this rulemaking, GE states that it adopts by reference the comments submitted to DOE by AHAM. Thus, GE is cited alongside AHAM when discussing AHAM's written comments.

[11] The Alliance to Save Energy submitted a written comment, designated as document number 23 in the docket of this rulemaking, stating that it endorses the joint comments submitted by ASAP, NRDC, and NCLC, and requested that it be listed as a co-endorser in citation of these joint comments.

GE, the U.S. manufacturers with significant investment in these top-loading products produced domestically could be significantly disadvantaged should standards eliminate top-loaders. (GE, No. 20 at p. 3)

AHAM commented that DOE already addressed the product class issue for residential clothes washers in its denial of California's Petition for Waiver.[12] (AHAM, Public Meeting Transcript, No. 7 at p. 43)

Finally, the Joint Petition proposes energy conservations standard levels for both the top-loading and front-loading standard and compact product classes. (Joint Petition, No. 32 at 8)

c. Consumer Utility

DOE received additional comments regarding specific issues that interested parties suggested are related to consumer utility in the context of residential clothes washer product classes.

Cycle Time

AHAM, ALS, and GE stated that the longer cycle times of front-loading clothes washers support differentiation of product classes by method of access. According to ALS, cycle times longer than 85 minutes are necessary for front-loaders to achieve good wash performance, which can be achieved in a 55-minute wash cycle by a top-loader. (AHAM, No. 24 at p. 2; ALS, No. 13 at p. 4; GE, No. 20 at p. 2)

The California Utilities stated that it had conducted a preliminary survey indicating that there may not be significant differences in cycle times between top-loading and front-loading clothes washers. The Joint Comment noted that cycle times for front-loading clothes washers are becoming shorter. The California Utilities and the Joint Comment also suggested that the lower remaining moisture content (RMC) typical of front-loaders could lead to shorter clothes dryer cycle times, reducing the combined time of washing and drying a laundry load. (California Utilities, No. 19 at p. 3; Joint Comment, No. 15 at p. 4)

Mid-Cycle Access

ALS stated that garments can be added during a wash cycle in a top-loading clothes washer, but that the loading door on a front-loading clothes washer must be locked. According to ALS, the door can be unlocked mid-cycle, but it requires time and may require draining the wash water. (ALS, No. 13 at p. 4)

The California Utilities stated that many front-loading clothes washers are now equipped with a feature to unlock the door in the middle of a wash cycle. According to the Joint Comment, such a feature has been available on front-loaders for over a decade. (California Utilities, No. 19 at p. 3; Joint Comment No. 14 at p. 4)

Cost

ALS, GE, and Whirlpool stated that multiple product classes allow consumers a low-cost clothes washer option. ALS stated that purchase cost was the primary reason that top-loading residential clothes washers have maintained a majority of the market share, and that inherent differences between top-loading and front-loading designs will preclude comparable consumer cost for equivalent top-loaders and front-loaders. ALS commented that key components contributing to the added cost of front-loading clothes washers are motors, electronic controls, heavy mass weights, and door assembly costs. ALS estimated that the front-loading door feature results in a manufacturing cost differential of $250 and a consumer price differential of at least $500 when compared to a top-loading door. Also, according to ALS, consumer objections to stooping have required manufacturers to introduce pedestals for front-loading clothes washers, adding $250 to the retail price. (ALS, No. 13 at p. 3; GE, Public Meeting Transcript, No. 7 at p. 41; GE, No. 20 at p. 1; Whirlpool, No. 22 at p. 2) GE stated that a single product class would force extremely expensive technological changes on the industry. GE also commented that increased prices would have a disproportionate impact on low-income consumers who are especially sensitive to price. According to GE, these consumers may be unable to make high initial payments or obtain credit, and may choose to defer replacing older, less efficient clothes washers or to leave the home laundry market altogether. (GE, No. 20 at pp. 1, 3)

EHP commented that, in the past, manufacturers have been able to innovate to meet improved performance while maintaining cost. EHP also stated that payback in the form of lower energy and water costs would offset a higher initial cost of high efficiency top-loading clothes washers. (EHP, No. 18 at p. 2) The Joint Comment stated that high efficiency top-loading clothes washers are available on the market priced near or below $500. (Joint Comment, No. 15 at p. 4)

Consumer Preference and Market Share

According to AHAM, ALS, GE, and Whirlpool, consumer preference supports maintaining clothes washer product class distinction by method of access. ALS commented that most consumers prefer not to stoop or bend while loading clothes, which is not required for a top-loading clothes washer. GE estimated that top-loading residential clothes washers account for about 65 percent of the U.S. market. Whirlpool commented that one-third of consumers who purchased front-loaders have switched back to high-efficiency top-loaders. Whirlpool listed as contributing factors the existence of high efficiency top-loading clothes washers with better utility than front-loaders in terms of ergonomics, vibration, noise, cycle times, value proposition, sour smell, ease of use, and familiarity. Whirlpool further noted that front-loader sales have slowed even though 84 percent of consumers say energy conservation is very important to them when buying an appliance. ALS stated that it had recently received a letter from a consumer supporting Whirlpool's statement that many consumers who purchased front loaders subsequently switched back to top loaders. (AHAM, No. 24 at p. 2; ALS, Public Meeting Transcript, No. 7 at p. 45; ALS, No. 13 at pp. 2, 4; GE, No. 20 at pp. 1–2; Whirlpool, Public Meeting Transcript, No. 7 at p. 44; Whirlpool, No. 22 at pp. 2–3)

EHP stated that the means of loading is merely a convenience factor for consumers. (EHP, No. 18 at p. 2) ASAP, the California Utilities, NEEP, and PG&E commented that the growth in front-loader market share from 15 percent 5 years ago to approximately 35 percent now indicates that consumer preference for front-loading clothes washers has shifted dramatically recently. The California Utilities also stated that consumer preference research that DOE commissioned for the last residential clothes washer energy conservation rulemaking indicated that concern for axis of rotation and door placement was scored low by consumers.[13] PG&E and

[12] This comment refers to DOE's denial of the California Energy Commission's petition for waiver from Federal preemption of its residential clothes washer water conservation standards. 71 FR 78157 (Dec. 28, 2006). On October 28, 2009, for reasons unrelated to product class issues, the Ninth Circuit U.S. Court of Appeals reversed DOE's ruling and remanded CEC's petition for further review. *California Energy Comm'n* v. *DOE,* 585 F.3d 1143 (9th Cir. 2009)

[13] The CA Utilities cited the 2001 Residential Clothes Washer Final Rule TSD, Appendices I and J. Appendix J details results of consumer analysis performed to determine what clothes washer attributes consumers value most and how changes in those attributes as a result of standards would affect consumer utility and clothes washer prices. Focus group results placed axis of rotation 12th and door placement as 7th out of a list of 65 possible

the California Utilities suggested that DOE conduct an analysis of consumer preferences to assess current market conditions and trends. (ASAP, Public Meeting Transcript, No. 7 at p. 45; California Utilities, No. 19 at p. 3; NEEP, No. 21 at pp. 1–2; PG&E, Public Meeting Transcript, No. 7 at pp. 31, 43)

Other Features

GE listed larger capacity, reduced vibration, and better cleaning performance as additional utilities of top-loading residential clothes washers. (GE, No. 20 at pp. 2–3)

d. DOE Response

EPCA provides the criteria under which DOE may define classes for covered equipment:

A rule prescribing an energy conservation standard for a type (or class) of covered products shall specify a level of energy use or efficiency higher or lower than that which applies (or would apply) for such type (or class) for any group of covered products which have the same function or intended use, if the Secretary determines that covered 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 from that which applies (or will apply) to other products within such type (or class).

In making a determination under this paragraph concerning whether a performance-related feature justifies the establishment of a higher or lower standard, the Secretary shall consider such factors as the utility to the consumer of such a feature, and such other factors as the Secretary deems appropriate. 42 U.S.C. 6295(q)

In previous rulemakings, DOE has concluded that the method of loading clothes in washers (axis of access) is a ''feature'' within the meaning of 42 U.S.C. 6295(o)(4) and, consequently, established separate product classes for top-loading and front-loading residential clothes washers. 56 FR 22263 (May 14, 1991).

In reviewing comments submitted by interested parties in response to the framework document for the current rulemaking, DOE identified at least one consumer utility related to the method of loading clothes for residential clothes washers which represents a ''feature'' for purposes of 42 U.S.C. 6295(o)(4). Specifically, DOE believes that the longer cycle times of front-loading residential clothes washers versus cycle times for top-loaders are likely to impact consumer utility. (See chapter 5 of the direct final rule TSD.) Because the longer wash cycle times for front-loaders arise from the reduced mechanical action of agitation as compared to top-loaders, DOE believes such longer cycles may be required to achieve the necessary cleaning, and thereby constitute a performance-related utility of front-loading versus top-loading residential clothes washers pursuant to the meaning of 42 U.S.C. 6295(q).

Based on a review of residential clothes washer models currently listed in the CEC product database, DOE concludes that capacity is not a meaningful differentiator between top-loaders and front-loaders. DOE acknowledges that top-loading models from a single manufacturer achieve the highest capacity—4.3 cubic feet—but multiple front-loading models from two other manufacturers are rated at 4.1–4.2 cubic feet.

Interested parties did not submit sufficient information for DOE to evaluate the relative wash performance, vibration, noise, or odor of top-loading versus front-loading clothes washers.

DOE does not consider first cost a ''feature'' that provides consumer utility for purposes of EPCA analysis. DOE acknowledges that price is an important consideration to consumers, especially low-income purchasers, but DOE accounts for such consumer impacts in the LCC and PBP analyses conducted in support of this rulemaking.

Given the above discussion, DOE concludes that top-loading washers provide consumer utilities that, in the context of residential clothes washers, are a feature for purposes of 42 U.S.C. 6295(o)(4). Therefore, DOE retains the product class distinction between top-loading and front-loading clothes washers in this final rule.

In response to the comments related to impacts on the relative market share of top-loading versus front-loading residential clothes washers, DOE considered the cross-price elasticity of demand for top-loading and front-loading residential clothes washers in its shipments analysis. The results of this analysis are presented in chapter 9 of the direct final rule TSD.

Finally, DOE considered the impacts on manufacturers in its manufacturer impacts analysis (see chapter 12 of the direct final rule TSD).

3. Compact Product Class

ASAP, BSH, and EHP stated that DOE should consider defining a single compact product class encompassing both top-loading and front-loading clothes washers. Such a product class definition would shift front-loading compact-size clothes washers from the current front-loading product class to the existing top-loading compact product class, which would be redesignated simply as ''compact'' to eliminate the top-loading distinction. Alternatively, BSH proposed that a compact front-loading product class be defined with a capacity equal to or less than two cubic feet. BSH commented that compact-size front-loaders would have difficulty achieving the same efficiency as standard-size front-loaders, yet they provide specific utility due to their ability to fit in small living spaces in areas of high population density. AHAM and BSH noted that capacity is one of the general criteria for defining separate product classes. (ASAP, Public Meeting Transcript, No. 7 at p. 47; BSH, Public Meeting Transcript, No. 7 at p. 40; BSH, No. 11 at pp. 2, 3, 5; EHP, No. 18 at p. 2)

The Joint Petition proposes a new front-loading, compact product class and proposes energy conservations standard levels for both the top-loading and front-loading compact product classes. (Joint Petition, No. 32 at p. 8)

Based on these comments, DOE is retaining the top-loading compact product class and adding a front-loading compact product class, as proposed in the Joint Petition.

4. Product Class Summary

Table III–1 presents the product classes set forth in DOE's regulations at 10 CFR 430.32(g) and the product classes established in this rulemaking.

TABLE III–1—CLOTHES WASHER PRODUCT CLASSES

Product classes in 430.32(g)	Product classes established in this rulemaking
i. Top-loading, compact (less than 1.6 cubic feet capacity.	i. Top-loading, compact (less than 1.6 cubic feet capacity).
ii. Top-loading, standard (1.6 cubic feet or greater capacity).	ii. Top-loading, standard (1.6 cubic feet or greater capacity).
iii. Top-loading, semi-automatic.	iii. Front-loading, compact (less than 1.6 cubic feet capacity).

features. The TSD is available at *www1.eere.energy.gov/buildings/appliance_standards/residential/clothes_washers.html.*

TABLE III–1—CLOTHES WASHER PRODUCT CLASSES—Continued

Product classes in 430.32(g)	Product classes established in this rulemaking
iv. Front-loading	iv. Front-loading, standard (1.6 cubic feet or greater capacity).
v. Suds-saving.	

B. Test Procedure

As noted previously, the DOE test procedures for residential clothes washers appear at 10 CFR part 430, subpart B, appendices J1 and J2. Until the compliance date of the amended energy and water conservation standards established in today's direct final rule, absent withdrawal of the rule by DOE pursuant to 42 U.S.C. 6295(p)(4), manufacturers must use the test procedures at appendix J1 to certify compliance. Subsequently, manufacturers must use the test procedures at appendix J2.

DOE established the test procedure at appendix J2 on March 7, 2012 (77 FR 13888) to incorporate standby mode energy consumption as well as to update various active mode testing provisions. EISA 2007 amended EPCA to require DOE to amend its test procedures to integrate measures of standby mode and off mode energy consumption into the overall energy efficiency, energy consumption, or other energy descriptor for each covered product unless the current test procedure already fully accounts for and incorporates standby and off mode energy consumption or such integration is technically infeasible. (42 U.S.C. 6295(gg)(2)) In addition to incorporating standby power provisions, DOE received comments in response to the August 2009 framework document stating that it should also consider changes to the active mode provisions in the test procedure.

DOE published a notice of proposed rulemaking issued on September 21, 2010 (75 FR 57556) (hereinafter referred to as the September 2010 TP NOPR) to propose amendments regarding both standby mode and active mode provisions of the test procedure, including the following: (1) Incorporating standby and off mode power consumption into a combined energy metric; (2) addressing technologies not covered by the appendix J1 test procedure, such as steam wash cycles and self-clean cycles; (3) revising the number of annual wash cycles; (4) updating use factors; (5) revising the procedures and specifications for test cloth; (6) redefining the appropriate water fill level for the capacity measurement method; (7) establishing a new measure of water consumption; and (8) revising the definition of the energy test cycle.

The International Electrotechnical Commission (IEC) published IEC Standard 62301, ''Household electrical appliances—Measurement of standby power,'' Edition 2.0 2011–01 (IEC Standard 62301 (Second Edition)) on January 27, 2011. DOE reviewed this updated test procedure and determined that it improves the measurement of standby mode and off mode energy use compared to the previous version of the standard. Therefore, DOE published a supplemental notice of proposed rulemaking on August 9, 2011 (76 FR 49238) (hereinafter referred to as the August 2011 TP SNOPR) to integrate new measures of standby power consumption according to IEC Standard 62301 (Second Edition) and to incorporate additional amendments to the active mode provisions, including the following: (1) Revising the calculations for per-cycle energy use and annual energy cost; (2) updating the load adjustment factor; (3) clarifying the method for determining the energy test cycle; (4) clarifying the method for setting the wash time for certain clothes washers; (5) allowing the use of the most current AHAM Standard detergent; (6) clarifying the definition of ''cold wash'' for clothes washers that offer both ''cold wash'' and ''tap cold wash'' settings; and (7) performing various minor technical corrections. DOE published a second supplemental notice of proposed rulemaking on November 9, 2011 (76 FR 69870) to propose a revised definition of the energy test cycle. DOE published the final rule on March 7, 2012 (77 FR 13888), establishing the test procedure at appendix J2.

When conducting the test procedure rulemaking, DOE considered comments received on the clothes washer test procedure submitted as part of this rulemaking for energy conservation standards. In the framework document, DOE requested input on its test procedures for residential clothes washers and sought input, including supporting data, regarding how these procedures can be improved. In response to the framework document, DOE received several comments from interested parties regarding potential amendments to the DOE clothes washer test procedure to address the following issues: (1) The capacity measurement; (2) the test load size specification; (3) the energy and water use of self-clean cycles; (4) the energy and water use of steam cycles; (5) parameters representing consumer usage patterns; (6) the addition of a cleaning performance metric; (7) the remaining moisture content (RMC) measurement; (8) the measurement of standby and off mode energy use; (9) test cloth issues; (10) technical edits; and (11) anti-circumvention.

1. Capacity Measurement

DOE's clothes washer test procedure at appendix J1 states that, for measuring the capacity of the clothes washer, the clothes container shall be manually filled with water to ''its uppermost edge.'' This requirement can be interpreted in multiple ways, resulting in different capacity measurements that would each be allowable under the test procedure.

The Joint Comment stated that DOE should ensure that all data collected for this rulemaking be based on a consistent measurement of capacity, particularly because advertised capacity may be expressed using a conversion factor of 15/13 applied to the capacity measured under the DOE test procedure to approximate the capacity that would be measured using the international test standard promulgated by the IEC. The Joint Comment and Samsung stated that the measured clothes container volume can exceed the wetted space occupied by laundry by 15–20 percent or more. This could result in similar variation in MEF. The Joint Comment suggested that DOE determine whether such measurement uncertainty still exists for current vertical-axis clothes washers, and whether the capacity measurement in the test procedure should be modified for both vertical-axis and horizontal-axis clothes washers. (Joint Comment, No. 15, p. 2; Samsung, No. 25 at p. 1) ASAP commented that DOE should understand the difference between advertised capacity and the capacity that is reported to ENERGY STAR, the CEC, and other public databases, because the advertised capacity is typically larger than the reported values. (ASAP, Public Meeting Transcript, No. 7 at p. 20)

ALS commented that the test procedure should be revised to clarify that, for vertical-axis clothes washers, the ''uppermost edge'' would refer to the ''top of the tub cover.'' (ALS, Public Meeting Transcript, No. 7 at p. 22; ALS, No. 13 at p. 1) Samsung commented that there are various interpretations of what constitutes the usable volume and how the capacity is measured on vertical-axis clothes washers. According to Samsung, one such interpretation is to measure the volume to the top of the tub cover, even though the user is instructed to load to below the tub cover in a typical

use and care guide. Samsung estimates that loading to the top of the tub cover could result in a 15–20 percent increase in the capacity measurement of vertical-axis clothes washers (compared to loading to the level recommended in the use and care guide), which would also overstate the MEF and WF of the unit by 15–20 percent. Therefore, Samsung proposed possible language to clarify the capacity measurement in DOE's clothes washer test procedure based on wording from IEC Standard 60456, ''Clothes washing machines for household use—Methods for measuring the performance,'' (IEC Standard 60456) Edition 5, Committee Draft for Vote (FDIS). The fill level in the DOE test procedure would thus be defined as the ''uppermost edge which may be used to fill in clothes, respecting manufacturer instructions.'' (Samsung, No. 25 at p. 1)

BSH commented that a volumetric capacity metric is misleading when comparing conventional vertical-axis, high efficiency vertical-axis, and horizontal-axis clothes washers because more volume does not necessarily correspond with more load capacity. Performance should be related to load size rather than drum volume for consumer comparisons. (BSH, No. 11 at p. 2)

DOE recognizes that the clothes container capacity measurement in appendix J1 could be interpreted in multiple ways. To provide manufacturers with additional guidance prior to issuance of the March 2012 TP final rule, DOE issued an interpretive rule on July 26, 2010. In the interpretive rule, DOE provided clarifications to the methods for measuring clothes container capacity for both top-loading and front-loading clothes washers using the appendix J1 test procedure. This interpretive rule can be found on DOE's Web site at: *www1.eere.energy.gov/buildings/appliance_standards/residential/pdfs/cw_guidance_faq.pdf*.

In the March 2012 TP final rule, DOE established a different capacity measurement procedure at appendix J2 to provide for a clearer, more consistent and more easily repeatable measurement. Under appendix J1, DOE's guidance document instructs manufacturers to measure the fill level for top-loading clothes washers at the innermost diameter of the tub cover (defined as ''Fill Level 3'' in the guidance). For the reasons discussed in the March 2012 TP final rule, the revision to the capacity measurement in appendix J2 requires manufacturers to measure the fill level for top-loading clothes washers to the uppermost edge of the rotating portion of the basket, including the balance ring (defined as ''Fill Level 2'' in DOE's interpretive guidance).

For front-loaders, under both appendix J1 and appendix J2, the fill level must not exceed the highest point of contact between the door and the door seal, excluding any portion of the door or door seal that would occupy the measured volume space when the door is closed. This is consistent with the instructions provided for front-loaders in DOE's guidance document.

DOE used the revised capacity measurement for top-loaders in determining the conversion formulas from MEF to IMEF and WF to IWF in today's final rule. For more details of the testing and analysis, see chapter 5 of the direct final rule TSD.

DOE notes that the FTC promulgates labeling requirements for residential clothes washers, which would govern marketing claims made by the manufacturer regarding capacity.

2. Test Load Size

Table 5.1 of the DOE clothes washer test procedure specifies test cloth load sizes necessary to conduct the energy cycles. Minimum, maximum, and average load sizes are defined as a function of clothes washer capacity. Currently, the maximum load size provided in the table is 3.80 cubic feet (ft^3). No provision exists for determining load size if capacity exceeds that limit. 10 CFR 430 subpart B appendix J1.

AHAM, ALS, GE and Whirlpool support a linear extension of the load size table to larger capacities. AHAM, GE, and Whirlpool recommend extending the table for capacities up to 6.0 ft^3. Whirlpool noted that DOE granted a waiver which extended the table to a capacity of 4.1 ft^3, and ALS stated it agreed with this waiver. (AHAM, Public Meeting Transcript, No. 7 at p. 21; AHAM, No. 16 at p. 2; ALS, No. 13 at p. 1; GE, No. 20 at p. 1; Whirlpool, No. 22 at p. 1) The Joint Comment objected to the extension of Table 5.1 to a capacity of 6 ft^3 without verifying the validity of the resulting load sizes with current consumer data. (Joint Comment, No. 15 at pp. 1–2)

DOE reviewed current residential clothes washer product databases from sources such as CEC and ENERGY STAR, and observed reported capacities as large as 4.7 ft^3. In response to comments received in response to the September 2010 TP NOPR, DOE extended Table 5.1 in the amended test procedure to include capacities up to 6.0 ft^3 to accommodate additional increases in capacity expected in the future. As described fully in the September 2010 TP NOPR and March 2012 TP final rule, DOE determined that the linear relationship between test load size and container capacity in appendix J1 is valid, and therefore used the same linear relationship to extend Table 5.1 to 6.0 ft^3. (17 FR 13888)

3. Self Clean Cycles

DOE's clothes washer test procedure specifies energy test cycles, the energy and water use of which are averaged to calculate the MEF and WF of the unit under consideration. These energy test cycles are selected from among various cycle settings provided by the manufacturer for laundering clothing. They do not include any cycles or pre-set settings provided for the purpose of cleaning, sanitizing, or deodorizing any of the clothes washer components. DOE observed in its test sample of units for the preliminary analysis that a dedicated self-clean function is a prevalent feature, found in virtually all front-loading clothes washers and in certain top-loading models as well.

ASAP and the Joint Comment stated that the measurement of MEF and WF should account for the energy and water use of self-clean cycles. The Joint Comment further stated that such a measurement would provide not only a more accurate assessment of machine efficiency, but also a benefit to those clothes washer designs that address mold and odor issues without requiring periodic sanitizing cycles. (ASAP, Public Meeting Transcript, No. 7 at p. 19; Joint Comment, No. 15 at p. 3)

In the September 2010 TP NOPR, DOE proposed a usage factor of 12 annual self-clean cycles for incorporating the energy used in self-clean cycles. DOE based its usage factor on typical manufacturer instructions that recommend using this feature once each month. DOE received comments stating that consumer usage data on self-clean cycles was insufficient to validate the usage factors it proposed in the test procedure NOPR. In addition, there is uncertainty as to whether a self-clean cycle should be tested only if it is a specific feature provided by the manufacturer, or if a conventional cycle that the manufacturer recommends the consumer to run periodically for the purpose of cleaning or sanitizing the clothes washer should also be tested as a self-clean cycle. Finally, DOE is concerned about the increased test burden required for testing self-clean cycles given the relatively small amount of annual energy used in these periodic cycles. For these reasons, DOE did not include the energy and water use of self-clean cycles in the modified test procedure.

4. Steam Cycles

The energy test cycles specified in the DOE clothes washer test procedure do not include provisions for testing any cycles incorporating steam injection. DOE is aware of a number of clothes washers available on the market that offer a steam feature as either a stand-alone cycle or as an add-on to a traditional wash cycle. DOE notes that steam features are available on primarily some higher-end front-loading clothes washers.

ASAP and the Joint Comment stated that DOE should amend the test procedure to account for the impact of steam cycle use. (ASAP, Public Meeting Transcript, No. 7 at p. 19; Joint Comment, No. 15 at p. 3)

In the September 2010 TP NOPR, DOE proposed a temperature usage factor of 0.02 to incorporate the energy used in steam cycles. DOE believed that extra hot and steam cycles would be reserved for the most heavily soiled loads, and would have similar use factors. DOE assumed that the steam wash cycles would be selected somewhat fewer times than the extra hot cycle because on some models steam is available only as an option on certain settings. DOE received comments stating that consumer usage data on steam cycles is insufficient to validate the temperature usage factors it proposed in the September 2010 TP NOPR. Furthermore, DOE notes that because there is significant variation in how individual manufacturers implement steam features, creating a universal definition of a steam cycle for the energy test cycle would be difficult. Finally, DOE is concerned about the increased test burden required for testing steam cycles given the relatively small amount of annual energy used in these cycles. For these reasons, DOE did not include the energy and water use of steam cycles in the modified test procedure.

5. Consumer Usage Patterns

Various factors are provided in the DOE clothes washer test procedure to properly account for consumer usage patterns, including the number of use cycles per year, selection of load sizes, selection of temperature settings, and the percentage of washed clothes loads that are dried in a clothes dryer.

ALS supported reducing annual usage to 300 cycles, based on Procter & Gamble consumer studies. The Joint Comment stated DOE should collect data on current consumer laundry usage to validate or update the cycles per year, estimates of ''average'' load size among clothes washers of varying capacities, annual load size usage factors, temperature use factors, and dryer use factor. The Joint Comment stated that DOE should ensure that there is no systematic bias in these factors favoring larger capacities. The Joint Comment also requested that DOE reassess the load adjustment factor, which was established in the 1990s. (ALS, No. 13 at p. 1; Joint Comment, No. 15 at pp. 1–3)

In the March 2012 TP final rule, DOE reduced the number of annual cycles to 295 based on a survey of available consumer usage data and comments received from interested parties. DOE increased the dryer usage factor to 0.91 based on the most recent consumer survey data available.

DOE is unaware of any updated consumer usage data regarding load sizes among clothes washers of varying capacities and load size usage factors. Therefore, DOE did not amend the load usage factors or the linear relationship used to determine load size based on clothes washer capacity in the modified test procedure. Similarly, DOE did not identify any evidence that suggests any unwarranted bias in favor or larger capacities in the test procedure.

DOE received additional information from commenters regarding temperature use factors (TUFs). The information received contained significant disparities, however, and no information supporting particular TUFs was more persuasive or reliable than information supporting other TUFs. Therefore, the information provided no basis upon which to change the TUF values in the appendix J1 test procedure, and DOE retained these TUFs in appendix J2. DOE did, however, establish a new TUF for a full warm wash/warm rinse cycle and eliminated the incremental use factor attributed to warm rinse in appendix J1.

Finally, DOE determined that the load adjustment factor (LAF) is duplicative of, yet inconsistent with, the load usage factors. Therefore, for consistency with the rest of the test procedure, DOE amended the representative load size calculation in the equation for drying energy to incorporate the load usage factors rather than a separate LAF. DOE replaced the LAF with a weighted-average load size, calculated by multiplying the minimum, average, and maximum load usage factors by the minimum, average, and maximum load sizes, respectively, and summing the products.

6. Standard Extractor RMC Test Procedure

The DOE test procedure contains provisions for evaluating the moisture absorption and retention characteristics of a lot of test cloth by measuring the RMC in a standard extractor at a specified set of conditions.

AHAM submitted detailed recommendations of changes to the methodology used for the Standard Extractor RMC Test Procedure included in the overall clothes washer test procedure. Whirlpool and GE stated that they support AHAM's recommendations. (AHAM, Public Meeting Transcript, No. 7 at p. 21; AHAM, No. 16 at p. 2; GE, No. 20 at p. 1; Whirlpool, No. 22 at p. 1) DOE largely agrees with AHAM's recommendations and implemented many of them in the revised test procedure.

7. Performance Metric

DOE's clothes washer test procedure provides a measure of representative energy and water use. It does not evaluate cleaning or rinsing performance or fabric care. AHAM, BSH, GE, and Whirlpool commented that DOE should add a performance measure, particularly because at the higher efficiency levels, clothes washers are reaching the limit where product performance and consumer satisfaction may not be economically reached. AHAM noted that its clothes washer standard, ANSI/AHAM HLW–1–2007, ''Performance Evaluation Procedures for Household Clothes Washers,'' addresses performance and is substantially harmonized with IEC Standard 60456. Whirlpool also noted that ANSI/AHAM HLW–1–2007 provides performance measurement. ALS and BSH also recommended review of IEC Standard 60456 for methods of assessing performance, and ALS recommended review of the Australian standard AS/NZS 2040.1. (AHAM, No. 16 at p. 2; ALS, No. 13 at p. 2; BSH, No. 11 at p. 2; GE, No. 20 at p. 1; Whirlpool, No. 22 at p. 2) ALS stated it had not yet determined whether it would support a performance metric, or what a measurement method for measuring performance would be, although it added that it is concerned that energy conservation standards have reached the point where higher levels will cause unacceptable performance, especially for vertical-axis top-loaders. (ALS, No. 13 at p. 1)

DOE test procedures must be reasonably designed to produce test results that measure energy efficiency, energy use, water use in specified instances, or estimated annual operating cost of a covered product during a representative use cycle or period of use. 42 U.S.C. 6293(b)(3). DOE notes that the measurement of energy efficiency or energy or water use presumes the proper functioning of a

product. DOE considers utility in setting energy conservation standards, and DOE may not prescribe a standard that is likely to result in the unavailability in the United States of performance characteristics, including reliability. 42 U.S.C. 6295(o)(2)(B)(i)(IV), (o)(4) DOE has considered performance generally in the development of these standards and does not believe that the standards established in today's final rule would adversely impact the utility of residential clothes washers.

8. Standby Power

In the framework document, DOE noted that it considered incorporating certain provisions of IEC Standard 62301, ''Household electrical appliances–Measurement of standby power'', First Edition 2005–06 (IEC Standard 62301 (First Edition)) in accordance with requirements of EISA 2007. DOE further noted that it would consider an updated version of IEC Standard 62301 in its residential clothes washer test procedure rulemaking. In response to the framework document, DOE received comments regarding the inclusion of standby and off mode power consumption in its clothes washer test procedure and its consideration of the updated version of IEC Standard 62301.

ALS commented that it supports revising the test procedure to add provisions for measuring standby power. (ALS, No. 13, No. 1) The California Utilities stated that DOE should make a determination of the metrics that it will use for clothes washer energy conservation standards, because if standby and off mode power is incorporated, MEF might not be used to regulate clothes washers in this rulemaking. According to the California Utilities, it would be detrimental to proceed with the preliminary analysis without finalizing possible changes to the metric. (California Utilities, No. 19 at p. 1) Whirlpool stated that standby power should be incorporated into MEF, rather than addressed as a separate metric. (Whirlpool, No. 22 at p. 2) ASAP, the California Utilities, the Joint Comment, and NEEP urged DOE to proceed with the clothes washer test procedure rulemaking without waiting further for the release of an updated version of IEC Standard 62301. (ASAP, Public Meeting Transcript, No. 7 at p. 18; California Utilities, No. 19 at p. 1; Joint Comment, No. 15 at p. 1; NEEP, No. 21 at p. 1) ASAP also commented that the mode definitions in IEC Standard 62301 are not necessarily comparable to DOE's statutory mode definitions, and that it may not be advisable to use the IEC definitions. (ASAP, Public Meeting, No. 7 at p. 19)

In the September 2010 TP NOPR, DOE proposed to incorporate by reference into the clothes washer test procedure specific provisions from IEC Standard 62301 (First Edition) regarding test conditions and test procedures for measuring standby mode and off mode power consumption. DOE also proposed to adopt certain provisions from the IEC Standard 62301 Committee Draft for Vote (CDV) version (an earlier draft version of the IEC 62301 revision), as well as the Final Draft International Standard (FDIS) version (the draft version developed just prior to the issuance of the Second Edition). Specifically, DOE proposed to adopt the 30-minute stabilization and 10-minute measurement periods as described in the CDV version and the mode definitions for active, standby and off mode as described in the FDIS version.

In the August 2011 TP SNOPR, DOE evaluated IEC Standard 62301 (Second Edition) and concluded that the application of the provisions of the Second Edition to all power measurements in standby mode and off mode for clothes washers would be an improvement over the First Edition and would not be unduly burdensome to conduct. Therefore, DOE proposed incorporating by reference the relevant paragraphs of section 4 and section 5 of IEC Standard 62301 (Second Edition) in the clothes washer test procedure.

In the March 2012 TP final rule, DOE incorporated by reference the relevant paragraphs of section 4 and section 5 of IEC Standard 62301 (Second Edition) in the clothes washer test procedure. DOE integrated standby and off mode energy use into its revised clothes washer test procedure by establishing an IMEF metric based on measurements made according to certain provisions of this updated IEC standard. 77 FR 13888. Accordingly, DOE based its analysis for clothes washer energy conservation standards in today's direct final rule on this IMEF metric.

DOE notes that AHAM provided a related comment in response to the Request for Information (RFI) issued by DOE to implement Executive Order 13563, ''Improving Regulation and Regulatory Review (76 FR 6123, Feb. 3, 2011), opposing any test procedure requirement to measure separately the energy use of delay start and cycle finished modes.[14] AHAM stated that the additional burden that would be required to measure a de minimis amount of energy would not be justified. (AHAM, IRRR, No. 10 at pp. 5–6) [15]

Based on the results of the data presented in the August 2011 TP SNOPR, DOE believes that including a specific measurement of energy use of a cycle finished feature that incorporates intermittent tumbling and air circulation would not significantly impact the total annual energy consumption. Furthermore, measuring the energy use over the entire duration of cycle finished mode would increase the test duration by up to 10 hours, depending on the maximum duration of cycle finished mode provided on the clothes washer under test. DOE believes this would represent a significant increase in test burden that would not be warranted by the minimal additional energy use captured by measuring cycle finished mode separately or as part of the active washing mode.

Therefore, in the March 2012 TP final rule, DOE did not adopt provisions to measure cycle finished mode separately or as part of the active washing mode. DOE believes that measuring power consumption of each mode separately would introduce significant test burden without a corresponding improvement in a representative measure of annual energy use. Therefore, DOE provided in the March 2012 TP final rule for measuring total energy consumption, in which all low-power mode hours are allocated to the inactive and off modes, and the low-power mode power consumption is measured only in the inactive and off modes, depending on which of these modes is present.

9. Test Cloth

Different lots of energy test cloth used in the clothes washer test procedure are released to the industry at least once a year, and the properties of the test cloth must be measured and standardized against reference historical lots. AHAM and ALS support revisions to the clothes washer test procedure for improving the process to correlate new test cloth batches to the historical lots. AHAM provided a proposal for an industry-developed auditing program, as well as suggested specifications for test cloth tolerances. GE supports this

[14] Definitions of operating modes, including cycle finished, delayed start, active washing, inactive, and off modes, are provided in the March 2012 TP final rule. 77 FR 13888.

[15] The notation in the form ''AHAM, IRRR, No. 10 at pp. 5–6'' identifies a written comment that DOE has received and has included in the docket of the Request for Information (RFI) to implement Executive Order 13563, ''Improving Regulation and Regulatory Review (76 FR 6123, Feb. 3, 2011). (Docket No. DOE–HQ–2011–0014). This particular notation refers to a comment (1) submitted by Association of Home Appliance Manufacturers (AHAM), (2) in document number 10 in the docket of that RFI, and (3) appearing on pages 5–6 of document number 10.

proposal. (AHAM, Public Meeting Transcript, No. 7 at pp. 21–22; AHAM, No. 16 at p. 2; ALS, No. 13 at p. 1; GE, No. 20 at p. 1) Whirlpool noted that the test cloth is currently available from one supplier that has limited capability to meet industry's needs. Whirlpool suggested that DOE assume responsibility for test cloth procurement and qualification. (Whirlpool, No. 22 at p. 1) DOE is currently working with industry, suppliers, and test laboratories to develop an auditing program that meets industry's needs. Qualification tests are being conducted at an independent test laboratory as well as at DOE's Appliance Testing and Evaluation Center (ATEC).

10. Technical Edits

AHAM and GE suggested that DOE remove obsolete sections of the clothes washer test procedure in guidelines that AHAM submitted to DOE on September 22, 2008. (AHAM, Public Meeting Transcript, No. 7 at p. 21; AHAM, No. 16 at p. 2; GE, No. 20 at p. 1) DOE agreed with these suggestions and removed the obsolete provisions in the revised test procedure as part of the residential clothes washer test procedure rulemaking.

11. Anti-Circumvention

EPCA requires that test procedures be reasonably designed to produce test results which measure energy efficiency, energy use, water use or estimated annual operating cost of a covered product during a representative average use cycle or period of use, as determined by the Secretary. 42 U.S.C. 6293(b)(3). This statutory requirement may be undermined if products are purposefully designed to use controls or features that produce test results that are so unrepresentative of a product's actual energy or water consumption as to provide materially inaccurate comparative data. The Joint Comment stated that DOE should ensure that the test procedure is not vulnerable to circumvention and should prohibit any mode or other operating function that is designed solely or primarily to reduce energy and water consumption during testing. According to the Joint Comment, sophisticated and inexpensive electronic controls may detect the DOE testing conditions and minimize energy and water use under those specific conditions. The Joint Comment described as an illustrative example a clothes washer with adaptive fill control that could be programmed to minimize the fill level when it measured a clothes load size at exactly the weight of the average DOE test load for that capacity machine. (Joint Comment, No. 15 at p. 3) DOE considered issues of circumvention in its clothes washer test procedure rulemaking.

C. Technological Feasibility

1. General

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

After DOE has determined that particular technology options are technologically feasible, it further evaluates each technology option in light of the following additional screening criteria: (1) Practicability to manufacture, install, or service; (2) adverse impacts on product utility or availability; and (3) adverse impacts on health or safety. Section IV.B of this notice discusses the results of the screening analysis for residential clothes washers, particularly the designs DOE considered, those it screened out, and those that are the basis for the efficiency levels considered in this rulemaking. For further details on the screening analysis for this rulemaking, see chapter 4 of the direct final rule TSD.

2. Maximum Technologically Feasible Levels

When DOE proposes to adopt an amended standard for a type or class of covered product, it must determine the maximum improvement in energy efficiency or maximum reduction in energy use that is technologically feasible for such product. (42 U.S.C. 6295(p)(1)) Accordingly, in the engineering analysis DOE determined the maximum technologically feasible (''max-tech'') improvements in energy efficiency for residential clothes washers, using the design parameters that lead to the creation of the most efficient products available on the market or in working prototypes. (See chapter 5 of the direct final rule TSD.) The max-tech levels that DOE determined for this rulemaking are described in section IV.C.4 of this final rule.

D. Energy Savings

1. Determination of Savings

DOE used its national impact analysis (NIA) spreadsheet model to estimate energy savings from amended standards for the products that are the subject of this rulemaking.[16] For each TSL, DOE forecasted energy savings beginning in 2015, the year that manufacturers would be required to comply with amended standards, and ending in 2044. DOE quantified the energy savings attributable to each TSL as the difference in energy consumption between the standards case and the base case. The base case represents the forecast of energy consumption in the absence of amended mandatory efficiency standards, and considers market demand for more efficient products.

The NIA spreadsheet model calculates the electricity savings in site energy expressed in kilowatt-hours (kWh). Site energy is the energy directly consumed by appliances at the locations where they are used. DOE reports national energy savings on an annual basis in terms of the aggregated source (primary) energy savings, which is the savings in the energy that is used to generate and transmit the site energy. (See chapter 10 of the direct final rule TSD). To convert site energy to source energy, DOE derived annual conversion factors from the model used to prepare the Energy Information Administration's (EIA) *Annual Energy Outlook 2010* (*AEO2010*).

2. Significance of Savings

As noted above, 42 U.S.C. 6295(o)(3)(B) prevents DOE from adopting a standard for a covered product unless such standard would result in ''significant'' energy savings. Although the term ''significant'' is not defined in the Act, the U.S. Court of Appeals, 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 all of the TSLs considered in this rulemaking are nontrivial, and, therefore, DOE considers them ''significant'' within the meaning of section 325 of EPCA.

[16] The NIA spreadsheet model is described in section IV.G of this notice.

E. Economic Justification

1. Specific Criteria

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

a. Economic Impact on Manufacturers and Consumers

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

For individual consumers, measures of economic impact include the changes in life-cycle cost (LCC) and payback period (PBP) associated with new or amended standards. The LCC, which is specified separately in EPCA as one of the seven factors to be considered in determining the economic justification for a new or amended standard, 42 U.S.C. 6295(o)(2)(B)(i)(II), is discussed in the following section. For consumers in the aggregate, DOE also calculates the national net present value of the economic impacts throughout the forecast period applicable to a particular rulemaking.

b. Life-Cycle Costs

The LCC is the sum of the purchase price of a product (including its installation) and the operating expense (including energy, maintenance, and repair expenditures) discounted over the lifetime of the product. The LCC savings for the considered efficiency levels are calculated relative to a base case that reflects likely trends in the absence of amended standards. The LCC analysis requires a variety of inputs, such as product prices, product energy consumption, energy prices, maintenance and repair costs, product lifetime, and consumer discount rates. In its analysis, DOE assumed that consumers will purchase the considered products in 2015.

To account for uncertainty and variability in specific inputs, such as product lifetime and discount rate, DOE uses a distribution of values, with probabilities attached to each value. A distinct advantage of this approach is that DOE can identify the percentage of consumers estimated to receive LCC savings or experience an LCC increase, in addition to the average LCC savings associated with a particular standard level. In addition to identifying ranges of impacts, DOE evaluates the LCC impacts of potential standards on identifiable subgroups of consumers that may be affected disproportionately by a national standard.

c. Energy Savings

Although significant conservation of energy is a separate statutory requirement for imposing an energy conservation standard, EPCA requires DOE, in determining the economic justification of a standard, to consider the total projected energy savings that are expected to result directly from the standard. (42 U.S.C. 6295(o)(2)(B)(i)(III)) DOE uses the NIA spreadsheet results in its consideration of total projected energy savings.

d. Lessening of Utility or Performance of Products

In establishing classes of products, and in evaluating design options and the impact of potential standard levels, DOE sought to develop standards for residential clothes washers that would not lessen the utility or performance of those products. (42 U.S.C. 6295(o)(2)(B)(i)(IV)) DOE believes that the TSLs adopted in today's direct final rule would not reduce the utility or performance of the clothes washers under consideration in this rulemaking.

e. Impact of Any Lessening of Competition

EPCA directs DOE to consider any lessening of competition that is likely to result from standards. It also 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 direct final 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 published a NOPR containing energy conservation standards identical to those set forth in today's direct final rule and transmitted a copy of today's direct final rule and the accompanying TSD to the Attorney General, requesting that the Department of Justice (DOJ) provide its determination on this issue. DOE will consider DOJ's comments on the rule in determining whether to proceed with the direct final rule. DOE will also publish and respond to DOJ's comments in the **Federal Register** in a separate notice.

f. Need for National Energy Conservation

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

Energy savings from the proposed standards also are likely to result in environmental benefits in the form of reduced emissions of air pollutants and greenhouse gases associated with energy production. DOE reports the environmental effects from today's standards, and from each TSL it considered, in the emissions analysis contained in chapter 15 in the direct final rule TSD and in section V.B.6 of this notice. DOE also reports estimates of the economic value of emissions reductions resulting from the considered TSLs.

g. Other Factors

EPCA allows the Secretary of Energy, in determining whether a standard is economically justified, to consider any other factors that the Secretary deems to be relevant. (42 U.S.C. 6295(o)(2)(B)(i)(VII)) In developing this direct final rule, DOE has also considered the submission of the Joint Petition, which DOE believes sets forth a statement by interested persons that are fairly representative of relevant points of view (including representatives of manufacturers of covered products, States, and efficiency advocates) and contains recommendations with respect to an energy conservation standard that are in accordance with 42 U.S.C. 6295(o). DOE has encouraged the submission of

consensus agreements as a way to bring diverse interested parties together, to develop an independent and probative analysis useful in DOE standard setting, and to expedite the rulemaking process. DOE also believes that standard levels recommended in the consensus agreement may increase the likelihood for regulatory compliance, while decreasing the risk of litigation.

2. Rebuttable Presumption

As set forth in 42 U.S.C. 6295(o)(2)(B)(iii), EPCA creates a rebuttable presumption that an energy conservation standard is economically justified if the additional cost to the consumer of a product that meets the standard is less than three times the value of the first year's energy savings resulting from the standard, as calculated under the applicable DOE test procedure. DOE's LCC and PBP analyses generate values used to calculate the effect potential amended energy conservation standards would have on the payback period for consumers. These analyses include, but are not limited to, the 3-year payback period contemplated under the rebuttable-presumption test. In addition, DOE routinely conducts an economic analysis that considers the full range of impacts to consumers, manufacturers, the nation, and the environment, as required under 42 U.S.C. 6295(o)(2)(B)(i). The results of this analysis serve as the basis for DOE's evaluation of the economic justification for a potential standard level (thereby supporting or rebutting the results of any preliminary determination of economic justification). The rebuttable presumption payback calculation is discussed in section IV.F.11 of this direct final rule and chapter 8 of the direct final rule TSD.

IV. Methodology and Discussion

DOE used two spreadsheet tools to estimate the impact of today's direct final rule. The first spreadsheet calculates LCCs and PBPs of potential new energy conservation standards. The second provides shipments forecasts and then calculates impacts of potential energy conservation standards on national energy savings and net present value. The two spreadsheets are available online at: *http://www1.eere.energy.gov/buildings/appliance_standards/residential/clothes_washers.html.* The Department also assessed manufacturer impacts, largely through use of the Government Regulatory Impact Model (GRIM).

Additionally, DOE estimated the impacts on utilities and the environment of energy conservation standards for residential clothes washers. DOE used a version of EIA's National Energy Modeling System (NEMS) for the utility and environmental analyses. The NEMS model simulates the energy sector of the U.S. economy. EIA uses NEMS to prepare its *Annual Energy Outlook,* a widely known baseline energy forecast for the United States. 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.*

The version of NEMS used for appliance standards analysis, which makes minor modifications to the *AEO* version, is called NEMS–BT.[17] 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. Market and Technology Assessment

1. General

When beginning an energy conservation standards rulemaking, DOE develops information that provides an overall picture of the market for the products concerned, including the purpose of the products, the industry structure, and market characteristics. This activity includes both quantitative and qualitative assessments based primarily on publicly available information. The subjects addressed in the market and technology assessment for this rulemaking include products covered by the rulemaking, quantities and types of products sold and offered for sale, retail market trends, product classes and manufacturers, regulatory and non-regulatory programs, and technology options that could improve the energy efficiency of the product(s) under examination. See chapter 3 of the direct final rule TSD for further discussion of the market and technology assessment.

2. Products Included in This Rulemaking

This subsection addresses whether EPCA covers certain products and thereby authorizes DOE to adopt standards for those products, and whether DOE will consider in this rulemaking standards for certain products that DOE determined are covered under EPCA.

ASAP questioned whether combination washer/dryers are covered products in this rulemaking. (ASAP, Public Meeting Transcript, No. 7 at p. 47) ''Clothes washer'' is defined in 10 CFR 430.2 to mean a consumer product designed to clean clothes using a water solution of soap or detergent and mechanical agitation or other movement. A combination washer/dryer meets this definition and also performs a drying function. As a result, DOE determined that combination washer/dryers are covered products according to the existing regulatory definition of clothes washer. DOE notes that combination washer/dryers are currently being testing by certain manufacturers according to the DOE clothes washer test procedure and that certification data is available for such products in, among others, the CEC and ENERGY STAR product databases. DOE also does not have information that would indicate that, while operating in clothes washer mode, the energy and water use of such a machine is inherently different from the energy and water use of a stand-alone clothes washer.

3. Product Classes

Existing energy conservation standards divide residential clothes washers into five product classes based on location of access, capacity, and features such as suds saving. As mentioned previously in section III.A.1 DOE is not maintaining the top-loading semiautomatic and suds-saving product classes. DOE is also splitting the front-loading product class into two separate product classes based on capacity. Table IV–1 presents the product classes set forth in 10 CFR 430.32(g) and the product classes established in this rulemaking.

TABLE IV–1—CLOTHES WASHER PRODUCT CLASSES

Product Classes in 430.32(g)	Product classes established in this rulemaking
i. Top-loading, compact (less than 1.6 cubic feet capacity).	i. Top-loading, compact (less than 1.6 cubic feet capacity).
ii. Top-loading, standard (1.6 cubic feet or greater capacity).	ii. Top-loading, standard (1.6 cubic feet or greater capacity).
iii. Top-loading, semi-automatic.	iii. Front-loading, compact (less than 1.6 cubic feet capacity).

[17] 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 name ''NEMS–BT'' refers to the model as used here. (BT stands for DOE's Building Technologies Program.)

TABLE IV–1—CLOTHES WASHER PRODUCT CLASSES—Continued

Product Classes in 430.32(g)	Product classes established in this rulemaking
iv. Front-loading	iv. Front-loading, standard (1.6 cubic feet or greater capacity).
v. Suds-saving.	

4. Non-Regulatory Programs

As part of the market and technology assessment, DOE reviews non-regulatory programs promoting energy efficient residential appliances in the United States. Non-regulatory programs that DOE considers in its market and technology assessment include ENERGY STAR, a voluntary labeling program administered jointly by the U.S. Environmental Protection Agency (EPA) and DOE. ENERGY STAR identifies energy efficient products through a qualification process.[18] To qualify, a product must exceed Federal minimum standards by a specified amount, or if no Federal standard exists, a product must exhibit select energy-saving features. ENERGY STAR specifications currently exist for residential clothes washers.

5. Technology Options

As part of the market and technology assessment, DOE developed a list of technologies to consider for improving the efficiency of residential clothes washers. Initially, these technologies encompassed all those DOE believes would improve energy efficiency and are technologically feasible. Chapter 3 of the direct final rule TSD includes the detailed list of all technology options identified for residential clothes washers.[19] DOE received multiple comments from interested parties in response to the technologies proposed for analysis.

In response to the framework document, interested parties suggested to DOE various databases from which it could obtain relevant product features and performance data. ALS recommended that DOE examine the CEC, FTC, and DOE certification databases, as well as the Web sites that ALS maintains for its own brands. (ALS, No. 13 at p. 2) The California Utilities and PG&E noted discrepancies among several databases, for instance that not all clothes washer models appear in all relevant lists, and requested that DOE reconcile the differences among them. (California Utilities, No. 19 at p. 4) DOE collected information to support this rulemaking from as many publicly available sources as it could identify, including trade publications, technical reports, manufacturers' literature, product databases, and inputs from interested parties. As part of its data collection, DOE reviewed all of those databases, as well as others that include qualifying product lists from ENERGY STAR and the CEE. In doing so, DOE evaluated product data critical to its analysis to ensure that appropriate values were being used.

ASAP, the Joint Comment, and PG&E stated that the data collection should include more recent data than for 2007. According to ASAP, more recent data would capture changes in market share as well as the effects of manufacturer production tax credits. (ASAP, Public Meeting Transcript, No. 7 at p. 122; Joint Comment, No. 15 at p. 8; PG&E, Public Meeting Transcript, No. 7 at p. 36) DOE attempts to collect the most comprehensive and recent data available. For today's direct final rule, DOE used AHAM's residential clothes washer data submission, which included shipments, shipment-weighted efficiency, and market share efficiency data through 2008.

The California Utilities recommended that DOE collect data on sales-weighted clothes washer capacity, preferably in increments of 0.5 cubic feet, because they suggest that capacity has a greater effect on clothes washer efficiency than do other features. The Joint Comment also recommended that shipment data be disaggregated by capacity in at most 0.5-cubic-foot increments, and that such data should identify fill control type (*i.e.,* adaptive water fill control, manual fill control, or combination adaptive and manual fill control). The Joint Comment stated that DOE also should collect shipment data for combination washer/dryers. (California Utilities, No. 19 at p. 4; Joint Comment, No. 15 at pp. 4, 8) DOE is unaware of residential clothes washer shipments data disaggregated to the granularity suggested by the California Utilities and the Joint Comment. DOE requested that interested parties provide such data or information on sources to obtain this information but received no further information.

B. Screening Analysis

DOE uses the following four screening criteria to determine which technology options are suitable for further consideration.

(1) *Technological feasibility.* DOE will consider technologies incorporated in commercial products or in working prototypes to be technologically feasible. (The technological feasibility of options was discussed in the preceding section as part of the market and technology assessment.)

(2) *Practicability to manufacture, install, and service.* If mass production and reliable installation and servicing of a technology in commercial products could be achieved on the scale necessary to serve the relevant market at the time the standard comes into effect, then DOE will consider that technology practicable to manufacture, install, and service.

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

(4) *Adverse impacts on health or safety.* If DOE determines that a technology will have significant adverse impacts on health or safety, it will not consider this technology further.

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

Technologies that pass through the screening analysis are referred to as ''design options'' in the engineering analysis. Details of the screening analysis are provided in chapter 4 of the direct final rule TSD.

In the framework document, DOE identified the following initial technology options that could improve the efficiency of residential clothes washers, as shown in Table IV–2.

TABLE IV–2—INITIAL TECHNOLOGY OPTIONS FOR RESIDENTIAL CLOTHES WASHERS

1. Adaptive control systems.
2. Added insulation.
3. Advanced agitation concepts for vertical-axis machines.
4. Automatic fill control.
5. Bubble action.
6. Direct-drive motor.
7. Electrolytic disassociation of water.
8. Horizontal-axis design.
9. Horizontal-axis design with recirculation.
10. Hot water circulation loop.
11. Improved fill control.

[18] For more information, visit *www.energystar.gov.*

[19] DOE notes that it included two technology options, improved horizontal axis washer drum design and reduced thermal mass, in its initial list of options, but later determined in its engineering analysis that available data did not indicate that these technologies improved energy efficiency of clothes washers. See section IV.C.1,

TABLE IV–2—INITIAL TECHNOLOGY OPTIONS FOR RESIDENTIAL CLOTHES WASHERS—Continued

12. Improved horizontal-axis washer drum design.
13. Improved water extraction to lower remaining moisture content.
14. Increased motor efficiency.
15. Low-standby-power design.
16. Ozonated laundering.
17. Plastic particle cleaning.
18. Reduced thermal mass.
19. Silver ion injection.
20. Spray rinse or similar water-reducing rinse technology.
20. Steam washing.
21. Thermostatically controlled mixing valves.
22. Tighter tub tolerance.
23. Ultrasonic washing.

DOE received the following specific comments with regard to the screening analysis for the residential clothes washer technology options presented in the framework document.

1. Technologies Requiring Clarification or Reclassification

AHAM, BSH, and GE commented that the horizontal-axis, top-loading clothes washer described in the framework document should be considered as a horizontal-axis product regardless of loading position. (AHAM, Public Meeting Transcript, No. 7 at p. 53; AHAM, No. 16 at p. 3; BSH, No. 11 at p. 3; GE, No. 20 at p. 1) ALS commented that one very small U.S. manufacturer has made a horizontal-axis top-loader, but it has not been readily accepted by consumers. (ALS, No. 13 at p. 2) As discussed in section III.A.2, DOE maintains product class distinction by method of loading for today's final rule. Therefore, DOE considers a horizontal-axis design as a technology to improve the efficiency of top-loading clothes washers. DOE notes that such products are currently on the market in the United States.

Several manufacturers requested additional information on some of the technology options without further comment. AHAM, GE, and Whirlpool requested clarification on bubble action, electrolytic disassociation of water, and improved horizontal-axis washer drum design. AHAM and GE stated that they sought clarification on increased motor efficiency, BSH requested clarification on improved horizontal-axis washer drum design and tighter tub tolerance, and Whirlpool requested clarification on the reduced thermal mass technology option. ALS stated it would not offer comment on electrolytic disassociation of water, ozonated laundering, plastic particle cleaning, and ultrasonic washing until more information was available on the technology. (AHAM, Public Meeting Transcript, No. 7 at pp. 52–53; AHAM, No. 16 at p. 3; ALS, No. 13 at p. 4; BSH, No. 11 at p. 3; GE, No. 20 at p. 1; Whirlpool, No. 22 at p. 4) ASAP asked whether the low standby-power design included both standby and off modes. (ASAP, Public Meeting Transcript, No. 7 at p. 63) Additional detail on each of these technologies is provided in chapter 3 of the direct final rule TSD.

DOE requested comment in the framework document on whether additional technology options should be considered. ALS and Whirlpool stated that they are unaware of additional technologies that should be considered in DOE's preliminary analysis. (ALS, No. 13 at p. 5; Whirlpool, No. 22 at p. 5) AHAM and GE suggested that DOE add turbidity sensors to the list of technology options considered. Whirlpool commented that turbidity sensors have not been proven to provide adequate stain removal, soil removal, and rinsing performance. (AHAM, Public Meeting Transcript, No. 7 at p. 68; AHAM, No. 16 at p. 4; GE, No. 20 at p. 1; Whirlpool, No. 22 at p. 5) Multiple manufacturers stated to DOE during interviews that turbidity sensors have not been implemented in clothes washers largely due to technical barriers such as the high foaming properties of U.S. laundry detergents. Therefore, DOE did not add turbidity sensors as a technology option.

AHAM, GE, Samsung, and SCE stated that DOE should evaluate smart grid-enabled, demand-responsive clothes washers. AHAM and GE identified peak load shedding, wherein peak electricity demand is reduced via voluntary curtailment of clothes washer usage during certain times, as an important capability of such clothes washers. (AHAM, Public Meeting Transcript, No. 7 at p. 31; AHAM, No. 16 at p. 4; GE, Public Meeting Transcript, No. 7 at p. 31; GE, No. 20 at pp. 1, 3; Samsung, No. 25 at p. 4; SCE, Public Meeting Transcript, No. 7 at pp. 30, 64) DOE is unaware at this time of any such clothes washers available on the U.S. market for evaluation in terms of energy and water savings. Therefore, DOE did not consider smart-grid or other network-enabled technology options in this rulemaking.

In the framework document, DOE tentatively included steam washing in the list of residential clothes washer technology options. AHAM, GE, and Whirlpool noted that steam washing is already available in higher price point clothes washers. BSH stated that it has found through laboratory testing that steam washing does not improve cleaning performance. (AHAM, No. 16 at p, 4; BSH, No. 11 at p. 3; GE, No. 20 at p. 1; Whirlpool, No. 22 at p. 4) DOE research and testing indicates that steam generation requires significantly more energy than the potential energy savings associated with using less hot water during the wash cycle. Therefore, in the final list of technology options, DOE did not consider steam washing as a means to reducing energy consumption.

2. Technological Feasibility

AHAM, BSH, GE, and Whirlpool stated that added insulation would provide no meaningful energy savings, resulting in a minimal impact on MEF. BSH also stated that added insulation would be an issue for Underwriters Laboratories (UL) listing, and that the energy savings associated with horizontal-axis designs that incorporate recirculation may be small. (AHAM, Public Meeting Transcript, No. 7 at p. 52; AHAM, No. 16 at p. 3; BSH, No. 11 at p. 3; GE, No. 20 at p. 1; Whirlpool, No. 22 at p. 3) DOE agrees that the energy savings associated with added insulation would be negligible, particularly as the amount of hot water used in clothes washers decreases. DOE did not observe insulation around the tub in any of the units in its test sample, and multiple manufacturers stated that there was no energy benefit associated with the use of insulation. Therefore, DOE screened out added insulation. For horizontal-axis design with recirculation, DOE observes that units incorporating this design are available on the market, and one manufacturer stated that it can achieve energy savings of about 5 percent. Therefore, DOE retained horizontal-axis design with recirculation for its analysis.

AHAM, GE, and Whirlpool commented that standby power accounts for a small percentage of total energy consumption—AHAM estimates it accounts for 3 percent of annual energy use—so that designs incorporating low standby power would have a minimal impact. (AHAM, Public Meeting Transcript, No. 7 at p. 53; AHAM, No. 16 at p. 3; GE, No. 20 at p. 1; Whirlpool, No. 22 at p. 4) DOE recognizes that standby power is a relatively small percentage of annual clothes washer energy consumption. Under EPCA, as amended by EISA 2007, however, DOE is required to integrate standby and off mode energy use into the energy efficiency metric if technically feasible and consistent with 42 USC 6295(o). Today's final rule includes amendments to include measures for standby and off mode power consumption for clothes washers.

DOE received additional comments from interested parties suggesting that DOE exclude certain technologies proposed in the framework document from further analysis because they already are in widespread use. AHAM, BSH, GE, and Whirlpool commented that adaptive control systems, automatic fill control, improved fill control, spray rinse or similar water-reducing rinse technologies, and thermostatically controlled mixing valves are already widely used in residential clothes washers, although they assumed that improved fill control was the same technology as adaptive fill controls. AHAM, GE, and Whirlpool stated that direct-drive motors, horizontal-axis designs with recirculation, and hot water circulation loops also are widely used. AHAM and GE further stated that the widespread use of direct-drive motors currently applies only to top-loaders, although the technology is also available for front-loaders. Whirlpool added that horizontal-axis design is widely used. According to Whirlpool, the efficiency gains from these technology options are being recognized already. AHAM, BSH, and GE further commented that reduced thermal mass is already in widespread use for horizontal-axis clothes washers. AHAM, BSH, GE, and Whirlpool also stated that current products are nearing the maximum possible centrifugal force levels, so that no additional energy savings could be achieved by improved water extraction to lower remaining moisture content. (AHAM, Public Meeting Transcript, No. 7 at p. 53; AHAM, No. 16 at pp. 3–4; BSH, No. 11 at p. 3; GE, No. 20 at p. 1; Whirlpool, No. 22 at pp. 3–4) DOE evaluated each of these technologies as part of its reverse-engineering and manufacturer interviews, and determined that baseline clothes washers are available that meet current Federal standards without the use of such designs, each of which represents a potential means to improve energy efficiency. DOE does not consider level of commercialization in itself to be an indicator of whether a technology should be screened out. Therefore DOE retained all the above mentioned technology options for its analysis.

According to Whirlpool, it routinely pursues increased motor efficiency in its product development. (Whirlpool, No. 22 at p. 4) Because this technology option meets DOE's screening criteria, it was retained for further analysis.

3. Practicability to Manufacture, Install, and Service/Adverse Impacts on Product Utility or Availability

AHAM, BSH, GE, and Whirlpool commented that advanced agitation concepts already exist in high efficiency top-loading residential clothes washers. Whirlpool stated that the cost of this technology option limits its adoption to higher-priced models. (AHAM, No. 16 at p. 3; BSH, No. 11 at p. 3; GE, No. 20 at p. 1; Whirlpool, No. 22 at p. 3) DOE considers costs of the design options necessary to achieve each efficiency level as part of the LCC and PBP analysis. Therefore, DOE retained advanced agitation concepts for top-loading machines for its analysis.

For ozonated laundering, AHAM and GE commented that they are aware of such technology only for expensive stand-alone units. According to those commenters, it is unclear how ozonated laundering could be implemented into the more price-conscious residential market. (AHAM, Public Meeting Transcript, No. 7 at p. 53; AHAM, No. 16 at p. 3; GE, No. 20 at p. 1) Whirlpool stated that ozonated laundering offers poor cleaning performance and is quite costly. (Whirlpool, No. 22 at p. 4) ASAP, AWE, and the Joint Comment noted that residential clothes washers using ozonated laundry technology currently are on the market in Japan. AWE specifically mentioned the Sanyo Aqua Ozone combination washer/dryer and stated that ozone is also used by multiple manufacturers for commercial laundry. ASAP and the Joint Comment stated that ozonated laundry allows significant reductions in water and energy use. (ASAP, Public Meeting Transcript, No. 7 at p. 63; AWE, No. 12 at p. 2; Joint Comment, No. 15 at p. 4) Because no such residential clothes washers have been produced or demonstrated for the U.S. market, DOE does not believe this technology would be practicable to manufacture, install, and service on the scale necessary to serve the U.S. residential clothes washer market at the time of the effective date of an amended standard. Also, because implementation of this technology in a residential application is so limited, DOE is unable to adequately assess the impacts on consumer health or utility. For these reasons, DOE screened out ozonated laundry.

AHAM, BSH, GE, and Whirlpool stated that plastic particle cleaning does not provide effective wash performance. BSH added that other concerns include the manufacture, maintenance, and disposal of the plastic particles. (AHAM, Public Meeting Transcript, No. 7 at p. 54; AHAM, No. 16 at p. 4; BSH, No. 11 at p. 3; GE, No. 20 at p. 1; Whirlpool, No. 22 at p. 4) Samsung commented that plastic particle cleaning would have to be evaluated with consideration of wash and rinse performance. (Samsung, No. 25 at p. 3) Though clothes washers using plastic particle cleaning exist in working prototypes, this technology has not yet been commercialized, and thus consumer utility has yet to be thoroughly evaluated in terms of cleaning performance, as well as handling of the plastic particles. In addition, because no clothes washer manufacturer is currently producing such a machine, and because the reliability and consumer habits associated with using plastic particles are as yet unknown, DOE believes that it would not be practicable to manufacture, install, and service this technology on the scale necessary to serve the relevant market at the time of the effective date of an amended standard. For these reasons, DOE screened out plastic particle cleaning.

Whirlpool commented that tighter tub tolerance can be achieved, but the technology option is costly enough to limit its adoption to higher price-point clothes washers because a stronger structure is required. (Whirlpool, No. 22 at p. 4) Because DOE accounts for the cost associated with each design option necessary to achieve a certain efficiency level, it did not screen out tighter tub tolerance on this basis and retained this design option for consideration in the engineering analysis.

AHAM, BSH, GE, and Whirlpool stated that ultrasonic washing is not a proven technology for residential clothes washers. Whirlpool further stated that this technology has not been proven to provide adequate stain removal, soil removal, or rinsing performance. (AHAM, Public Meeting Transcript, No. 7 at p. 54; AHAM, No. 16 at p. 4; BSH, No. 11 at p. 3; GE, No. 20 at p. 1; Whirlpool, No. 22 at p. 4) DOE's research supports these comments, indicating that ultrasonic washing has not been shown to remove soil from clothes adequately. In addition, bubble cavitations caused by standing ultrasonic waves potentially could damage fragile clothing or clothing fasteners, further reducing product utility. For these reasons, DOE screened out ultrasonic washing.

DOE understands that bubble action has been incorporated into commercially available residential clothes washers in Europe and Asia. Because production is nonexistent in the U.S., however, DOE does not believe that this technology would be practicable to manufacture, install, and

service on the scale necessary to serve the residential market at compliance date of new standards. For these reasons, DOE screened out bubble action.

4. Adverse Impacts on Health or Safety

ALS stated that it was not aware of any technologies that should be removed from consideration due to safety concerns. (ALS, No. 13 at p. 4)

ASAP and the Joint Comment stated that DOE should retain silver ion injection because it provides a deodorizing action in cold water washing and currently is available in the U.S. residential clothes washer market. According to the Joint Comment, such technology may encourage consumers to use fewer warm and hot water cycles. (ASAP, Public Meeting Transcript, No. 7 at p. 63; Joint Comment, No. 15 at p. 4) Whirlpool acknowledged that some manufacturers have incorporated silver ion technology as a means of disinfection, but stated that silver has an adverse impact on the environment. Whirlpool commented that the U.S. EPA requires that silver used for such a purpose be reported and tracked under the Federal Insecticide, Fungicide, and Rodenticide Act. (Whirlpool, No. 22 at p. 5) The EPA reporting requirement for clothes washers incorporating silver does not prevent commercialization of such technology, and DOE is not aware that any adverse impacts on health or safety have been demonstrated for this technology. Therefore DOE retained this option for consideration in the engineering analysis.

5. Additional Screening Criteria

DOE received a number of comments from interested parties recommending that it use additional criteria for screening technology options besides the four listed in 10 CFR part 430, subpart C, appendix A at 4(a)(4). AHAM, BSH, GE, and Whirlpool commented that technology options also should be evaluated on the basis of wash performance, rinse performance, and fabric care (damage, fraying, etc.). (AHAM, No. 16 at p. 4; BSH, No. 11 at p. 3; GE, No. 20 at p. 1; Whirlpool, No. 22 at p. 5) Miele, Inc. (Miele) questioned whether DOE would be evaluating each technology option on the basis of adequate wash performance. (Miele, Public Meeting Transcript, No. 7 at p. 65) For this rulemaking, DOE used the screening criteria set forth in its regulations. Technologies are evaluated in the screening analysis to determine whether they have an adverse impact on product utility or availability. Because DOE believes that the general utility of a clothes washer includes the ability to clean clothing adequately, DOE screened out those technologies that it believes have not been demonstrated to achieve adequate cleaning (*i.e.,* ultrasonic washing, as discussed previously).

Based on comments received regarding the initial technology options, DOE retained the design options shown in Table IV–3 for its subsequent engineering analysis. These remaining design options met all of the screening criteria listed above.

TABLE IV–3—DESIGN OPTIONS RETAINED FOR ENGINEERING ANALYSIS

1. Adaptive control systems.
2. Advanced agitation concepts for top-loading machines.
3. Automatic water fill control.
4. Direct-drive motor.
5. Horizontal-axis design.
6. Horizontal-axis design with recirculation.
7. Hot water circulation loop.
8. Improved fill control.
9. Improved horizontal-axis washer drum design.
10. Improved water extraction to lower remaining moisture content.
11. Increased motor efficiency.
12. Low-standby-power electronic controls.
13. Reduced thermal mass.
14. Silver ion injection.
15. Spray rinse or similar water-reducing rinse technology.
16. Thermostatically controlled mixing valves.
17. Tighter tub tolerance.

C. Engineering Analysis

In the engineering analysis, DOE evaluates a range of product efficiency levels and their associated manufacturing costs. The purpose of the analysis is to estimate the incremental manufacturer production costs (MPCs) associated with increasing efficiency levels above that of the baseline model in each product class. The engineering analysis considers technologies not eliminated in the screening analysis, although certain technologies are not analyzed if data does not exist to evaluate the energy efficiency characteristics of the technology; available data suggest that the efficiency benefits of the technology are negligible; or for reasons stated in the March 2012 TP final rule, DOE did not amend the test procedure to measure the energy impact of these technologies. DOE considers the remaining technologies, designated as design options, in developing cost-efficiency curves, which subsequently are used for the LCC and PBP analyses.

DOE has identified the following three methodologies for generating the manufacturing costs needed for the engineering analysis: (1) The design-option approach, which provides the incremental costs of adding to a baseline model design options that will improve its efficiency; (2) the efficiency-level approach, which provides the relative costs of achieving increases in energy efficiency levels, without regard to the particular design options 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 regarding costs for parts and material, labor, shipping/packaging, and investment for models that operate at particular efficiency levels.

DOE conducted the engineering analyses for the top-loading standard and front-loading standard product classes using a combination of the cost-assessment approach and the efficiency-level approach. The cost-assessment approach provides an accurate means for estimating a single manufacturer's incremental manufacturing costs for achieving various levels of increased efficiency. This approach involved physically disassembling commercially available products to develop cost-efficiency relationships for each manufacturer's product lines. Because each manufacturer may choose a different path to achieve higher levels of efficiency, an efficiency-level approach produces an industry-wide cost-efficiency relationship for each product class. DOE developed cost-efficiency relationships for the top-loading standard and front-loading standard product classes by calculating the market-weighted average of the individual cost-efficiency relationships it developed for each manufacturer.

Because less data was available for the top-loading compact and front-loading compact product classes, DOE used the design-option approach to develop the cost-efficiency relationships for these product classes. For the top-loading compact product class, DOE developed the cost-efficiency relationship by estimating the incremental costs of adding specific design options to a baseline model that would provide sufficient improvement in efficiency to achieve the higher efficiency levels considered for the analysis. For the front-loading compact product class, DOE estimated the efficiency of a baseline product by extrapolating the rated efficiencies of front-loading clothes washers with capacities nearing those that delineate the compact product class (*i.e.,* 1.6 to 3.0 cubic feet). DOE then estimated the incremental cost of adding specific design options to

this baseline model that would improve its efficiency enough to achieve the higher efficiency level considered for the analysis.

The efficiency levels that DOE considered in the engineering analysis are attainable using technologies currently available on the market for residential clothes washers. In addition, to provide interested parties with additional information about DOE's assumptions and results and the ability to perform independent analyses for verification, DOE associated each efficiency level with specific technologies that manufacturers might use. Chapter 5 of the direct final rule TSD describes the methodology and results of the efficiency level analysis used to derive the cost-efficiency relationships.

AHAM, ALS, GE, Samsung, and Whirlpool commented that they support the use of an efficiency-level approach for the analysis. (AHAM, Public Meeting Transcript, No. 7 at p. 81; AHAM, No. 16 at p. 5; ALS, No. 13 at p. 9; GE, No. 20 at p. 1; Samsung, No. 25 at p. 4; Whirlpool, No. 22 at p. 6) The Joint Comment stated that it supports a design-option approach, with the most significant design options evaluated separately rather than aggregated with other measures to help ensure transparency of the analysis. (Joint Comment, No. 15 at p. 5) The California Utilities stated that DOE should give greater weight to its reverse-engineering approach to isolate the cost premium of features on higher-efficiency clothes washers that may not contribute to or may even adversely affect efficiency. (California Utilities, No. 19 at p. 4) As discussed earlier, and as described in further detail in chapter 5 of the direct final rule TSD, DOE used a combination of these approaches, as appropriate, to develop the cost-efficiency relationships for each product class. The cost-efficiency relationships for each product class reflect only those design options that enable higher efficiencies, and exclude other non-efficiency related features that may contribute additional cost to higher-efficiency products. Details of the features and technologies associated with each efficiency level are also provided in chapter 5.

1. Other Technologies Not Analyzed

In performing the engineering analysis, DOE did not consider certain technologies that could not be evaluated for one or more of the following reasons: (1) Data are not available to evaluate the energy efficiency characteristics of the technology; (2) available data suggested that the efficiency benefits of the technology would be negligible; and (3) for the reasons stated in the March 2012 TP final rule, DOE did not amend the test procedure to measure the energy impact of these technologies. In its final analysis, DOE did not include the following design options:

a. Adaptive Control Systems

In the September 2010 TP NOPR, DOE stated that it was aware of multiple clothes washer models available on the market that use adaptive control technologies to respond to measured or inferred load size and fabric mix. However, as described in the August 2011 TP SNOPR, these models have since been discontinued, and DOE is unaware of any other residential clothes washers currently on the market offering adaptive controls other than adaptive fill control. Adaptive controls could allow a clothes washer to sense the fabric mix and soil level of a wash load, for example, and then adjust wash parameters such as the number of rinses, cycle time, and water temperatures accordingly. DOE is aware that many dishwashers incorporate adaptive controls by means of a turbidity sensor that adjusts the number and duration of wash and rinse cycles. The dishwasher test procedure accounts for this feature through the use of soiled dishware loads. 10 CFR part 430, subpart B, appendix C.

DOE is aware of other industry and international clothes washer test procedures that use a soiled wash load to determine wash performance, including AHAM HLW–1, ''Performance Evaluation Procedures for Household Clothes Washers''; IEC 60456, ''Clothes washing machines for household use–Methods for measuring the performance''; and Standards Australia/Standards New Zealand (AS/NZS) 2040.1, ''Performance of household electrical appliances–Clothes washing machines–Methods for measuring performance, energy and water consumption.'' [20] Because of the lack of commercially available clothes washers with adaptive features, however, DOE did not amend the test procedure in the March 2012 TP final rule to include provisions for measuring the energy consumption of clothes washers offering adaptive controls other than adaptive fill control. For these reasons, DOE did not include adaptive controls in its engineering analysis.

b. Improved Horizontal-Axis Washer Drum Design

Although several manufacturers have claimed improved wash performance and greater utility from improved drum designs for front-loading clothes washers, DOE is unaware of any publicly available data to corroborate a decrease in cycle time or water consumption or an increase in energy efficiency as a result of implementing this design option in residential clothes washers. Therefore, DOE did not include this design option in its analysis.

c. Reduced Thermal Mass

Reduced thermal mass describes minimizing the amount of energy consumed by heating the wash tub to the temperature of the wash water. DOE research suggests that manufacturers typically already use tubs with low thermal mass for all clothes washers and that there is no practicable way to manufacture clothes washers with significantly lower thermal mass beyond the current practice. DOE is unaware of any data available regarding efficiency improvements related to further decreasing the thermal mass of wash tubs, and therefore did not consider this technology in its analysis.

d. Silver Ion Injection

Silver ion injection provides an alternative to the traditional method of sanitizing clothes using a hot water wash. Silver ion injection works by electrolyzing pure silver during the wash and rinse cycles, and releasing the ions into the wash basket to sanitize the basket and wash load. While this technology option appears to offer an efficiency improvement by eliminating the need for high wash water temperatures, the current DOE test procedure does not capture this efficiency gain. Additionally, DOE lacks data on the reduction in warm and hot water cycles associated with silver ion injection and is not aware of any test procedures that could be used to measure any energy savings resulting from the use of silver ion injection. Because of this, DOE was unable to consider silver ion injection for further analysis.

e. Tighter Tub Tolerance

The tighter tub tolerance technology option reduces the annular volume between the inner wash basket and the outer tub and hence reduces the total amount of water required for a fill cycle. As a result of discussions with manufacturers, DOE believes that this technology option has reached its limit for efficiency gains. Decreasing the space between the wash basket and the tub any further could create problems such as ''suds lock,'' whereby suds remain between the wash basket and

[20] AHAM and AS/NZS standards are available online at *http://webstore.ansi.org/*.

tub; improper draining during the spin cycle; noise; and vibration, thereby negatively impacting product utility. Therefore, DOE did not consider this design option in its engineering analysis.

Table IV–4 shows the final list of design options that DOE retained for the engineering analysis.

TABLE IV–4—RETAINED DESIGN OPTIONS FOR RESIDENTIAL CLOTHES WASHERS

1. Advanced agitation concepts for top-loading machines.
2. Automatic water fill control.
3. Direct-drive motor.
4. Horizontal-axis design.
5. Horizontal-axis design with recirculation.
6. Hot water circulation loop.
7. Improved fill control.
8. Improved water extraction to lower remaining moisture content.
9. Increased motor efficiency.
10. Low-standby-power electronic controls.
11. Spray rinse or similar water-reducing rinse technology.
12. Thermostatically controlled mixing valves.

2. Baseline Efficiency Levels

In the framework document, DOE proposed baseline efficiency levels in active mode for top-loading standard, top-loading compact, and front-loading clothes washers. DOE did not consider front-loading compact models in the framework document. The Joint Petition, however, proposed standard levels for a front-loading compact product classes. In today's final rule, DOE defined baseline efficiency levels and higher efficiency levels for each of the four product classes to conduct its engineering analyses. DOE defined a baseline efficiency level of 1.60 MEF/8.5 WF for the front-loading compact product class, as well as an updated baseline efficiency level of 0.77 MEF/14.0 WF for the top-loading compact product class. Chapter 5 of the direct final rule TSD provides further details on the development of these baseline efficiency levels.

In the framework document, DOE based the baseline level for top-loading standard units on the MEF specified by current Federal energy conservation standards and the water factor (WF) requirement established by EISA 2007, which became effective for residential clothes washers manufactured on or after January 1, 2011. The top-loading compact MEF similarly was based on existing standards, with the WF scaled from the top-loading standard-size value by the ratio of MEFs for the two product classes. Because DOE understands that all commercially available front-loading clothes washers have efficiencies that meet or exceed the existing Federal standards and the former ENERGY STAR level of 1.72 MEF and 8.0 WF, effective prior to July 2009, DOE applied the former ENERGY STAR level to characterize the baseline unit efficiency for front-loading clothes washers.

AHAM, ALS, and BSH stated that they support the proposed baseline efficiency levels for top-loading standard (1.26 MEF/9.5 WF), top-loading compact (0.65 MEF/18.4 WF), and front-loading standard (1.72 MEF/8.0 WF) product classes. (AHAM, Public Meeting Transcript, No. 7 at p. 72; AHAM, No. 24 at p. 2; ALS, Public Meeting Transcript, No. 7 at p. 73; ALS, No. 13 at p. 5; BSH, No. 11 at p. 4) Whirlpool commented that it supports the proposed baseline efficiency levels for the top-loading standard and front-loading standard product classes. (Whirlpool, No. 22 at p. 5) The Joint Comment stated that DOE should determine the WF of baseline top-loading compact clothes washers through sampling rather than by scaling the standard-size baseline value. (Joint Comment, No. 15 at p. 5) For the direct final rule analysis, DOE defined the baseline efficiency levels for the standard product classes, both top-and front-loading, as they were defined in the framework document. DOE defined the baseline efficiency level of 0.77 MEF/14.0 WF for the top-loading compact product class based on a survey of products currently available on the market. This baseline represents an improvement over the 0.65 MEF/18.4 WF baseline defined in the framework document.

Samsung stated that because it does not support separate classes based on washer axis, it recommends a single baseline efficiency level. (Samsung, No. 25 at p. 4) For the reasons discussed in III.A.2 DOE has retained separate product classes based on method of access and capacity, and thus continued to use separate baseline efficiency levels for each product class.

BSH suggested including a front-loading compact product class, with a baseline efficiency level of 1.63 MEF/8.5 WF, based on data from the CEC residential clothes washer product database. (BSH, No. 11 at p. 4) The Joint Petition also included a front-loading compact product class. DOE defined a baseline efficiency level of 1.60 MEF/8.5 WF for the front-loading compact product class, based on an extrapolation of the rated efficiencies of front-loading clothes washers with capacities nearing those that delineate the compact product class (*i.e.,* 1.6 to 3.0 cubic feet). Chapter 5 of the direct final rule TSD provides further details of on the development of the baseline efficiency level for the front-loading compact product class.

AHAM, ALS, GE, and Samsung stated that no baseline efficiency levels need to be defined for top-loading semi-automatic and suds-saving product classes, since these product classes should be eliminated. (AHAM, No. 16 at p. 4; ALS, No. 13 at p. 5; GE, No. 20 at p. 1; Samsung, No. 25 at p. 4) Because DOE eliminated the top-loading semi-automatic and suds-saving product classes, DOE did not define corresponding baseline efficiency levels.

3. Higher Efficiency Levels

a. Efficiency Levels Proposed in Framework Document

In the framework document, DOE considered efficiency levels higher than baseline levels based on specifications prescribed by ENERGY STAR and CEE's Super-Efficient Home-Appliances Initiative. The highest efficiency levels were defined by the maximum available technology that DOE could identify on the market. Where the increments between adjacent efficiency levels were large, DOE proposed to add an intermediate ''gap-fill'' level. Table IV–5 through Table IV–7 show the efficiency levels proposed in the framework document, based on MEF and WF.

TABLE IV–5—EFFICIENCY LEVELS PROPOSED IN THE FRAMEWORK DOCUMENT FOR TOP-LOADING STANDARD RESIDENTIAL CLOTHES WASHER FRAMEWORK DOCUMENT

Level	Efficiency level description	Efficiency level	
		MEF (ft^3/kWh/cycle)	WF (gal/cycle/ft^3)
Baseline	DOE Standard	1.26	9.50

TABLE IV–5—EFFICIENCY LEVELS PROPOSED IN THE FRAMEWORK DOCUMENT FOR TOP-LOADING STANDARD RESIDENTIAL CLOTHES WASHER FRAMEWORK DOCUMENT—Continued

Level	Efficiency level description	Efficiency level	
		MEF (ft^3/kWh/cycle)	WF (gal/cycle/ft^3)
1	Gap Fill	1.40	9.50
2	Former ENERGY STAR (pre-July 2009)	1.72	8.00
3	Former ENERGY STAR (pre-Jan 2011), also CEE Tier 1	1.80	7.50
4	Current ENERGY STAR (Jan 2011), also CEE Tier 2	2.00	6.00
5	Max Available	2.26	4.48

TABLE IV–6—EFFICIENCY LEVELS PROPOSED IN THE FRAMEWORK DOCUMENT FOR TOP-LOADING COMPACT RESIDENTIAL CLOTHES WASHER FRAMEWORK DOCUMENT

Level	Efficiency level description	Efficiency level	
		MEF (ft^3/kWh/cycle)	WF (gal/cycle/ft^3)
Baseline	DOE Standard	0.65	18.40
1	Max Available	0.78	13.90

TABLE IV–7—EFFICIENCY LEVELS PROPOSED IN THE FRAMEWORK DOCUMENT FOR FRONT-LOADING RESIDENTIAL CLOTHES WASHER FRAMEWORK DOCUMENT

Level	Efficiency level description	Efficiency level	
		MEF (ft^3/kWh/cycle)	WF (gal/cycle/ft^3)
Baseline	Former ENERGY STAR (pre-July 2009)	1.72	8.00
1	Former ENERGY STAR (pre-Jan 2011), also CEE Tier 1	1.80	7.50
2	Current ENERGY STAR (Jan 2011), also CEE Tier 2)	2.00	6.00
3	CEE Tier 3	2.20	4.50
4	Gap Fill	2.40	4.20
5	Max Available	2.89	3.36

DOE received a number of comments on the efficiency levels and provides responses to those comments and changes made to the efficiency levels for today's direct final rule in the paragraphs that follow. The efficiency levels analyzed for today's final rule are set forth in section IV.C.3.b (Table IV–8 through Table IV–11).

Whirlpool stated that it supports the efficiency levels proposed in the framework document. (Whirlpool, No. 22 at p. 6) PG&E asked how DOE will prioritize MEF and WF when determining efficiency levels. As noted previously, efficiency levels were based primarily on levels defined by the ENERGY STAR and CEE voluntary programs. DOE subsequently added gap-fill levels based on data for available products, selecting combinations of MEF and WF that were achieved by a significant number of existing clothes washers and that also reasonably spanned the incremental changes in both metrics between the next-lowest and next-highest efficiency levels.

BSH proposed one additional efficiency level for a newly created front-loading compact product class above the baseline efficiency level it proposed—2.31 MEF/4.4 WF. BSH identified this as the maximum available technology level. (BSH, No. 11 at p. 6) The Consensus Agreement submitted by the Joint Petitioners includes efficiency standards for front-loading compact clothes washers of 1.72 MEF and 8.0 WF. As described previously, DOE defined a baseline efficiency level of 1.60 MEF and 8.5 WF for the front-loading compact product class. DOE defined one additional efficiency level at 1.72 MEF and 8.0 WF based on the standard level proposed in the Consensus Agreement.

ASAP, Earthjustice, and the Joint Comment stated that DOE should modify its proposed efficiency levels to harmonize them for standard-capacity top-loaders and front-loaders. In particular, those interested parties stated that DOE should set the highest efficiency level for the top-loading standard product class to CEE's Tier 3 level. (ASAP, Public Meeting Transcript, No. 7 at p. 87–88; Earthjustice, No. 17 at p. 7; Joint Comment, No. 15 at p. 5) The CEE Tier 3 level is 2.20 MEF/4.5 WF, which is slightly less stringent in MEF but slightly more stringent in WF than the maximum technologically feasible level for this product class identified in the framework document, 2.26 MEF/4.48 WF. Under EPCA, DOE is required to analyze the max-tech level for each product class. (42 U.S.C. 6295(o)(2)) In the framework document, DOE based its max-tech level for top-loading standard residential clothes washers on the maximum performance of products available on the market in the United States at that time. Since publication of the framework document, DOE became aware of a new max-tech unit on the market rated at 2.47 MEF and 3.6 WF. Therefore, in the direct final rule analysis, DOE created a new max-tech efficiency level corresponding to these efficiency ratings.

AHAM and ASAP questioned the gap-fill level identified as Efficiency Level 4 for front-loading clothes washers. ASAP recommended that Efficiency Level 4 be specified as having a WF of 4.0 rather than the value of 4.2 proposed in the framework document. (AHAM, Public Meeting Transcript, No. 7 at p. 89; ASAP, Public Meeting Transcript, No. 7 at p. 89) DOE proposed Efficiency Level 4 for front-loading clothes washers—2.40 MEF/4.20 WF—based on performance metrics represented in a number of models in the CEC and ENERGY STAR databases. Therefore, DOE retained Efficiency Level 4 at a WF of 4.2.

In addition, DOE's reverse engineering suggested that an additional gap-fill level between Efficiency Level 4 (gap-fill) and Efficiency Level 5 (max available) was warranted (see chapter 5 of the direct final rule TSD for more information). Based on a review of available products, DOE defined a second gap-fill level at 2.60 MEF/3.8 WF. DOE notes a small incremental span in WF between ASAP's proposed Efficiency Level 4 (4.0 WF) and DOE's additional gap-fill level (3.8 WF). DOE found no meaningful differences in technology options required to achieve either water consumption level. Therefore, DOE retained a WF of 3.8 for the additional gap-fill level.

b. Efficiency Levels Used in Final Analysis

Table IV–8 through Table IV–11 show the efficiency levels used in the final analysis according to the test procedure in appendix J1 as well as the revised test procedure in appendix J2.

TABLE IV–8—EFFICIENCY LEVELS FOR TOP-LOADING STANDARD RESIDENTIAL CLOTHES WASHER FINAL ANALYSIS

Level	Efficiency level description	Efficiency level—appendix J1		Integrated efficiency level—appendix J2	
		MEF (ft^3/kWh/cycle)	WF (gal/cycle/ft^3)	IMEF (ft^3/kWh/cycle)	IWF (gal/cycle/ft^3)
Baseline	DOE Standard + 0 W Standby	1.26	9.5	0.84	9.9
1	Gap Fill + 0 W Standby	1.40	9.5	0.98	9.9
2	Former ENERGY STAR (pre-2009) + 0 W Standby [Consensus Agreement 2015].	1.72	8.0	1.29	8.4
3*	Former ENERGY STAR (pre-2011) + 2.3 W Standby.	1.80	7.5	1.34	7.9
5	Former ENERGY STAR (pre-2011) + 0.08 W Standby.	1.80	7.5	1.37	7.9
6	Current ENERGY STAR (Jan 2011) + 0.08 W Standby [Consensus Agreement 2018].	2.00	6.0	1.57	6.5
7	Max Available (at time of Framework Document) + 0.08 W Standby.	2.26	4.5	1.83	5.0
8	Current Max Available + 0.08 W Standby	2.47	3.6	2.04	4.1

*DOE also analyzed design options that would meet an efficiency level 4, represented by ''Former ENERGY STAR (pre-2011) + 1.7 W Standby''; however, this efficiency level has the same IMEF and IWF as the efficiency level represented by Former ENERGY STAR (pre-2011) + 2.3 W Standby and is therefore not included in the table.

TABLE IV–9—EFFICIENCY LEVELS FOR FRONT-LOADING STANDARD RESIDENTIAL CLOTHES WASHER FINAL ANALYSIS

Level	Efficiency level description	Efficiency level—appendix J1		Integrated efficiency level—appendix J2	
		MEF (ft^3/kWh/cycle)	WF (gal/cycle/ft^3)	IMEF (ft^3/kWh/cycle)	IWF (gal/cycle/ft^3)
Baseline	Former ENERGY STAR (pre-2009) + 2.3 W Standby.	1.72	8.0	1.37	8.3
1	Former ENERGY STAR (pre-2009) + 1.7 W Standby.	1.72	8.0	1.39	8.3
2	Former ENERGY STAR (pre-2009) + 0.08 W Standby.	1.72	8.0	1.41	8.3
3	Former ENERGY STAR (pre-2011) + 0.08 W Standby.	1.80	7.5	1.49	7.8
4	Current ENERGY STAR (Jan 2011) + 0.08 W Standby.	2.00	6.0	1.66	6.3
5	CEE Tier 3 + 0.08 W Standby [Consensus Agreement 2015].	2.20	4.5	1.84	4.7
6	Gap Fill + 0.08 W Standby	2.40	4.2	2.02	4.4
7	Gap Fill + 0.08 W Standby	2.60	3.8	2.20	4.0
8	Max Available + 0.08 W Standby	2.89	3.2	2.46	3.4

TABLE IV–10—EFFICIENCY LEVELS FOR TOP-LOADING COMPACT RESIDENTIAL CLOTHES WASHER FINAL ANALYSIS

Level	Efficiency level description	Efficiency level—appendix J1		Integrated efficiency level—appendix J2	
		MEF (ft^3/kWh/cycle)	WF (gal/cycle/ft^3)	IMEF (ft^3/kWh/cycle)	IWF (gal/cycle/ft^3)
Baseline	Baseline product on the market	0.77	14.0	0.59	14.4
1	Consensus Agreement (2015 Proposed Standard).	1.26	14.0	0.86	14.4
2	Consensus Agreement (2018 Proposed Standard).	1.81	11.6	1.15	12.0

TABLE IV–11—EFFICIENCY LEVELS FOR FRONT-LOADING COMPACT RESIDENTIAL CLOTHES WASHER FINAL ANALYSIS

Level	Efficiency level description	Efficiency level—appendix J1		Integrated efficiency Level—appendix J2	
		MEF (ft^3/kWh/cycle)	WF (gal/cycle/ft^3)	IMEF (ft^3/kWh/cycle)	IWF (gal/cycle/ft^3)
Baseline	DOE-estimated baseline level	1.60	8.5	1.03	8.8
1	Consensus Agreement (2015 Proposed Standard).	1.72	8.0	1.13	8.3

As discussed in III.B, DOE recently published a revised test procedure, designated appendix J2, use of which will be required as of the compliance date of the 2015 standard in this direct final rule, absent adverse comment that results in withdrawal of today's direct final rule pursuant to 42 U.S.C. 6295(p)(4). 77 FR 13888. The revised test procedure establishes an IMEF metric that incorporates energy use in standby and off mode, and an IWF metric that incorporates water usage from all cycles included in the energy test cycle.

DOE included the impacts of new provisions in the amended test procedure in developing the IMEF/IWF efficiency levels in today's DFR. To perform this translation, DOE tested a wide range of both top-loading and front-loading clothes washers according to the test procedure at appendix J1 and the revised test procedure at appendix J2. Based on these tests, DOE developed correlation curves relating MEF to IMEF and WF to IWF. Chapter 5 of the direct final rule TSD provides additional detail on the method DOE used to convert from MEF/WF levels to IMEF/IWF levels.

Because the revised standards for residential clothes washers are required by EPCA to incorporate standby mode and off mode energy use (42 U.S.C. 6295(gg)(3)), DOE created efficiency levels for the top-loading standard and front-loading standard product classes that incorporate reduced standby power options into the MEF efficiency levels where DOE determined them to be most cost effective. In residential clothes washers, only units with electronic controls consume standby power; units with electromechanical controls consume no standby or off-mode power.

For the top-loading standard product class, standby power is likely to be added at Efficiency Level 3 in Table IV–8. This corresponds to the efficiency level at which electronic controls would be required. Because reduced standby power design options are more cost-effective than most other available design options, they are likely to be one of the first design options used by manufacturers to achieve higher IMEF ratings in units above Efficiency Level 3. DOE identified three distinct standby power design options, which are incorporated at Efficiency Level 3, Efficiency Level 4, and Efficiency Level 5. Efficiency Levels 6–8 incorporate the standby design option in Efficiency Level 5, which has the lowest energy use.

For the front-loading standard product class, DOE is unaware of any units that do not use electronic controls. Therefore, standby power is experienced at all efficiency levels. As with top-loading clothes washers, reduced standby power design options are more cost-effective than most other available design options, and they are likely to be one of the first design options used by manufacturers to achieve higher IMEF ratings in units above the baseline level. Therefore, as shown in Table IV–9, DOE incorporated the three distinct standby power design options at the Baseline Level, Efficiency Level 1, and Efficiency Level 2. Efficiency Levels 3–8 incorporate the standby design option in Efficiency Level 2, which has the lowest energy use.

Chapter 5 of the direct final rule TSD provides detailed descriptions of the design options associated with each efficiency level, including details of the active mode and standby mode efficiency levels for each product class.

For the front-loading standard product class, DOE introduced a second gap fill level in the final analysis at 2.6 MEF/3.8 WF (EL 7). During the reverse-engineering analysis, DOE observed specific technology options employed at this efficiency level, and thus determined that an additional gap fill at this level is appropriate.

For the top-loading compact product class, DOE defined the baseline efficiency level based on a survey of units currently available on the market, as described previously in section IV.C.2. Efficiency Level 1 and Efficiency Level 2 represent the standard levels proposed in the Consensus Agreement for 2015 and 2018, respectively. Chapter 5 of the direct final rule TSD provides detailed descriptions of the design options manufacturers are likely to use to achieve the higher efficiency levels.

For the front-loading compact product class, DOE defined the baseline efficiency level based on an extrapolation of the rated efficiencies of front-loading clothes washers with capacities nearing those that delineate the compact product class (*i.e.,* 1.6 to 3.0 cubic feet), as described in section IV.C.2. Efficiency Level 1 represents the 2015 standard level proposed in the Consensus Agreement.

Chapter 5 of the direct final rule TSD provides further details of the analysis

performed on the efficiency levels for this product class. As discussed in more detail in chapter 5, manufacturers indicated during manufacturer interviews that the efficiency levels chosen by DOE would not result in an increased cycle time for units within any of the product classes established in today's direct final rule, an assertion that is supported by DOE analysis of test data and published product literature. DOE seeks comment on this issue in section II.B.3.

4. Maximum Technologically Feasible Efficiency Levels

In the framework document, DOE based its max-tech level for top-loading standard and front-loading standard residential clothes washers on the maximum performance of products currently on the market in the United States, based on its review of various product databases. DOE considered several models in each product class to determine max-tech values that best represent optimal performance of IMEF and IWF for clothes washers on the market. DOE sought comment on whether the ''maximum available'' efficiency levels, shown in Table IV–12, represented max-tech efficiency.

TABLE IV–12—PROPOSED MAXIMUM TECHNOLOGICALLY FEASIBLE EFFICIENCY LEVELS PROPOSED IN THE FRAMEWORK DOCUMENT FOR RESIDENTIAL CLOTHES WASHERS

Product class	Max-tech levels	
	MEF	WF
1. Top-loading, Compact (less than 1.6 ft^3 capacity)	0.78	13.90
2. Top-loading, Standard	2.26	4.48
3. Front-loading	2.89	3.36

The American Water Works Association (AWWA), the California Utilities, the Joint Comment, and PG&E objected to the use of ''maximum available'' efficiency levels as a substitute for max-tech. AWWA, the California Utilities, and the Joint Comment stated that DOE must survey available technologies to determine the maximum achievable levels. (AWWA, No. 14 at p. 1; California Utilities, No. 19 at p. 5; Joint Comment, No. 15 at p. 5; PG&E, Public Meeting Transcript, No. 7 at p. 90) Whirlpool stated that it believes that it manufactures the model that is the basis for the maximum available level for top-loading clothes washers. Whirlpool stated that this maximum available level is at or near the max-tech limit. Even so, Whirlpool stated that the platform is relatively costly (with a suggested retail price of $1099–$1299), so that it would not be an economically justified standard level. ALS commented that the max-tech efficiency level should not represent a niche product, a product with low-end capacity, or some proprietary design. SCE asked whether an efficiency-level approach would limit how DOE develops its max-tech levels. (ALS, No. 13 at p. 9; Whirlpool, Public Meeting Transcript, No. 7 at p. 91, Whirlpool, No. 22 at p. 6; SCE, Public Meeting Transcript, No. 7 at p. 90)

Under EPCA, DOE is required to consider the maximum technologically feasible level. DOE determines max-tech levels based on technologies that are either commercially available or have been demonstrated as working prototypes. If the max-tech design meets DOE's screening criteria, DOE considers the design in further analysis. DOE also considers consumer utility and availability of features, which may be met by a niche product, as required by EPCA.

As described previously, DOE became aware of a new top-loading standard clothes washer with a higher MEF and lower WF than the max-tech level considered in the framework document. This new max-tech efficiency level was added for the direct final rule analysis. For front-loading standard clothes washers, DOE did not identify any other designs or combinations of technologies beyond the ''maximum available'' that would lead to a different max-tech level without requiring proprietary designs. For top-loading compact clothes washers, DOE used the 2018 standard level proposed in the Consensus Agreement as the max-tech level, as described previously. For front-loading compact clothes washers, DOE used the 2015 standard level proposed in the Consensus Agreement as the max-tech level.

Finally, DOE has observed that the max-tech units on the market use a combination of significantly reduced water volumes, reduced water temperatures, extended cycle times, and extremely high spin speeds. (See chapter 5 of the direct final rule TSD). DOE is not aware of any additional design options that could be used to increase the efficiency beyond the max-tech levels without causing potential negative effects on consumer utility. Nor is DOE aware of any working prototype clothes washers that exceed the efficiency levels of the max-tech units on the market in the United States. Therefore, DOE believes the ''max available'' efficiency levels for residential clothes washers correspond to the maximum technologically feasible efficiency levels. Accordingly, DOE does not believe that using an efficiency-level approach would limit how it develops its max-tech levels.

Table IV–13 shows the max-tech levels used for the final analysis.

TABLE IV–13—MAXIMUM TECHNOLOGICALLY FEASIBLE EFFICIENCY LEVELS FOR RESIDENTIAL CLOTHES WASHERS FINAL ANALYSIS

Product class	Max tech levels—appendix J2	
	IMEF	IWF
Top-loading, Standard	2.04	4.1
Front-loading, Standard	2.46	3.4
Top-loading, Compact	1.15	12.0
Front-loading, Compact	1.13	8.3

5. Proprietary Designs

In its engineering and economic analyses DOE considers all design options that are commercially available or present in a working prototype, including proprietary designs and technologies. DOE will consider a proprietary design in the subsequent analyses only if the achieved efficiency level can also be reached using other nonproprietary design options. If the proprietary design is the only approach available to achieve a given efficiency level, then DOE will reject that efficiency level to avoid impacts on competition that would likely result.

AHAM, GE, and Whirlpool stated that they are not aware of any proprietary designs or technologies that would impact this rulemaking. (AHAM, Public Meeting Transcript, No. 7 at p. 93; AHAM, No. 16 at p. 5; GE, No. 20 at p. 1; Whirlpool, No. 22 at p. 7) Earthjustice commented that DOE must evaluate the maximum technologically feasible standards for clothes washers, including those that use proprietary technology. According to Earthjustice, DOE's unqualified rejection of efficiency levels incorporating proprietary technologies repeats the errors that DOE made over 25 years ago in refusing to analyze efficiency levels incorporating technologies available only in prototypes. In that rulemaking, Earthjustice stated that the D.C. Circuit wrote that DOE ''conclusively assume[d] that manufacturers cannot incorporate any prototypes for any product type or class into all appliances of that type or class [by the effective date of the

standard].'' *Natural Resources Defense Council* v. *Herrington,* 768 F.2d 1355, 1396 (D.C. Cir. 1985). Earthjustice believes that DOE's approach in the current clothes washer rulemaking would similarly exclude a technology without any analysis of technological feasibility or economic justification. Earthjustice also stated that Congress clearly intended for DOE to carefully consider the impact of adopting standards that depend on the use of proprietary technologies, as it required in 42 U.S.C. 6295(o)(2)(B)(i)(V) that DOE consider the impact on competition in weighing the economic justification for a given standard level. Earthjustice concluded that DOE cannot lawfully exclude proprietary technologies from its analysis without a justification that complies with EPCA. (Earthjustice, No. 17 at pp. 9–10)

DOE considers in its analysis technologies that have been incorporated into working prototypes, consistent with the D.C. Circuit decision discussed above. DOE also considers proprietary technologies if the efficiency levels that can be met using those technologies can also be met using other, non-proprietary technologies. DOE does not consider proprietary technologies when such technologies provide the only means to reach a given efficiency level because of the potential market barriers and impacts on competition.

6. Reverse Engineering

ASAP and Samsung stated that they support DOE's reverse engineering. (ASAP, Public Meeting Transcript, No. 7 at p. 74; Samsung, No. 25 at p. 4) The California Utilities requested that DOE explore how to make pertinent manufacturer cost data available to the public while protecting manufacturer confidentiality. (California Utilities, No. 19 at p. 5) To supplement and validate the AHAM data submittals, DOE conducted interviews with manufacturers. Cost information supplied to DOE by the manufacturers was aggregated or otherwise incorporated into the analysis to protect confidentiality. Data developed by DOE during the teardowns and subsequent analysis are detailed in chapter 5 of the direct final rule TSD.

AHAM, ALS, BSH, and Whirlpool suggested that DOE complete its reverse-engineering analysis on the following four product types:

- Conventional agitator top-loading;
- High efficiency agitator top-loading;
- High efficiency non-agitator top-loading; and
- Standard-size front-loading.

AHAM, GE, and Whirlpool also recommended that DOE reverse-engineer compact top-loading clothes washers. BSH recommended adding both compact top-loading and compact front-loading clothes washers. (AHAM, Public Meeting Transcript, No. 7 at p. 81; AHAM, No. 16 at p. 5; ALS, No. 13 at p. 9; BSH, No. 11 at p. 4; GE, No. 20 at p. 1; Whirlpool, No. 22 at p. 6) DOE's test sample for its reverse engineering analysis included representative residential clothes washers from all of these categories. DOE modeled the likely construction of a compact front-loading clothes washer by extrapolating from front-loading clothes washers with capacities nearing those delineating the compact product class (*i.e.,* between 1.6 and 3.0 cubic feet in capacity).

ASAP stated that, when DOE evaluates the characteristics of baseline models, no extraneous features and amenities should be included that do not contribute to energy and water performance. (ASAP, Public Meeting Transcript, No. 7 at p. 74) DOE's cost models disaggregate total manufacturing costs by sub-assemblies and individual components, thereby allowing DOE to identify only those specific design options contributing to incremental efficiency improvements.

Based on product teardowns and cost modeling, DOE developed overall cost-efficiency relationships for all four residential clothes washer product classes. Table IV–14 through Table IV–17 show DOE's estimates of incremental manufacturing cost for improvement of clothes washer efficiency above the baseline. As mentioned previously in section IV.C.3.b, DOE applied the correlation curves it developed to translate MEF into IMEF and WF into IWF. Chapter 5 of the direct final rule TSD provides details on DOE's engineering analysis, including the development of the cost-efficiency curves and correlation curves.

TABLE IV–14—COST-EFFICIENCY RELATIONSHIP FOR TOP-LOADING STANDARD RESIDENTIAL CLOTHES WASHERS

Efficiency level	Efficiency level—appendix J1		Integrated efficiency level—appendix J2		Incremental manufacturing cost (2010$)
	MEF (ft^3/kWh/cycle)	WF (gal/cycle/ft^3)	IMEF (ft^3/kWh/cycle)	IWF (gal/cycle/ft^3)	
Baseline	1.26	9.5	0.84	9.9	$0.00
EL 1	1.40	9.5	0.98	9.9	3.11
EL 2	1.72	8.0	1.29	8.4	8.44
EL 3*	1.80	7.5	1.34	7.9	13.06
EL 5	1.80	7.5	1.37	7.9	14.24
EL 6	2.00	6.0	1.57	6.5	25.29
EL 7	2.26	4.5	1.83	5.0	60.65
EL 8	2.47	3.6	2.04	4.1	69.79

* EL4 is not included in the table because it has the same IMEF and IWF as EL 3. The incremental manufacturing cost for EL 4 is $16.98.

TABLE IV–15—COST-EFFICIENCY RELATIONSHIP FOR FRONT-LOADING STANDARD RESIDENTIAL CLOTHES WASHERS

Efficiency level	Efficiency level—appendix J1		Integrated efficiency level—appendix J2		Incremental manufacturing cost (2010$)
	MEF (ft^3/kWh/cycle)	WF (gal/cycle/ft^3)	IMEF (ft^3/kWh/cycle)	IWF (gal/cycle/ft^3)	
Baseline	1.72	8.0	1.37	8.3	$0.00
EL 1	1.72	8.0	1.39	8.3	3.92
EL 2	1.72	8.0	1.41	8.3	1.18
EL 3	1.80	7.5	1.49	7.8	3.18
EL 4	2.00	6.0	1.66	6.3	6.20
EL 5	2.20	4.5	1.84	4.7	17.25

TABLE IV–15—COST-EFFICIENCY RELATIONSHIP FOR FRONT-LOADING STANDARD RESIDENTIAL CLOTHES WASHERS—Continued

Efficiency level	Efficiency level—appendix J1		Integrated efficiency level—appendix J2		Incremental manufacturing cost (2010$)
	MEF (ft^3/kWh/cycle)	WF (gal/cycle/ft^3)	IMEF (ft^3/kWh/cycle)	IWF (gal/cycle/ft^3)	
EL 6	2.40	4.2	2.02	4.4	40.36
EL 7	2.60	3.8	2.20	4.0	53.88
EL 8	2.89	3.2	2.46	3.4	73.51

TABLE IV–16—COST-EFFICIENCY RELATIONSHIP FOR TOP-LOADING COMPACT RESIDENTIAL CLOTHES WASHERS

Efficiency level	Efficiency level—appendix J1		Integrated efficiency level—appendix J2		Incremental manufacturing cost (2010$)
	MEF (ft^3/kWh/cycle)	WF (gal/cycle/ft^3)	IMEF (ft^3/kWh/cycle)	IWF (gal/cycle/ft^3)	
Baseline	0.77	14.0	0.59	14.4	$0.00
EL 1	1.26	14.0	0.86	14.4	5.00
EL 2	1.81	11.6	1.15	12.0	45.00

TABLE IV–17—COST-EFFICIENCY RELATIONSHIP FOR FRONT-LOADING COMPACT RESIDENTIAL CLOTHES WASHERS

Efficiency level	Efficiency level—appendix J1		Integrated efficiency level—appendix J2		Incremental manufacturing cost (2010$)
	MEF (ft^3/kWh/cycle)	WF (gal/cycle/ft^3)	IMEF (ft^3/kWh/cycle)	IWF (gal/cycle/ft^3)	
Baseline	1.60	8.5	1.03	8.8	$0.00
EL 1	1.72	8.0	1.13	8.3	3.00

D. Markups Analysis

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

DOE developed an average manufacturer markup by examining the annual Securities and Exchange Commission (SEC) 10–K reports filed by publicly traded manufacturers primarily engaged in appliance manufacturing and whose combined product range includes residential clothes washers.

For retailers, DOE developed separate markups for baseline products (baseline markups) and for the incremental cost of more efficient products (incremental markups). Incremental markups are coefficients that relate the change in the manufacturer sales price of higher-efficiency models to the change in the retailer sales price. DOE relied on economic data from the U.S. Census Bureau to estimate average baseline and incremental markups.[21]

Chapter 6 of the direct final rule TSD provides details on DOE's development of markups for residential clothes washers.

E. Energy and Water Use Analysis

DOE's energy and water use analysis estimated the energy and water use of clothes washers in the field, *i.e.,* as they are actually used by consumers. The energy and water use analysis provided the basis for other analyses DOE performed, particularly assessments of the energy and water savings and the savings in consumer operating costs that could result from DOE's adoption of amended standards. In contrast to the DOE test procedure, which provides standardized results that can serve as the basis for comparing the performance of different appliances used under the same conditions, the energy and water use analysis seeks to capture the range of operating conditions for clothes washers in U.S. homes.

To determine the field energy and water use of products that would meet possible amended standard levels, DOE used data from the Energy Information Administration (EIA)'s 2005 Residential Energy Consumption Survey (RECS), which was the most recent such survey available at the time of DOE's analysis.[22] RECS is a national sample survey of housing units that collects statistical information on the consumption of and expenditures for energy in housing units along with data on energy-related characteristics of the housing units and occupants. RECS provides sufficient information to establish the type (product class) of clothes washer used in each household. As a result, DOE was able to develop household samples for each of the considered product classes. RECS is the only source that provides a nationally representative household sample that includes estimates of usage by clothes washers.

For each sample household, DOE estimated the field-based annual energy and water use of front- and top-loading standard-capacity clothes washers by multiplying the annual number of clothes washer cycles for each household by the per-cycle energy and water use values established by the engineering analysis (using the DOE test procedure) for each considered efficiency level. Per-cycle clothes washer energy use is calculated in the test procedure as the sum of per-cycle machine energy use of the washer (including the energy used to heat water and remove moisture from clothing, and standby and off-mode energy use.

During the framework document public meeting, Whirlpool stated that although RECS has its limitations, there

[21] U.S. Census, 2002 Business Expenditure Survey (BES), Electronics and Appliance Stores sectors.

[22] For information on RECS, see *www.eia.doe.gov/emeu/recs/.*

is no alternative for characterizing the annual energy use of clothes washers. (Whirlpool, No. 22 at p. 7) AHAM, ALS, and GE expressed support for DOE's plan to use RECS as a primary source of information for estimating the energy consumption of clothes washers. (AHAM, No. 16 at p. 6; ALS, No. 13 at p. 10; GE, No. 20 at p. 1)

A more detailed description of DOE's energy and water use analysis for clothes washers is contained in chapter 7 of the direct final rule TSD.

1. Clothes Washer Usage

Commenting on the framework document, AWE said that average wash cycles per year are decreasing. (AWE, No. 12 at p. 3) AHAM stated that DOE should reduce the assumed average number of loads to reflect current data. (AHAM, No. 7 at p. 115) The Joint Comment said that DOE must update the average number of use cycles based on current data. (Joint Comment, No. 15 at p. 5)

Data collected from the 2005 RECS indicate that the frequency of clothes washer use has decreased compared to the assumptions incorporated in DOE's previous test procedure. The average usage value obtained from RECS is 295 cycles per year.[23] Data collected by DOE from the AHAM Fact Book 2005, American Housing Survey (AHS) 2007, and 2006 data provided by Proctor and Gamble [24] confirmed the data on average wash cycles from RECS. More recent nationally-representative data were not available. It is important to note that DOE uses the actual usage for each household sampled in its energy use analysis, not the average usage.

AWE said that DOE should consider that average washer capacity is increasing. (AWE, No. 12 at p. 3) The new DOE test procedure, which was used for estimating per cycle clothes washer energy use, considers recent data on the clothes load in calculating energy use to remove moisture from clothing. The load is a weighted average that depends on load usage factors and the capacity of the clothes washer.

2. Rebound Effect

In calculating energy consumption of residential clothes washers, DOE considered whether it would be appropriate to include a rebound effect (also called a take-back effect), which represents the increased energy consumption that can result from increases in energy efficiency and the associated reduction in operating costs. The rebound effect assumes that consumers will increase their overall annual usage of a more efficient product, thereby decreasing their overall annual savings. Samsung, AHAM, and GE said that they are unaware of a rebound effect for residential clothes washers. (Samsung, No. 25 at p. 5; AHAM, No. 16 at p. 6; GE, No. 20 at p. 1) Whirlpool stated that it is unaware of any data indicating that consumers would purchase a larger clothes washer than their needs dictated. (Whirlpool, No. 22 at p. 7)

A recent review of empirical estimates of the direct rebound effect [25] found one study of direct rebound effects for clothes washing. This study found that the demand for clean clothes (measured as weight of clothes) increased by 5.6% after consumers received new (more efficient) washers.[26] This rebound effect results in part from savings in water and detergent costs. If the estimate was based solely on the savings in the energy costs of the service, the estimated effect would be smaller. DOE does not believe that this study supports include a rebound effect in today's direct final rule, however, because the study used field data from participants who received high-efficiency clothes washers free of charge and was short-term in nature—roughly 3 months of use with the new washers. These factors could contribute to the increase in clothes washed. Lastly, the field trial was in a very small town and included 103 participants, which may not be representative of the U.S. household population.

Based on the above considerations and the comments by manufacturers, DOE did not include a direct rebound effect in its analysis of residential clothes washer energy and water use. However, DOE did perform a sensitivity analysis assuming a 5-percent rebound effect.

F. Life-Cycle Cost and Payback Period Analysis

DOE conducted LCC and PBP analyses to evaluate the economic impacts on individual consumers of potential energy conservation standards for clothes washers. The LCC is the total consumer expense over the life of a product, consisting of purchase and installation costs plus operating costs (expenses for energy use, maintenance, and repair). To compute the operating costs, DOE discounts future operating costs to the time of purchase and sums them over the lifetime of the product. The PBP is the estimated amount of time (in years) it takes consumers to recover the increased purchase cost (including installation) of a more efficient product through lower operating costs. DOE calculates the PBP by dividing the change in purchase cost (normally higher) due to a more stringent standard by the change in average annual operating cost (normally lower) that results from the standard.

For any given efficiency level, DOE measures the PBP and the change in LCC relative to an estimate of the base-case appliance efficiency levels. The base-case estimate reflects the market in the absence of new or amended energy conservation standards, including the market for products that exceed the current energy conservation standards.

For each considered efficiency level in each product class, DOE calculated the LCC and PBP for a nationally representative set of housing units. For the analysis for today's rule, DOE developed household samples from the 2005 RECS. For each sample household, DOE determined the energy consumption for the clothes washer and the appropriate electricity price. By developing a representative sample of households, the analysis captured the variability in energy consumption and energy prices associated with the use of residential clothes washers.

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

The computer model DOE uses to calculate the LCC and PBP, which incorporates Crystal Ball (a commercially available software program), relies on a Monte Carlo simulation to incorporate uncertainty and variability into the analysis. The Monte Carlo simulations randomly

[23] In the TP final rule, DOE changed the representative number of wash cycles per year from 392 to 295 based on the 2005 RECS data. (77 FR 13888)

[24] Procter and Gamble. Study #US064358: Drying Habits. Unpublished PowerPoint Deck. Procured through personal communication with author Cindy Garner, 7/21/2009.

[25] S. Sorrell, J. Dimitropoulos, and M. Sommerville, Empirical estimates of the direct rebound effect: a review, *Energy Policy* 37 (2009), pp. 1356–71.

[26] L.W. Davis, Durable Goods and Residential Demand for Energy and Water: Evidence from a Field Trial, Department of Economics, University of Michigan (2007).

sample input values from the probability distributions and clothes washer user samples. The model calculated the LCC and PBP for products at each efficiency level for 10,000 housing units per simulation run.

Several interested parties supported DOE's use of Monte Carlo simulation to account for variability and uncertainty in inputs to the LCC and PBP analysis. (AHAM, No. 16 at p. 6; ALS, No. 13 at p. 10; GE, No. 20 at p. 1; Samsung, No. 25 at p. 5; Whirlpool, No. 22 at p. 8)

Table IV–18 summarizes the approach and data DOE used to derive inputs to the LCC and PBP calculations. The subsections that follow provide further discussion. Details of the spreadsheet model, and of all the inputs to the LCC and PBP analyses, are contained in chapter 8 and its appendices of the direct final rule TSD.

TABLE IV–18—SUMMARY OF INPUTS AND METHODS FOR THE LCC AND PBP ANALYSIS *

Inputs	Method
Product Cost	Derived by multiplying manufacturer cost by manufacturer and retailer markups and sales tax, as appropriate. Used historical data to derive a price scaling index to forecast product costs.
Installation Costs	Assumed no change with efficiency level.
Annual Energy Use	Used DOE test procedure with data on cycles from the 2005 RECS, market data on RMC, and load weights from test procedure. Used IMEF and IWF to account for self-cleaning, steam cleaning and non-active mode power usage.
Energy and Water Prices	Electricity: Based on EIA's Form 861 data for 2008. Variability: Regional energy prices determined for 13 regions. Water: Based on 2008 AWWA/Raftelis Survey. Variability: By census region.
Energy and Water Price Trends	Energy: Forecasted using *Annual Energy Outlook 2010* (*AEO2010*) price forecasts. Water: Forecasted using BLS historic water price index information.
Repair and Maintenance Costs	Assumed no change with efficiency level.
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. Variability: Characterized using Weibull probability distributions.
Discount Rates	Approach involves identifying all possible debt or asset classes that might be used to purchase the considered appliances, or might be affected indirectly. Primary data source was the Federal Reserve Board's SCF ** for 1989, 1992, 1995, 1998, 2001, 2004 and 2007.
Compliance Date	2015.

* References for the data sources mentioned in this table are provided in the sections following the table or in chapter 8 of the direct final rule TSD.

** Survey of Consumer Finances.

1. Product Cost

To calculate consumer product costs, DOE multiplied the manufacturer selling prices developed in the engineering analysis by the supply-chain markups described above (along with sales taxes). DOE used different markups for baseline products and higher-efficiency products, because DOE applies an incremental markup to the increase in MSP associated with higher-efficiency products. ALS supported DOE's approach, as it was employed for estimating future retail prices in other appliance rulemakings. (ALS, No. 13 at p. 10)

Examination of historical price data for a number of appliances that have been subject to energy conservation standards indicates that an assumption of constant real prices and costs may overestimate long-term trends in appliance prices. Economic literature and historical data suggest that the real costs of these products may in fact trend downward over time according to ''learning'' or ''experience'' curves. 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. In the NODA, DOE proposed that when sufficiently long-term data are available on the cost or price trends for a given product, it would analyze the available data to forecast future trends.

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 available for residential clothes washers.

In its analysis for today's notice, DOE performed an exponential fit on historical Producer Price Index (PPI) data for household laundry equipment from the Bureau of Labor Statistics' (BLS). (PPI data specific to residential clothes washers were not available.) The PPI data used cover the period 1991–2010. An inflation-adjusted price index for household laundry equipment was calculated by dividing the PPI series by the GDP price deflator for the same years. DOE forecast a price factor index using this exponential model.[27] The value for 2015 used in the LCC and PBP analysis is 0.882. Thus, product prices forecast for the LCC and PBP analysis are equal to 0.882 times the 2010 values for each efficiency level in each product class. DOE's forecast of product prices for clothes washers is described in further detail in appendix 8–E of the direct final rule TSD.[28]

[27] For the NIA, DOE also considered several alternative price trends consistent with the available data as sensitivity cases (see section IV.G.4).

[28] 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 product price trends over time.

2. Installation Cost

Installation cost includes labor, overhead, and any miscellaneous materials and parts needed to install the product. DOE found no evidence that installation costs would be impacted with increased efficiency levels, so it did not include installation costs in its analysis.

3. Annual Energy Consumption

For each sampled household, DOE determined the energy consumption for a clothes washer at different efficiency levels using the approach described above in section IV.E.

4. Energy Prices

DOE derived average annual energy 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. For Census divisions containing one of those large states, DOE calculated the regional average excluding the data for the large state.

DOE calculated average residential electricity prices for each of the 13 geographic areas using data from EIA's Form EIA–861 database (based on ''Annual Electric Power Industry Report'').[29] DOE calculated an average annual regional residential price by: (1) Estimating an average residential price for each utility (by dividing the residential revenues by residential sales); and (2) weighting each utility by the number of residential consumers it served in that region. The final rule analysis used the data for 2008, the most recent data available.

The Joint Comment stated that DOE should consider using regionally based, top-tier residential electricity prices rather than average rates because energy savings would occur at the highest rate the consumer might pay. The California Utilities stated that DOE's analysis should capture the value of energy over time. They pointed to California's use of time-dependent valuation of savings (TDV), which places a high value on energy savings that occur during high cost times of the day and year. (California Utilities, No. 19 at p. 6) ALS supported DOE's approach because has been employed for estimating current and forecasted energy prices in other appliance rulemakings. (ALS, No. 13 at p. 10)

DOE did not use marginal (*i.e.,* top-tier) electricity prices in the current analysis, because for an appliance such as a residential clothes washer, there is little difference between marginal and average electricity prices. The effect of ascending block rates, used by many utilities, is offset by two other features of rate structures: (1) Residential consumers tend to pay relatively high fixed charges, which raises the average price relative to the marginal energy price; and (2) seasonal rates also are common, with summer rates typically higher, and winter rates lower, than the average (this may be reversed in winter-peaking regions). Because clothes washer energy use is not seasonal, over the year the rate differences average out. DOE's analysis of the Edison Electric Institute's Typical Bills and Average Rates Reports for summer and winter 2008 confirms that, when averaged over the year and over a wide consumer base, as is appropriate for clothes washers, marginal and average rates are approximately equal.

5. Energy Price Projections

To estimate energy prices in future years, DOE multiplied the average regional energy prices discussed in section IV. F.4 by the forecasts of annual average residential energy price changes in the Reference case from *AEO2010,* which has an end year of 2035.[30] To estimate price trends after 2035, DOE applied the average annual rate of change in the *AEO2010 forecasts* from 2020 to 2035. The rates used were 1.14 percent for electricity price and 1.16 percent for natural gas price.

6. Water and Wastewater Prices

For today's direct final rule, DOE obtained data on water and wastewater prices for 2010 from the Water and Wastewater Rate Survey conducted by Raftelis Financial Consultants and the water utility association, AWWA. The survey, which analyzes each industry separately, covers approximately 308 water utilities and 228 wastewater utilities. The water survey includes, for each utility, the cost to consumers of purchasing a given volume of water or treating a given volume of wastewater. The data provide a division of the total consumer cost into fixed and volumetric charges. DOE's calculations use only the volumetric charge to calculate water and wastewater prices, because only this charge is affected by a change in water use. Average water and wastewater prices were estimated for each of four census regions. Each RECS household was assigned a water and wastewater price depending on its census region location.

Commenting on the framework document, AWWA stated that the Water and Wastewater Survey conducted by Raftelis and AWWA is the best available national survey of water and wastewater rates. AWWA also noted additional steps that DOE can take to make its incorporation of available water and sewer rates more robust. These include considering base charges that are embedded in the cost of customer service; capturing differences in rate structures at the community level; and accounting for variability in rate structures due to asset management systems at some utilities. (AWWA, No. 14 at p. 3)

In response, DOE believes, as stated above, that using only the volumetric charge to calculate water and wastewater prices is appropriate, because only this charge is affected by a change in water use. DOE was not able to capture differences and variability in rate structures to the degree suggested by AWWA because the Water and Wastewater Rate Survey does not have a large enough number of utilities to allow DOE to develop prices at a level more detailed than the Census region.

AWWA stated that while it is difficult to fully capture the true future cost of water in a national analysis, reliance on a simple extrapolation of current rate structures alone is inadequate. It suggested that DOE account for the need of water and wastewater systems to increase rates in the next 30 to 50 years as systems age. (AWWA, No. 14 at p. 2–3) DOE is not aware of any national-level long-term forecasts of water and wastewater prices. To forecast water and wastewater price trends, DOE used a price index for water and sewerage maintenance from the Bureau of Labor Statistics (BLS), and then adjusted the index for inflation using the Consumer Price Index. DOE developed a price trend based on 45 years of BLS data from 1975 to 2010.

DOE also used price information for households that use well water and a septic tank from the National Ground Water Association, as well as national cost data on residential septic systems from the National Onsite Wastewater Recycling Association (NOWRA).

Chapter 8 of the direct final rule TSD provides more detail about DOE's approach to developing water and wastewater prices.

7. Maintenance and Repair Costs

Repair costs are associated with repairing or replacing components that have failed in an appliance; maintenance costs are associated with maintaining the operation of the product. Typically, small incremental

[29] Available at: *www.eia.doe.gov/cneaf/electricity/page/eia861.html.*

[30] U.S. Energy Information Administration. *Annual Energy Outlook 2010.* Washington, DC. April 2010.

increases in product efficiency produce no, or only minor, changes in repair and maintenance costs compared to baseline efficiency products. In its preliminary analysis, DOE did not have information suggesting that those costs would change with higher efficiency levels.

AHAM and GE stated that information obtained from clothes washer manufacturers indicates that where higher efficiencies are provided via a different configuration (horizontal axis compared to vertical axis), the costs of maintenance and repair increase. (AHAM, No. 16 at p. 7; GE, No. 20 at p. 1) BSH stated that because front-loading units often are installed stacked with the dryer on top of the washer or built into cabinetry, a greater effort is required to access the appliances to perform service. (BSH, No. 11 at p. 6) Miele stated that there can be a higher repair cost for apartment-size front-loaders because they must be removed from the stacked installation to do the repair. (Miele, Public Meeting Transcript, No. 7 at p. 130) ALS suggested that high efficiency technologies may have greater frequency of maintenance. (ALS, No. 13 at p. 10) Whirlpool said that maintenance, repair, and installation costs could be twice current levels if exotic new technologies are required to meet new efficiency levels. (Whirlpool, No. 22 at p. 8) ASAP said that claims of significantly higher repair costs for front-loading machines must be evaluated critically and that recent data for front-loaders should be used. (ASAP, No. 14 at p. 6) Samsung agreed with the view that there is negligible difference in maintenance, repair, and installation costs for baseline and high efficiency units. (Samsung, No. 25 at p. 6)

DOE does not have any data indicating increases in maintenance and repair costs associated with the efficiency levels within each of the product classes considered in its analysis. (Differences in such costs between top- and front-loading washers are not relevant to the LCC analysis.) Therefore, DOE did not assume that more efficient washers in each product class would have greater repair or maintenance costs.

8. Product Lifetime

Because the lifetime of appliances varies depending on utilization and other factors, DOE develops a distribution of lifetimes from which specific values are assigned to the appliances in the samples. In the previous rulemaking for clothes washers, DOE estimated an average product lifetime of 14.1 years. 66 FR 3314.

Commenting on the framework document, AHAM and GE stated that DOE's estimate of 14 years overstates the average useful life of horizontal-axis products. They stated that, based on AHAM data, the average useful life of top-loading configurations is 14 years, while that of front-loading configurations is 11 years. (AHAM, No. 16 at p. 7; GE, No. 20 at p. 1) Samsung supported using DOE's estimated useful life of 14.1 years. (Samsung, No. 25 at p. 6) Whirlpool stated that the September 2008 issue of *Appliance* magazine cites an average life of 11 years, which is consistent with their experience. (Whirlpool, No. 22 at p. 8) ALS supported using an average product lifetime of 14 years, but for only the traditional top-loading models. They said that front-loading and new high efficiency top-loading designs may have shorter lifetimes because of greater design complexity, electronic components that are more expensive to repair, complaints about mold in door boot/seals, and issues concerning out-of-balance spin. (ALS, No. 13 at p. 11) The Joint Comment said that claims of substantially shorter product lifetimes for front-loaders must be evaluated critically. (Joint Comment, No. 15 at p. 6)

To substantiate the estimates for residential clothes washer lifetimes in the literature, DOE conducted an analysis of standard-capacity residential clothes washer lifetimes in the field based on a combination of shipments data and RECS 2005 data on the ages of the clothes washer products reported in the household stock. As described in chapter 8 of the direct final rule TSD, the analysis yielded an estimate of mean age for standard-capacity residential clothes washers of approximately 14.2 years. It also yielded a survival function that DOE incorporated as a probability distribution in its LCC analysis. Because the RECS data do not indicate whether the washer has top-loading or front-loading configuration, DOE was not able to derive separate lifetime estimates for these two product classes. DOE did not receive any data or analysis to support separate lifetimes for the different product classes.

See chapter 8 of the direct final rule TSD for further details on the method and sources DOE used to develop product lifetimes.

9. Discount Rates

In the calculation of LCC, DOE applies discount rates to estimate the present value of future operating costs. DOE estimated separate distributions of residential discount rates for clothes washers purchased as replacements and for washers purchased in new homes. To establish residential discount rates for the LCC analysis, DOE identified all debt or asset classes that might be used to purchase clothes washers, including household assets that might be affected indirectly. It estimated the 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 amended standards would take effect. DOE assigned each sample household a specific discount rate drawn from one of the distributions. The average inflation-adjusted 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 direct final rule. See chapter 8 in the direct final rule TSD for further details on the development of consumer discount rates.

10. Compliance Date of Amended Standards

In the context of EPCA, the compliance date is the future date when parties subject to the requirements of a new standard must comply. If no adverse comments are received in response to the direct final rule that may provide a reasonable basis for withdrawal under 42 U.S.C. 6295(o) or other applicable law, compliance with amended standards for residential clothes washers will be required on March 7, 2015. DOE calculated the LCC and PBP for clothes washers as if consumers would purchase new products in 2015. In the case of TSL 3, which includes a second set of standards for top-loading standard clothes washers that would require compliance on January 1, 2018, DOE calculated separate LCC and PBP for clothes washers meeting these standards and purchased in 2018.

11. Base-Case Efficiency Distribution

To accurately estimate the share of consumers that would be affected by a standard at a particular efficiency level, DOE's LCC analysis considered the projected distribution of product efficiencies that consumers purchase under the base case (*i.e.,* the case without new energy efficiency standards). DOE refers to this distribution of product efficiencies as a base-case efficiency distribution. DOE relied on data submitted by AHAM to

estimate the base-case efficiency distributions for each of the product classes that were analyzed in the LCC and PBP analysis. To project the efficiency distributions in 2015, DOE considered the 2006–2008 trends and the potential effect of programs such as ENERGY STAR.

For front-loading clothes washers, the data from AHAM show some increase in the share of higher efficiency levels between 2006 and 2008. However, by 2008 over 95 percent of the front-loading clothes washer market was already at or above the 2011 ENERGY STAR criteria (Efficiency Level 4). Therefore, DOE believes that the ENERGY STAR qualification requirements are likely to have a limited impact in further expanding the market shares of higher efficiency front-loading clothes washers. Based on the above considerations, DOE assumed that the 2008 market shares would remain constant through 2015.

For top-loading clothes washers, the data from AHAM show an increase in the share of medium- and high-efficiency levels (Efficiency Levels 2–8) from 6.3 percent in 2006 to 8.5 percent in 2008. To estimate a trend from 2008 to 2015, DOE fit an exponential curve to the three data points that suggests the growth in share would level off at around 20 percent. The estimated total share of the medium- and high-efficiency levels in 2015 is 19.2 percent. DOE then disaggregated this total share into shares of specific levels using assumptions described in chapter 8 of the direct final rule TSD.

Table IV–19 shows the 2015 base-case efficiency distribution for top-loading and front-loading clothes washers.

TABLE IV–19—BASE-CASE EFFICIENCY DISTRIBUTION BY PRODUCT CLASS

Efficiency level	Top-loading standard size (percent)	Front-loading standard size (percent)	Top-loading compact size (percent)	Front-loading compact size (percent)
Baseline	40.4	0.0	100.0	100.0
1	40.4	0.0	0.0	0.0
2	2.8	0.0	0.0	.....
3	0.9	4.3	.....	.....
4	0.9	24.0	.....	.....
5	0.9	48.9	.....	.....
6	9.1	11.4	.....	.....
7	4.6	11.4	.....	.....
8	0.0	0.0	.....	.....

12. Inputs to Payback Period Analysis

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

The inputs to the PBP calculation are the total installed cost of the product to the customer for each efficiency level and the average annual operating expenditures for each efficiency level. The PBP calculation uses the same inputs as the LCC analysis, except that discount rates are not needed.

13. Rebuttable-Presumption Payback Period

As noted above, EPCA, as amended, establishes a rebuttable presumption that a standard is economically justified if the Secretary finds that the additional cost to the consumer of purchasing a product complying with an energy conservation standard level will be less than three times the value of the energy (and, as applicable, water) savings during the first year that the consumer will receive as a result of the standard, as calculated under the test procedure in place for that standard. (42 U.S.C. 6295(o)(2)(B)(iii)) For each considered efficiency level, DOE determined the value of the first year's energy and water savings by calculating the quantity of those savings in accordance with the applicable DOE test procedure, and multiplying that amount by the average energy and water price forecast for the year in which compliance with the amended standard would be required. The results of the rebuttable payback period analysis are summarized in section V.B.1.c of this notice.

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

The national impact analysis (NIA) assesses the national energy savings (NES) and the national net present value (NPV) of total consumer costs and savings that would be expected to result from new or amended standards at specific efficiency levels. (''Consumer'' in this context refers to consumers of the product being regulated.) DOE calculates the NES and NPV based on projections of annual appliance shipments, along with the annual energy consumption and total installed cost data from the energy use and LCC analyses. For the present analysis, DOE forecasted the energy savings, operating cost savings, product costs, and NPV of consumer benefits for products sold from 2015 through 2044.

DOE evaluates the impacts of new and amended standards by comparing base-case projections with standards-case projections. The base-case projections characterize energy use and consumer costs for each product class in the absence of new or amended energy conservation standards. DOE compares these projections with projections characterizing the market for each product class if DOE adopted new or amended standards at specific energy efficiency levels (*i.e.,* the TSLs or standards cases) for that class. For the base-case forecast, DOE considers historical trends in efficiency and various forces that are likely to affect the mix of efficiencies over time. For the standards cases, DOE also considers how a given standard would likely affect the market shares of efficiencies greater than the standard.

DOE uses an MS Excel spreadsheet model to calculate the energy savings and the national consumer costs and savings from each TSL. The TSD and other documentation that DOE provides during the rulemaking help explain the models and how to use them, and interested parties can review DOE's analyses by changing various input quantities within the spreadsheet. The NIA spreadsheet model uses typical values (as opposed to probability distributions) as inputs.

For the results presented in today's notice, DOE used projections of energy prices and housing starts from the *AEO2010* Reference case. The Joint Comment stated that electricity prices

should be subject to a sensitivity analysis and forecasts other than *AEO*. (Joint Comment, No. 15 at p. 5) As part of the NIA, DOE analyzed scenarios that used inputs from the *AEO2010* Low Economic Growth and High Economic Growth cases. Those cases have higher and lower energy price trends compared to the Reference case, as well as higher and lower housing starts, which result in higher and lower appliance shipments to new homes. NIA results based on these cases are presented in appendix 10–A of the direct final rule TSD. The range of forecasts in *AEO2010* is sufficiently broad that using other long-range energy forecasts would not provide added value to the sensitivity analysis.

Table IV–20 summarizes the inputs and methods DOE used for the NIA analysis for the direct final rule. Discussion of these inputs and methods follows the table. See chapter 10 of the direct final rule TSD for further details.

TABLE IV–20—SUMMARY OF INPUTS AND METHODS FOR THE NATIONAL IMPACT ANALYSIS

Inputs	Method
Shipments	Annual shipments from shipments model.
Compliance Date of Standard	2015.*
Base-Case Forecasted Efficiencies	Efficiency distributions are maintained unchanged during the forecast period.
Standards-Case Forecasted Efficiencies	Used a ''roll-up'' scenario for most efficiency levels and a ''shift'' scenario for highest efficiency levels.
Annual Energy Consumption per Unit	Annual weighted-average values as a function of IMEF.**
Total Installed Cost per Unit	Annual weighted-average values as a function of IMEF.** Incorporates forecast of future product prices based on historical data.
Annual Energy Cost per Unit	Annual weighted-average values as a function of the annual energy consumption per unit and energy prices.
Repair and Maintenance Cost per Unit	Annual values as a function of efficiency level.
Energy Prices	*AEO2010* forecasts (to 2035) and extrapolation through 2044.
Energy Site-to-Source Conversion Factor	Varies yearly and is generated by NEMS–BT.
Discount Rate	Three and seven percent real.
Present Year	Future expenses discounted to 2011, when the final rule will be published.

* For TSL 3, which includes two sets of standards for top-loading standard clothes washers, the compliance date for the second set of standards is in 2018.

** IMEF = integrated modified energy factor, which includes the energy used in the active, standby, and off modes.

1. Shipments

Forecasts of product shipments are needed to calculate the national impacts of standards on energy and water use, NPV, and future manufacturer cash flows. DOE develops shipment forecasts based on an analysis of key market drivers for residential clothes washers. In DOE's shipments model, shipments of products are driven by new construction and stock replacements. The shipments model takes an accounting approach, tracking market shares of each product class and the vintage of units in the existing stock. Stock accounting uses product shipments as inputs to estimate the age distribution of in-service product stocks for all years. The age distribution of in-service product stocks is a key input to calculations of both the NES and NPV, because operating costs for any year depend on the age distribution of the stock. DOE also considers the impacts on shipments from changes in product purchase price and operating cost associated with higher energy efficiency levels.

To forecast shipments under the base case, DOE utilized historical shipments data submitted by AHAM disaggregated by product class. AHAM and GE noted that they could not provide data on compact top-loading products given the few manufacturers and the resulting inability to aggregate the data. (AHAM, No. 16 at p. 8; GE, No. 20 at p. 1)

AWE suggested that DOE consider the trend in multi-family housing toward in-unit washers and away from common-area clothes washers. (AWE, No. 12 at p. 3) DOE considered trends away from common-area clothes washers in multi-family housing by looking at changes in the numbers of households with clothes washers. DOE used the data contained in the 2005 RECS to characterize ownership of residential clothes washers and usage in households of various types, including multi-family housing. For future trends, DOE captured in-unit washers within multi-family housing by estimating future clothes washer saturations in all new residential construction, including multi-family housing.

To estimate the effects on product shipments from increases in product price projected to accompany amended standards at higher efficiency levels, DOE applied a cross-price elasticity. Cross-price impacts measure the change in the market share of one washer configuration (*e.g.,* top loaders) caused by a change in the price of the other washer configuration (*e.g.,* front loaders). DOE estimated a logistic regression model equation that derives the relative probability of the market share of top- and front- loading clothes washers as a function of the monthly sales-weighted average price of top-loaders and front-loaders and the ratio of the monthly sales-weighted average of front-loader tub volume to the monthly sales-weighted average of top-loader tub volume. The equation indicates that front loader market share is positively correlated with top loader price and size and negatively correlated with front loader price. The regression results were used to derive the cross price impact of a change in the top-loading washer price on the front-loader market share (and vice versa).

DOE also applied a price elasticity parameter to estimate the effect of standards on each product class by itself. DOE estimated the price elasticity parameter using a regression analysis that used purchase price and efficiency data specific to residential clothes washers, as well as residential refrigerators and dishwashers, during 1980–2002. The estimated ''relative price elasticity'' incorporates the impacts from purchase price, operating cost, and household income, and it also declines over time. DOE estimated shipments in each standards case using the relative price elasticity along with

the change in the relative price between a standards case and the base case.

For details on the shipments analysis, see chapter 9 of the direct final rule TSD.

2. Forecasted Efficiency in the Base Case and Standards Cases

A key component of the NIA is the trend in energy efficiency forecasted for the base case (without new or amended standards) and each of the standards cases. Section IV.F.11 described how DOE developed a base-case energy efficiency distribution (which yields a shipment-weighted average efficiency) for each of the considered product classes for the first year of the forecast period. To project the trend in efficiency over the entire forecast period, DOE considered recent trends and the potential effect of programs such as ENERGY STAR. As discussed in section IV.F.11, DOE did not find a basis for projecting an increase in the average efficiency of front-loading clothes washers. For top-loading clothes washers, DOE assumed that the growth in share of the medium- and high-efficiency levels would level off at around 20 percent. Although there is room for the shares of the higher efficiency levels to grow, DOE believes that the growth will be constrained by the likelihood that consumers with a strong interest in energy efficiency will purchase front-loading clothes washers instead of top-loading clothes washers.

The historical record suggests that the likely market response to new or amended standards is that lower efficiency baseline models will roll up to the standard efficiency level, and some products will exceed the minimum requirements. To estimate efficiency trends in the standards cases, DOE has used ''roll-up'' and/or ''shift'' scenarios in its standards rulemakings. Under the ''roll-up'' scenario, DOE assumes: (1) Product efficiencies in the base case that do not meet the standard level under consideration would ''roll-up'' to meet the new standard level; and (2) product efficiencies above the standard level under consideration would not be affected. Under the ''shift'' scenario, DOE re-orients the distribution above the new minimum energy conservation standard.

For the direct final rule, DOE primarily used a roll-up scenario to establish the distribution of efficiencies for the year that compliance with revised standards would be required and for subsequent years. It also considered the potential impacts of the ENERGY STAR program. Because ENERY STAR criteria in 2011 consist of an MEF ≥2.00 and a WF ≤6.0, DOE assumed that the ENERGY STAR program would not affect the front-loader or top-loader market for any new standards set at levels less efficient than the 2011 ENERGY STAR requirements. As a result, for standards set at top-loader efficiency levels 1 through 5 and front-loader efficiency levels 1 through 3, DOE estimated that efficiency distributions would remain unchanged from 2015 through 2044. For any new standards set at efficiency levels that meet the 2011 ENERGY STAR requirements, DOE assumed that the market share of efficiency levels beyond the standard will increase. The level of increase was set equal to the market share change from 2006 to 2008 for the efficiency level directly preceding the standard. Using the above criteria, DOE assumed that from 2015 to 2022 the shipment weighted integrated modified energy factor (SWIMEF) market share would grow linearly. In all cases, because DOE has insufficient information on which to forecast changes in the market beyond 2022, DOE assumed that after 2022 the market would remain unchanged through 2044.

The details of DOE's approach to forecast efficiency trends are described in chapter 10 of the direct final rule TSD.

3. Total Installed Cost per Unit

As discussed in section IV.F.1, in the analysis for today's notice, DOE developed a price trend based on historical PPI data for household laundry equipment. It used this trend to forecast the prices of clothes washers sold in each year in the forecast period (2015–2044). DOE applied the same values to forecast prices for each product class at each considered efficiency level.

To evaluate the impact of the uncertainty of the price trend estimates, DOE investigated the impact of different product price forecasts on the consumer net present value for the considered TSLs for residential clothes washers. DOE considered three product price forecast sensitivity cases: (1) A trend based on the experience curve approach;[31] (2) a trend based on the ''chained price index—other consumer durable goods except ophthalmic'' that was forecasted for *AEO2010;* and (3) constant prices at 2010 levels. The results of these sensitivity cases are described in appendix 10–C of the direct final rule TSD.

4. National Energy and Water Savings

For each year in the forecast period, DOE calculates the national energy and water savings (NES) for each standard level by multiplying the stock of products affected by the energy conservation standards by the per-unit annual energy savings. Cumulative energy and water savings are the sum of the NES for each year.

To estimate the national energy savings expected from appliance standards, DOE uses a multiplicative factor to convert site energy consumption (at the home) into primary or source energy consumption (the energy required to convert and deliver the site energy). These conversion factors account for the energy used at power plants to generate electricity and losses in transmission and distribution. The conversion factors vary over time because of projected changes in generation sources (*i.e.,* the power plant types projected to provide electricity to the country). The factors that DOE developed are marginal values, which represent the response of the system to an incremental decrease in consumption associated with appliance standards. For today's rule, DOE used annual site-to-source conversion factors based on the version of NEMS that corresponds to *AEO2010,* which provides energy forecasts through 2035. For 2036–2044, DOE used conversion factors that remain constant at the 2035 values.

Section 1802 of the Energy Policy Act of 2005 (EPACT 2005) directed DOE to contract a study with the National Academy of Science (NAS) to examine whether the goals of energy efficiency standards are best served by measuring energy consumed, and efficiency improvements, at the actual point of use or through the use of the full-fuel-cycle, beginning at the source of energy production. (Pub. L. 109–58 (August 8, 2005)). NAS appointed a committee on ''Point-of-Use and Full-Fuel-Cycle Measurement Approaches to Energy Efficiency Standards'' to conduct the study, which was completed in May 2009. The NAS committee defined full-fuel-cycle energy consumption as including, in addition to site energy use: Energy consumed in the extraction, processing, and transport of primary fuels such as coal, oil, and natural gas; energy losses in thermal combustion in power generation plants; and energy losses in transmission and distribution to homes and commercial buildings.

[31] In the experience curve method, the real product price (or proxy thereof) is related to the cumulative production or ''experience'' with a product. As experience accumulates, the cost of producing the next unit decreases. The percentage reduction in cost that occurs with each doubling of cumulative production is known as the learning or experience rate. In typical experience curve formulations, the experience rate parameter is derived using two historical data series: Price (or cost) and cumulative production, which is a function of shipments during a long time span.

In evaluating the merits of using point-of-use and full-fuel-cycle measures, the NAS committee noted that DOE uses what the committee referred to as ''extended site'' energy consumption to assess the impact of energy use on the economy, energy security, and environmental quality. The extended site measure of energy consumption includes the energy consumed during the generation, transmission, and distribution of electricity but, unlike the full-fuel-cycle measure, does not include the energy consumed in extracting, processing, and transporting primary fuels. A majority of the NAS committee concluded that extended site energy consumption understates the total energy consumed to make an appliance operational at the site. As a result, the NAS committee recommended that DOE consider shifting its analytical approach over time to use a full-fuel-cycle measure of energy consumption when assessing national and environmental impacts, especially with respect to the calculation of greenhouse gas emissions. The NAS committee also recommended that DOE provide more comprehensive information to the public through labels and other means, such as an enhanced Web site. For those appliances that use multiple fuels (*e.g.,* water heaters), the NAS committee indicated that measuring full-fuel-cycle energy consumption would provide a more complete picture of energy consumed and permit comparisons across many different appliances, as well as an improved assessment of impacts.

In response to the NAS committee recommendations, DOE issued a notice of proposed policy for incorporating a full-fuel cycle analysis into the methods it uses to estimate the likely impacts of energy conservation standards on energy use and emissions. 75 FR 51423 (Aug. 20, 2010). Specifically, DOE proposed to use full-fuel-cycle (FFC) measures of energy and greenhouse gas (GHG) emissions, rather than the primary (extended site) energy measures it currently uses. Additionally, DOE proposed to work collaboratively with the Federal Trade Commission to make FFC energy and GHG emissions data available to the public to enable consumers to make cross-class comparisons. On October 7, 2010, DOE held an informal public meeting to discuss and receive comments on its planned approach. The notice, a transcript of the public meeting, and all public comments received by DOE are available at: *http://www.regulations.gov/#!docketDetail;D=EERE-2010-BT-NOA-0028.* DOE intends to develop a final policy statement on the subject and then take steps to begin implementing that policy in rulemakings and other activities.

a. Accounting for Other Energy Impacts

In the framework document for residential clothes washers, DOE requested comment on the issue of embedded energy (*i.e.,* the energy required for water treatment and delivery). Earthjustice maintained that DOE's legal justification for not considering embedded energy ''ignores that EPCA not only provides ample authority for DOE to consider this impact, but actually commands its consideration in weighing the economic justification for efficiency standards.'' (Earthjustice, No. 17 at p. 10) The California Utilities said that DOE should attempt to address the issue of embedded energy in water in its rulemaking analyses. (California Utilities, No. 19 at p. 5)

In response, DOE notes that EPCA directs DOE to consider (when determining whether a standard is economically justified) ''the total projected amount of energy, or as applicable, water, savings likely to result directly from the imposition of the standard.'' 42 U.S.C. 6295(o)(2)(B)(i)(III) DOE interprets ''directly from the imposition of the standard'' to include energy used in the generation, transmission, and distribution of fuels used by appliances. In addition, DOE is evaluating the full-fuel-cycle measure, which includes the energy consumed in extracting, processing, and transporting primary fuels. Unlike the energy used for water treatment and delivery, both DOE's current accounting of primary energy savings and the full-fuel-cycle measure are directly linked to the energy used by appliances.

Several interested parties commented that DOE's calculation of energy consumption should include the energy used in the manufacture, distribution, and ultimate recycling of residential clothes washers. (AWE, No. 12 at p. 2; Joint Comment, No. 15 at p. 6; Earthjustice, No. 17 at pp. 9–10) Both DOE's current accounting of primary energy savings and the full-fuel-cycle measure are directly linked to the energy used by appliances. The imposition of an energy efficiency standard for residential clothes washers would not lead directly to energy savings in the manufacture, distribution and recycling of clothes washers. DOE believes that any such savings would be both indirect and difficult to determine. Thus, DOE did not consider such energy use in the NIA pursuant to 42 U.S.C. 6295(o)(2)(B)(i)(III).

5. Net Present Value of Consumer Benefit

The inputs for determining the net present value (NPV) of the total costs and benefits experienced by consumers of considered appliances are: (1) Total annual installed cost, (2) total annual savings in operating costs, and (3) a discount factor. DOE calculates net savings each year as the difference between the base case and each standards case in total savings in operating costs and total increases in installed costs. DOE calculates operating cost savings over the life of each product shipped during the forecast period.

In calculating the NPV, DOE multiplies the net savings in future years by a discount factor to determine their present value. For today's direct final rule, DOE estimated the NPV of appliance consumer benefits using both a 3-percent and a 7-percent real discount rate. DOE uses these discount rates in accordance with guidance provided by the Office of Management and Budget (OMB) to Federal agencies on the development of regulatory analysis.[32] The discount rates for the determination of NPV are in contrast to the discount rates used in the LCC analysis, which are designed to reflect a consumer's perspective. The 7-percent real value is an estimate of the average before-tax rate of return to private capital in the U.S. economy. The 3-percent real value represents the ''social rate of time preference,'' which is the rate at which society discounts future consumption flows to their present value.

The California Utilities stated that because 3 percent is closer to the OMB's current estimated 30-year real discount rate, DOE should give primary weight to calculations based on the 3-percent real rate. (California Utilities, No. 19 at p. 6)

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 on private capital in the U.S. economy. It approximates the opportunity cost of capital and, according to Circular A–94, is the appropriate discount rate whenever the primary effect of a regulation is to displace or alter the use of capital in the

[32] OMB Circular A–4 (Sept. 17, 2003), section E, ''Identifying and Measuring Benefits and Costs. Available at: *www.whitehouse.gov/omb/memoranda/m03-21.html.*

private sector. In preparing Circular A–4, OMB found that the average rate of return on capital remains near the 7-percent rate estimated earlier. Circular A–4 also states that when a regulation primarily and directly affects private consumption, a lower discount rate (the social rate of time preference) is appropriate. 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 about 3 percent in real terms on a pre-tax basis. Circular A–4 concludes that ''for regulatory analysis, [agencies] should provide estimates of net benefits using both 3 percent and 7 percent.'' Consistent with the OMB guidance, for today's rule DOE provided and considered results derived using discount rates of 3 percent and 7 percent.

6. Benefits From Effects of Standards on Energy Prices

Reduction in electricity consumption associated with amended standards for residential clothes washers could reduce the electricity prices charged to consumers in all sectors of the economy and thereby reduce their electricity expenditures.

Commenting on the framework document, the California Utilities stated that the electricity price mitigation effects produced by new standards for clothes washers should be documented and the value of reduced electricity bills to all consumers quantified as a benefit. (California Utilities, No. 19 at p. 6)

For the direct final rule, DOE used NEMS–BT to assess the impacts of the reduced need for new electric power plants and infrastructure projected to result from clothes washer standards. In NEMS–BT, changes in power generation infrastructure affect utility revenue requirements, which in turn affect electricity prices. DOE estimated the impact on electricity prices associated with each considered TSL. Although the aggregate benefits for electricity users are potentially large, there may be negative effects on some of the actors involved in electricity supply, such as actors involved in power plant construction and fuel suppliers. Because there is uncertainty about the extent to which the benefits for electricity users from reduced electricity prices would be a transfer from actors involved in electricity supply to electricity consumers, DOE is continuing to investigate the extent to which electricity price changes projected to result from standards represent a net gain to society.

H. Consumer Subgroup Analysis

In analyzing the potential impact of new or amended standards on consumers, DOE evaluates the impact on identifiable subgroups of consumers (*e.g.,* low-income households) that may be disproportionately affected by a national standard. DOE evaluates impacts on particular subgroups of consumers primarily by analyzing the LCC impacts and PBP for those particular consumers from alternative standard levels. Chapter 11 in the direct final rule TSD describes the consumer subgroup analysis.

In response to the framework document, interested parties requested that DOE consider a number of subgroups for analysis. The Joint Comment said that renters and disabled homeowners should be considered as LCC subgroups. (Joint Comment, No. 15 at p. 6) AHAM and Whirlpool stated that DOE should consider low-income households as a consumer subgroup, because they are affected by the cost increases engendered by efficiency increases. (AHAM, No. 24 at p. 3; Whirlpool, No. 22 at p. 9) ALS supported considering subgroups comprising low-income households and senior citizens. (ALS, No. 13 at p. 12) Whirlpool said that DOE should consider a consumer subgroup comprising families with young children. (Whirlpool, No. 22 at p. 9)

For this rule, DOE analyzed the impacts of the considered standard levels on low-income households and senior-only households. DOE did not examine renters as a subgroup. DOE notes that, in most cases, renters pay the electricity bill but do not own the clothes washer in their home. To some extent, the higher cost of a more-efficient clothes washer incurred by the building owner would likely be passed on to the renter through increased rent. Because DOE is not aware of information that would allow it to reliably assess the extent to which such ''pass-through'' would occur, it was not able to quantitatively analyze the impacts of alternative standard levels on renters. DOE did not consider families with children as a subgroup. To the extent such families have low income, they are already included in the analysis of low-income households. DOE had no information to support the contention that families with children would otherwise be negatively affected by a standard. Lastly, DOE did not have any information with which to analyze disabled people as a subgroup.

I. Manufacturer Impact Analysis

The following sections address the various steps taken to analyze the impacts of the amended standards on manufacturers. These steps include conducting a series of analyses, interviewing manufacturers, and evaluating the comments received from interested parties during this rulemaking.

1. Overview

In determining whether an amended energy conservation standard for residential clothes washers subject to this rulemaking is economically justified, DOE is required to consider ''the economic impact of the standard on the manufacturers and on the consumers of the products subject to such standard.'' (42 U.S.C. 6295(o)(2)(B)(i)(I)) The statute also calls for an assessment of the impact of any lessening of competition as determined by the Attorney General that is likely to result from the adoption of a standard. (42 U.S.C. 6295(o)(2)(B)(i)(V)) DOE conducted the MIA to estimate the financial impact of amended energy conservation standards on manufacturers, and to assess the impacts of such standards on employment and manufacturing capacity.

The MIA is both a quantitative and qualitative analysis. The quantitative part of the MIA relies on the Government Regulatory Impact Model (GRIM), an industry cash-flow model customized for the residential clothes washers covered in this rulemaking. See section IV.I.2 below, for details on the GRIM analysis. The qualitative part of the MIA addresses factors such as product characteristics, characteristics of particular firms, and market trends. The complete MIA is discussed in chapter 12 of the direct final rule TSD. DOE conducted the MIA in the three phases described below.

a. Phase 1, Industry Profile

In Phase 1 of the MIA, DOE prepared a profile of the residential clothes washer industry based on the market and technology assessment prepared for this rulemaking. Before initiating the detailed impact studies, DOE collected information on the present and past market structure and characteristics of the industry, tracking trends in market share, product attributes, product shipments, manufacturer markups, and the cost structure for various manufacturers.

The profile also included a top-down analysis of manufacturers in the industry using Security and Exchange

Commission 10–K filings,[33] Standard & Poor's stock reports,[34] and corporate annual reports released by both public and privately held companies. DOE used this and other publicly available information to derive preliminary financial inputs for the GRIM (*e.g.,* revenues, cost of goods sold, depreciation, SG&A, and research and development (R&D) expenses).

b. Phase 2, Industry Cash Flow Analysis

Phase 2 focused on the financial impacts of potential amended energy conservation standards on the industry as a whole. Amended energy conservation standards can affect manufacturer cash flows in three distinct ways: (1) By creating a need for increased investment, (2) by raising production costs per unit, and (3) by altering revenue due to higher per-unit prices and/or possible changes in sales volumes. DOE used the GRIM to model these effects in a cash-flow analysis of the residential clothes washer industry. In performing this analysis, DOE used the financial values derived during Phase 1 and the shipment assumptions from the NIA.

c. Phase 3, Sub-Group Impact Analysis

Using average cost assumptions to develop an industry-cash-flow estimate may not adequately assess differential impacts of amended energy conservation standards among manufacturer subgroups. For example, small businesses, manufacturers of niche products, or companies exhibiting a cost structure that differs significantly from the industry average could be more negatively affected. During the manufacturer interviews, DOE discussed financial topics specific to each manufacturer and obtained each manufacturer's view of the industry as a whole. DOE reports the MIA impacts of amended energy conservation standards by grouping together the impacts on manufacturers of certain product classes. While DOE did not identify any other subgroup of manufacturers of residential clothes washers that would warrant a separate analysis, DOE specifically investigated impacts on small business manufacturers. See section VI.B for more information.

The MIA also addresses the direct employment impacts in manufacturing of clothes washers. DOE uses census data and information gained through manufacturer interviews in conjunction with the GRIM to estimate the domestic labor expenditures and number of domestic production workers in the base case and at each TSL from 2011 to 2044.

2. GRIM Analysis

DOE uses the GRIM to quantify the changes in cash flow that result in a higher or lower industry value. The GRIM analysis is a standard, annual cash-flow analysis that incorporates manufacturer costs, markups, shipments, and industry financial information as inputs, and models changes in costs, distribution of shipments, investments, and manufacturer margins that could result from amended energy conservation standards. The GRIM spreadsheet uses the inputs to arrive at a series of annual cash flows, beginning with the base year of the analysis, 2011 (which accounts for the investments needed to bring products into compliance), and continuing to 2044. DOE calculated INPVs by summing the stream of annual discounted cash flows during this period. DOE uses the industry average weighted average cost of capital (WACC) of 8.5 percent, as this represents the minimum rate of return necessary to cover the debt and equity obligations manufacturers use to finance operations.

DOE used the GRIM to compare INPV in the base case with INPV at various TSLs (the standards cases). The difference in INPV between the base and standards cases represents the financial impact of the amended standard on manufacturers. DOE collected this information from a number of sources, including publicly available data and interviews with a number of manufacturers. Additional details about the GRIM can be found in chapter 12 of the direct final rule TSD.

a. GRIM Key Inputs

Manufacturer Production Costs

Changes in the manufacturer production costs (MPCs) of residential clothes washers can affect revenues, gross margins, and cash flow of the industry, making these product cost data key GRIM inputs for DOE's analysis. DOE used the MPCs calculated in the engineering analysis for each efficiency level, as described in section IV.C above, and further detailed in chapter 5 of the direct final rule TSD. DOE used the AHAM data submittal to determine the MPCs at most efficiency levels for top-loading and front-loading standard product classes. To supplement the AHAM submittal and calculate max-tech MPCs for these product classes, DOE also conducted product tear downs to generate MPCs using a manufacturing cost model. DOE created separate cost curves for top-loading and front-loading compact product classes using data from tear-downs to develop baseline MPCs and applied the incremental costs that correspond to the proposed design options from the standard product classes. The cost model also disaggregated the MPCs into material, labor, overhead, and depreciation.

Base-Case Shipments Forecast

The GRIM estimates manufacturer revenues based on total unit shipment forecasts and the distribution of these values by efficiency level and product class. Changes in the efficiency mix at each standard level affect manufacturer finances. For this analysis, the GRIM uses the NIA shipments forecasts from 2011 to 2044, the end of the analysis period.

To calculate shipments, DOE developed a single shipment model for all residential clothes washers and disaggregated total shipments into front-loading and top-loading clothes washers, and assigned shipments to both the standard and compact product classes. In the base case, DOE forecasted change in market share of each product class by utilizing historical shipments data submitted by AHAM.

Product and Capital Conversion Costs

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

DOE based the conversion cost estimates required to meet each TSL on the AHAM data submittal for all product classes. Using the AHAM data submittal for both the product and capital conversion costs ensures that the costs required to meet amended energy conservation standards are consistent with the incremental costs to reach those efficiencies. DOE validated these costs in manufacturer interviews and through the product teardown analysis.

At each top-loading and front-loading standard efficiency level, DOE matched

[33] Available online at *www.sec.gov.*

[34] Available online at *www2.standardandpoors.com.*

the IMEF efficiency level to the corresponding MEF metric and used the aggregated total industry capital and product conversion cost from the May 2010 AHAM submittal. DOE multiplied each aggregated capital and product conversion total for these product classes by 1.05 to account for the non-AHAM member shipments. For the new max-tech levels revised using the AHAM data submittal, DOE scaled the aggregated total conversion costs at the next lowest efficiency level by the same percentage increase in production costs. DOE did not increase the required product and capital conversion costs for efficiency levels that do not contribute to a change in active mode efficiency to ensure that the costs required are consistent with the incremental costs to meet amended energy conservation standards and because, as described in section IV.C.3, the standby power technology options would require minimal product development.

For the top-loading compact product class, DOE scaled the top-loading standard conversion costs for the same efficiency level by the relative number of compact platforms. DOE did not include conversion costs for the front-loading compact product classes because the design options analyzed to improve efficiency would require minimal changes to baseline products.

DOE took a number of steps to analyze the conversion costs in the AHAM data submittal. DOE reviewed the AHAM conversion costs during manufacturer interviews to understand the magnitude and cost of the required conversions for individual manufacturers. DOE also reviewed public information in the CEC, ENERGY STAR, and CEE product databases as well as manufacturer Web sites to understand which product lines manufacturers would need to upgrade at each efficiency level. DOE also reviewed the AHAM submittal in conjunction with the technology options and information learned during product teardowns for multiple product lines.

DOE's estimates of the total capital conversion and production conversion costs by TSL can be found in section V.B.2 of today's direct final rule. The estimates of the total capital conversion and product conversion costs by product class and efficiency level can be found in chapter 12 of the direct final rule TSD.

b. GRIM Scenarios

Standards-Case Shipment Forecasts

The MIA results presented in section V.B.2 all use shipments from the reference NIA scenario in the GRIM. To determine efficiency distributions in the standards case for the reference NIA scenario, DOE analyzed the roll-up scenario. In this scenario, DOE assumed that product efficiencies in the base case that did not meet the standard would roll up to meet the new standard in the compliance year. See section IV.G.2 for a description of the standards case efficiency distribution. For standards-case shipments, DOE used a relative price elasticity that considers the possibility of higher first costs lowering total shipments. The reference NIA scenario also accounted for cross-price elasticity between top-loading and front-loading products to analyze the respective market share of each product class as prices change relative to one another.

The reference NIA scenario used historical data to derive a price scaling index to forecast product costs. The MPCs and MSPs in the GRIM use the default price forecast for all scenarios. See section IV.G.4 for a discussion of DOE's price forecasting methodology.

Markup Scenarios

MSP is equal to MPC times a manufacturer markup. The MSP includes direct manufacturing production costs (*i.e.,* labor, material, and overhead estimated in DOE's MPCs) and all non-production costs (*i.e.,* SG&A, R&D, and interest), along with profit.

To calculate the baseline manufacturer markup, DOE evaluated publicly available financial information for manufacturers of major household appliances whose product offerings include residential clothes washers. DOE also received feedback supporting the 1.22 baseline manufacturer markup during manufacturer interviews. In the base case for all three GRIM markup scenarios, DOE assumed that the products that meet the January 2011 ENERGY STAR criteria earn a moderately higher manufacturer markup than ''baseline'' products that fall below those efficiencies. Additionally, products that meet the CEE Tier 2 and Tier 3 criteria earn an incrementally higher markup than those that meet the 2011 ENERGY STAR criteria.

For the MIA, DOE modeled three standards-case markup scenarios to represent the uncertainty regarding the potential impacts on prices and profitability for manufacturers following the implementation of amended energy conservation standards: (1) A no commoditization markup scenario, (2) a tiered markup scenario, and (3) and a tiered markup with margin pressure scenario. Modifying these markups from the base case to the standards cases yields different sets of impacts on manufacturers' changing industry revenue and cash flow.

The no commoditization scenario assumes that the base-case markup structure (with baseline, ENERGY STAR, and CEE Tier 2 and Tier 3 markups) is maintained in the standards case. This scenario represents the upper bound of industry profitability because manufacturers are able to fully pass through additional costs from amended standards to their customers. In addition to fully passing through higher production costs, manufacturers continue to earn premium markups after standards for products that are no longer differentiated by the ENERGY STAR and CEE programs.

The tiered markup scenario also starts with the three different product markups in the base case (baseline, ENERGY STAR, and CEE Tier 2 and Tier 3 markups). In the standards case, the tiered markup scenario considers the situation in which the breadth of a manufacturer's portfolio of products shrinks and amended standards result in higher-tier products moving to lower tiers. As a result, higher efficiency products that previously commanded the ENERGY STAR and CEE Tier 2 and Tier 3 markups are assigned the ENERGY STAR and baseline markups, respectively. This scenario models a reduction in markups that manufacturers may experience as standards increase and reflects one of the industry's key concerns about product commoditization at higher efficiency levels as efficiency differentiators are eliminated.

DOE also modeled a lower bound profitability scenario. In the tiered markup with margin pressure scenario, the markups of products that exceed the minimum energy conservation standards similarly move to lower efficiency tiers as standards eliminate current efficiency differentiators. In this scenario, the manufacturer markups at the new minimum standard are also lowered. For both top-loading and front-loading clothes washers, manufacturers are able to maintain only the operating profit of the baseline product in absolute dollars. For products at the new minimum energy conservation standards, the higher production costs and the investments required to comply with the amended energy conservation standard do not yield additional operating profit. This scenario models concerns that higher production costs for minimally compliant products could greatly hurt manufacturer profitability because a large segment of the market is greatly impacted by increases in first costs and there would be tremendous

pressure to keep entry level products close to today's prices.

3. Discussion of Comments

During the framework public meeting, interested parties commented on the assumptions and results of the manufacturer impacts presented in the framework document. Commenters discussed several topics, including the cumulative regulatory burden on manufacturers, manufacturer tax credits, and manufacturer subgroups. DOE addresses these comments below.

a. Cumulative Regulatory Burden

DOE requested comment in the framework document on other regulations that it should consider in its examination of cumulative regulatory burden. DOE received a number of comments from interested parties.

AHAM stated that the International Association of Plumbing and Manufacturing Officials (IAPMO) recently released a draft version of ''The Green Plumbing and Mechanical Model Supplement'' for comment. The draft suggests that local municipalities may adopt a requirement for a WF of 5.0 or less. AHAM commented that if this proposal moves forward, it will introduce substantial additional regulatory burden for clothes washer manufacturers, as these requirements are substantially lower than 2011 ENERGY STAR levels. (AHAM, No. 15 at p. 5) Whirlpool stated that the proliferation of green building standards from entities such as *the* U.S. Green Building Council (USGBC), EPA, National Association of Home Builders (NAHB), and now IAPMO, creates an additional burden on manufacturers. (Whirlpool, No. 22 at p. 7) Conversely, ASAP argued that the IAPMO specifications referred to by AHAM are voluntary codes that local communities can consider. (ASAP, Public Meeting Transcript, No. 7 at p. 96) ASAP also commented that misapplying voluntary criteria in an attempt to write local standards is a hazard regardless of efficiency standards. (ASAP, Public Meeting Transcript, No. 7 at p. 96)

AHAM and GE stated that CEE Tiers continue to be raised in response to DOE standards levels, and local municipalities may require a CEE Tier rating for various incentives. In general, CEE Tiers are some percentage of a DOE standard and do not have strong data to support the levels. AHAM and GE commented that CEE Tiers may push the technology beyond practical performance and/or price points. (AHAM, No. 16 at p. 5; AHAM, Public Meeting Transcript, No. 7 at p. 95; GE, No. 20 at p. 1) ASAP commented that DOE is concerned with outside regulatory changes, and the CEE Tiers Program is not a regulatory program. (ASAP, Public Meeting Transcript, No. 7 at p. 96)

For the cumulative regulatory burden, DOE attempts to quantify or describe the impacts of other Federal regulations that have a compliance date within approximately three years of the compliance date of this rulemaking. While DOE describes voluntary programs that influence the efficiency of clothes washers in the cumulative burden and acknowledges that these programs can impact the product offerings of residential clothes washer manufacturers, DOE does not quantify the costs to comply with future voluntary programs because they are outside the scope of the cumulative regulatory burden. DOE notes that a WF of 5.0 or less considered by IAPMO corresponds to the front-loading standard size standards in the direct final rule and in the Joint Petition for 2015. DOE also notes that 42 U.S.C. 6297 describes EPCA's preemption of state and local regulation of appliance efficiency, including such requirements in State or local building codes.

ALS commented on the cumulative regulatory burden of the Restriction of Hazardous Substances (RoHS) Directive already existing in Europe and similar legislation that has been proposed in some states in the United States. (ALS, No. 13 at p. 12) Whirlpool stated that DOE should consider the increasing regulation of materials and RoHS proposals in its analysis of residential clothes washers. (Whirlpool, No. 22 at p. 7) AHAM commented that RoHS, and other hazardous substance issues are substantial regulatory burdens that are accumulating on manufacturers. (AHAM, Public Meeting Transcript, No. 7 at p. 165)

Most manufacturers of residential clothes washers that sell products in the United States also sell products in the European Union and must comply with the RoHS directive for those products sold in the European Union. While the potential restrictions of other hazardous substances and the potential for states to implement similar bans are also concerns for manufacturers, there is currently no corresponding Federal ban on many of the substances found in the RoHS directive. Therefore, DOE does not account for RoHS compliance costs in its calculation of product conversion costs.

AHAM stated that EPA is requiring the transition away from hydrochlorofluorocarbons (HCFCs), a shift to which the home appliance industry must devote resources. (AHAM, Public Meeting Transcript, No. 7 at p. 165) In response, DOE notes that residential clothes washers do not use HCFCs, and none of the design options analyzed by DOE would require changes to clothes washers due to the EPA phase-out.

Several manufacturers commented on the burden imposed by UL standards. ALS stated that a cumulative regulatory burden is imposed by the revision of UL Standard 2158 for clothes dryer safety, which requires fire containment test compliance by March 20, 2013. (ALS, No. 13 at p. 12) Whirlpool is concerned with the cumulative regulatory burden of new UL standards on entrapment for both clothes washers and dishwashers, new UL fire containment standards for clothes dryers, and a number of other safety standards for both products and components that are propagated by UL. (Whirlpool, No. 22 at p. 7) AHAM stated that there are several UL safety and functional standards that draw resources from manufacturers. BSH stated that UL 2157 and UL 2158 have been revised and present a regulatory burden to laundry appliance manufacturers. (BSH, No. 11 at p. 5) Miele stated that UL 2157 may require redesign of door lock mechanisms to prevent child entrapment, and that a similar effort is underway for dishwashers. UL 2158 was just revised, which, according to Miele will also cause a major redesign for fire containment in clothes dryer manufacturers. (Miele, Public Meeting Transcript, No. 7 at p. 165)

In the clothes dryer rulemaking, DOE accounted for the conversion costs for manufacturers to comply with the revisions to UL 2158 as mentioned in the comments from interested parties. DOE notes that the UL 2157 and 2158 are not Federal regulations. In contrast to the RoHS Directive requirements discussed previously, UL certification is a *de facto* requirement for selling products in the U.S. because many local building codes require all installed products to meet safety regulations. DOE has included the UL certification costs for both UL 2157 and UL 2158 as a sensitivity scenario in the GRIM, but does not include the UL conversion costs in the main MIA results. Refer to chapter 12 of the direct final rule TSD for more information about how DOE calculated the UL conversion costs.

AHAM, ALS, GE, and Whirlpool stated that the existing DOE rulemakings for commercial clothes washer and residential clothes dryer minimum standards represent a cumulative regulatory burden. Some of these commenters added that the DOE refrigerator and room air conditioner

rulemaking result in additional regulatory burdens. (AHAM, No. 16 at p. 6; AHAM, Public Meeting Transcript, No. 7 at p. 96; ALS, No. 13 at p. 12; GE, No. 20 at p. 1; Whirlpool, No. 22 at p. 7)

DOE agrees that these rulemakings are a part of the cumulative regulatory burden on manufacturers. DOE has attempted to quantify the impact of the other DOE energy conservation standards that have a compliance date within approximately three years of the compliance date of this rulemaking in chapter 12 of the direct final rule TSD.

AHAM added that cumulative regulatory burden is made even more demanding by the current economic conditions, and this rulemaking should explicitly consider cumulative regulatory impact in the economic justification analysis. (AHAM, Public Meeting Transcript, No. 7 at p. 96) PG&E stated that its understanding is that DOE compares the standards-case impacts to the base-case impacts, so that events such as the recession and other regulatory burdens that are independent of this rulemaking would not be considered. (PG&E, Public Meeting Transcript, No. 7 at p. 167) ASAP questioned how DOE intends to deal with the effects of the economic downturn and the potential recovery on shipment forecasts, and whether there is some sort of consistent approach DOE is considering with its other rulemakings. (ASAP, Public Meeting Transcript, No. 7 at p. 101)

DOE considers the cumulative regulatory burden on manufacturers as part of its statutory criteria to justify any energy conservation standard—the economic impact on manufacturers and consumers (42 U.S.C. 6295(o)(2)(B)(i)). DOE considers the cumulative regulatory burden in the qualitative part of its MIA analysis, though it attempts to quantify the cumulative regulatory burden whenever possible. In the MIA, DOE also modeled the impacts of amended energy conservation standards on residential clothes washer manufacturers from base year to the end of the analysis period (2011–2044). DOE used the most current information that is publicly available in many of its estimates and analyses, inputs that take the current economic downturn into consideration. For example, DOE used financial parameters like standard R&D to model the cash-flow impacts on the industry. To calculate the estimates of the financial parameters used in the GRIMs, DOE examined the latest six years of SEC 10–K data. These estimates were meant to reflect the parameters that are representative of each industry over the long-term and are not specifically attributable to current economic conditions.

As in other rulemakings, DOE used AHAM data for historical shipments. That data reflects the economic downturn for residential products including clothes washers. DOE also considers standards-case impacts with respect to the base case as part of the NIA (see section IV.G.2).

b. Manufacturer Tax Credits

DOE requested input on any ''market pull'' programs, such as manufacturer tax credits, that promote the adoption of more efficient residential clothes washers.

ASAP stated that DOE should find an effective way to address the effects of manufacturer tax incentives on conversion costs and the production credits available under current law for the production of high efficiency machines. (ASAP, Public Meeting Transcript, No. 7 at p. 83) The Joint Comment stated that DOE must fully account for the effects of Federal production tax credits in the MIA. Federal production tax credits for manufacturers of high efficiency appliances, including residential clothes washers, were first enacted in 2005 and then extended and expanded in 2008. The Joint Comment further stated that production tax credits provided manufacturers with a substantial incentive to continue to increase production of efficient front-loaders and top-loaders through 2010. According to the Joint Comment, these tax credits should substantially off-set the conversion capital requirements and product conversion expenses of meeting higher standards that are key inputs to the MIA. (Joint Comment, No. 15 at p. 7) Earthjustice commented that it would seem inconsistent to consider the tax credits for purposes of the MIA, and not to also consider that the tax credits may have an impact on the price of the product. (Earthjustice, Public Meeting Transcript, No. 7 at p. 83) SCE questioned whether DOE captures any positive manufacturer impacts due to the standards rulemaking. (SCE, Public Meeting Transcript, No. 7 at p. 166)

DOE considers all relevant manufacturer impacts, both positive and negative. For example, DOE's analysis includes the effects of any manufacturer production tax credits that may benefit certain manufacturers. ASAP and the Joint Comment above refer to tax credits that applied to residential clothes washers. However, these tax credits expired in 2010. Because 2011 is the base year to which industry cash flows are discounted on this rulemaking, any Federal production tax credits received by the industry fall outside of the analysis period and are not considered in the INPV analysis. While there are tax credits in proposed legislation, DOE is not aware of any existing Federal production tax credits that would substantially offset the required conversion costs for manufacturers. Federal production tax credits and other market pull programs such as ENERGY STAR and the CEE Tiers have helped spur the development and acceptance of more efficient products which DOE has accounted for in the market distribution of current products in the base case. However, such tax credits and other market pull programs would not substantially defray the capital conversion costs required if all products were required to meet the given efficiency.

c. Manufacturer Subgroups

DOE requested comment on appropriate manufacturer subgroups, if any, that DOE should consider in its manufacturer subgroup analysis for residential clothes washers. ALS suggested that low-volume manufacturers with less than 5 percent market share, including itself, be considered a manufacturer subgroup. (ALS, No. 13 at p. 12) ALS also stated that it is a highly leveraged small company that doesn't have the resources that the three major residential clothes washer manufacturers do. (ALS, Public Meeting Transcript, No. 7 at p. 165) AHAM stated that smaller niche manufacturers should be considered as a manufacturer subgroup. AHAM commented that these manufacturers often have less access to the newer technologies, and, in this economic climate, have fewer resources available for research and development of products. (AHAM, Public Meeting Transcript, No. 7 at p. 163) Whirlpool stated that it is unaware of any manufacturer subgroups that would be impacted differently from other manufacturers under this rulemaking. (Whirlpool, No. 22 at p. 10)

In the commercial clothes washers (CCW) final rule, DOE described the disproportionate impacts on the Low Volume Manufacturer (LVM) in the NOPR and TSD. DOE considered this manufacturer to be low-volume because its annual shipments in the combined residential and CCW market were significantly lower than those of its larger competitors. However, unlike its larger rivals, most of the LVM's unit shipments were in the CCW market, where the LVM had significant market share. Historically, this company derived 22 percent of its total revenue from the sale of front- and top-loading

clothes washers and 87 percent of that revenue was from the commercial market. As a result, DOE believed that the LVM could be affected disproportionately by any rulemaking concerning CCWs compared to its competitors, for whom CCWs represent less than 2 percent of total clothes washer sales. 75 FR 1122, 1137 (Jan. 8, 2010). However, DOE does not believe that a Low Volume subgroup is warranted for residential clothes washers because the CCW LVM has a small presence in the residential clothes washer market and residential clothes washers represent a small portion of overall clothes washer sales and a smaller portion of total revenue. DOE also notes that ALS, AHAM, and many other manufacturers signed the Joint Petition that included residential clothes washer standards identical to those in today's direct final rule. DOE also describes the potential impacts on the small business manufacturer it identified in section VI.B but does not report impacts on any other subgroups of manufacturers.

d. Miscellaneous

ASAP asked whether and how overseas manufacturers are engaged in the manufacturer interview process. (ASAP, Public Meeting Transcript, No. 7 at p. 108)

DOE invited as many domestic and international clothes washer manufacturers that sell products in the U.S. as it could identify to participate in the rulemaking process. DOE considered inputs from and interviewed the two international manufacturers that responded to its requests for participation. DOE notes that one of these manufacturers has domestic production.

4. Manufacturer Interviews

DOE interviewed manufacturers representing more than 80 percent of residential clothes washer sales. These interviews were in addition to those DOE conducted as part of the engineering analysis. DOE used these interviews to tailor the GRIM to incorporate unique financial characteristics of the industry. All interviews provided information that DOE used to evaluate the impacts of potential amended energy conservation standards on manufacturer cash flows, manufacturing capacities, and employment levels. See appendix 12–A of the direct final rule TSD for additional information on the MIA interviews. The following sections describe the most significant issues identified by manufacturers.

a. Potentially Large Conversion Costs

Manufacturers indicated that they were greatly concerned about the potential for this rulemaking to require significant product and capital conversion costs. Introducing new residential clothes washer platforms involves very large upfront costs. These capital and product development costs can be justified because a basic platform typically undergoes incremental changes over a number design cycles and the initial investment can be at least partially spread over all these shipments. Many of the existing residential clothes washer platforms have some designs options available that would necessitate only these incremental types of changes. Substantially higher efficiencies, however, could potentially necessitate a drum or cabinet capacity change. In this case, rather than requiring alteration of the current platform, the required changes would likely require design of a completely new platform. A new platform would require replacing most production equipment at a very large capital cost. Manufacturers also indicated that these initial costs for a new basic platform could result in a substantial shift in employment. Some manufacturers were also concerned that devoting resources to efficiency improvements could hurt their products in the market because these efforts could come at the expense of other features.

b. Product Classes

Manufacturers were divided on the need to retain top-loading and front-loading standard-size product classes. In general, manufacturers who produce top-loading clothes washers favored retaining the two distinct product classes. Manufacturers who produce only front-loading clothes washers were less concerned with maintaining the method of access as a product class distinction.

While all manufacturers agreed front-loading clothes washers are an important product offering, many manufacturers also stated that top-loading clothes washers are an important option for consumers because they have lower cycle times, lower price points, lower installation costs because they do not require a pedestal, are easier to load, are easier to add garments mid-cycle, and have less vibration. Some manufacturers in favor of maintaining the separate product classes also stated that eliminating top-loading clothes washers would harm lower-income customers who typically purchase baseline clothes washers. In addition, because front-loading clothes washers are mature in the marketplace, consumers are aware of the benefits of top-loading clothes washers, high efficiency top-loading products, and front-loading clothes washers and have the ability to choose higher efficiency products in either configuration.

c. Wash Performance

Manufacturers were concerned that efficiency gains over time have limited the potential to improve efficiency without negatively impacting wash performance (and the consumer). Many manufacturers were concerned that a test procedure that did not take a minimum wash performance into consideration, coupled with a more stringent energy conservation standard, could force manufacturers to limit water to a level that would harm consumers. For example, over-sudsing could be more commonplace. Also, water levels could be reduced to the point where cold water would no longer sufficiently clean clothes. Either one of these issues would result in lost energy savings as consumers either rewashed clothes or no longer selected cold water wash cycles. Consequently, many manufacturers supported adding a performance metric to the test procedure to ensure that consumers would genuinely benefit from improved efficiency.

d. Tub Capacity Measurement

Many manufacturers mentioned that different companies use inconsistent approaches in measuring tub capacity. While manufacturers offered slightly different suggestions for how to measure capacity, most were supportive of eliminating the ambiguity. Manufacturers hoped this issue would be resolved before the implementation of these amended energy conservation standards because the modified energy factor and water factor calculations are dependent on measured capacity.

e. ENERGY STAR

Manufacturers stated that the ENERGY STAR program is also a part of their overall energy strategy. To be competitive, many manufacturers must take ENERGY STAR levels into consideration when designing new clothes washers. One manufacturer mentioned that the costs associated with designing new products to meet ENERGY STAR levels were not reflected in DOE's incremental cost tables.

Another manufacturer mentioned that ENERGY STAR is an important purchasing decision, especially in the front-loading clothes washer market. The manufacturer expressed concern

that standards that are too aggressive could put the future of the ENERGY STAR program for residential clothes washers in jeopardy. In turn, that could impact local rebates that enable manufacturers to offer products that meet the minimum efficiency standards.

J. 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 any changes in the number of employees of manufacturers of the products subject to standards, their suppliers, and related service firms. The MIA addresses those impacts. Indirect employment impacts are changes in national employment that occur due to the shift in expenditures and capital investment caused by the purchase and operation of more efficient appliances. Indirect employment impacts from standards consist of the jobs created or eliminated in the national economy, other than in the manufacturing sector being regulated, due to: (1) Reduced spending by end users on energy; (2) reduced spending on new energy supply by the utility industry; (3) increased consumer spending on the purchase of new products; and (4) the effects of those three factors throughout the economy.

One method for assessing the possible effects on the demand for labor of such shifts in economic activity is to compare sector employment statistics developed by the Labor Department's Bureau of Labor Statistics (BLS). BLS regularly publishes its estimates of the number of jobs per million dollars of economic activity in different sectors of the economy, as well as the jobs created elsewhere in the economy by this same economic activity. Data from BLS indicate that expenditures in the utility sector generally create fewer jobs (both directly and indirectly) than expenditures in other sectors of the economy.[35] There are many reasons for these differences, including wage differences and the fact that the utility sector is more capital-intensive and less labor-intensive than other sectors. Energy conservation standards have the effect of reducing consumer utility bills. Because reduced consumer expenditures for energy likely lead to increased expenditures in other sectors of the economy, the general effect of efficiency standards is to shift economic activity from a less labor-intensive sector (*i.e.,* the utility sector) to more labor-intensive sectors (*e.g.,* the retail and service sectors). Thus, based on the BLS data alone, DOE believes net national employment may increase because of shifts in economic activity resulting from amended standards for clothes washers.

For the standard levels considered in today's direct final rule, 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-purpose version of the ''U.S. Benchmark National Input-Output'' (I–O) model, which was designed to estimate the national employment and income effects of energy-saving technologies. The ImSET software includes a computer-based I–O model having structural coefficients that characterize economic flows among the 187 sectors. ImSET's national economic I–O structure is based on a 2002 U.S. benchmark table, specially aggregated to the 187 sectors most relevant to industrial, commercial, and residential building energy use. DOE notes that ImSET is not a general equilibrium forecasting model. Given the relatively small change to expenditures due to energy conservation standards and the resulting small changes to employment, however, DOE believes that the size of any forecast error caused by using ImSET will be small.

For more details on the employment impact analysis, see chapter 13 of the direct final rule TSD.

K. Utility Impact Analysis

The utility impact analysis estimates several important effects on the utility industry of the adoption of new or amended standards. For this analysis, DOE used the NEMS–BT model to generate forecasts of electricity consumption, electricity generation by plant type, and electric generating capacity by plant type, that would result from each TSL. DOE obtained the energy savings inputs associated with efficiency improvements to considered products from the NIA. DOE conducts the utility impact analysis as a scenario that departs from the latest *AEO* Reference case. In the analysis for today's rule, the estimated impacts of standards are the differences between values forecasted by NEMS–BT and the values in the *AEO2010* Reference case.

As part of the utility impact analysis, DOE used NEMS–BT to assess the impacts on electricity prices of the reduced need for new electric power plants and infrastructure projected to result from the considered standards. In NEMS–BT, changes in power generation infrastructure affect utility revenue requirements, which in turn affect electricity prices. DOE estimated the change in electricity prices projected to result over time from each TSL. For further discussion, see section IV.G.5. For more details on the utility impact analysis, see chapter 14 of the direct final rule TSD.

In the framework document, DOE requested comment on the utility impact analysis, and in response received several comments from efficiency advocates and utilities. The California Utilities recommended that DOE evaluate how the standard will affect water and wastewater utilities, including their water infrastructure requirements. (California Utilities, No. 19 at p. 6) The Joint Comment stated that a new standard has the potential to have a substantial impact on the capital and operating cost profiles of water and wastewater utilities over the thirty-year period of analysis. (Joint Comment, No. 15 at p. 8)

DOE acknowledges that clothes washer standards could affect water and wastewater utilities. However, to analyze water and wastewater utility impacts, an analytical tool comparable to NEMS would be needed to account properly for the nationwide effects of standards on water and wastewater delivery and treatment. At this time, DOE does not have such a tool or access to any other means to quantify the water and wastewater utility impacts from potential clothes washer standards.

L. Emissions Analysis

In the emissions analysis, DOE estimated the reduction in power sector emissions of CO_2, NO_X, and Hg from amended energy conservation standards for clothes washers. DOE used the NEMS–BT computer model, which is run similarly to the *AEO* NEMS, except that clothes washer energy use is reduced by the amount of energy saved (by fuel type) due to 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 is the difference between the forecasted emissions estimated by NEMS–BT at each TSL and the *AEO2010* 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 rule, DOE used the version of NEMS–BT based on *AEO2010,* which incorporated projected effects of all emissions regulations promulgated as of Jan. 31, 2010.

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

SO_2 emissions from affected electric generating units (EGUs) are subject to nationwide and regional emissions cap and trading programs, and DOE has determined that these programs create uncertainty about the impact of energy conservation standards on SO_2 emissions. Title IV of the Clean Air Act sets an annual emissions cap on SO_2 for affected EGUs in the 48 contiguous States and the District of Columbia (DC). SO_2 emissions from 28 eastern States and DC are also limited under the Clean Air Interstate Rule (CAIR, 70 FR 25162 (May 12, 2005)), which created an allowance-based trading program that would gradually replace the Title IV program in those States and DC. 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). On July 6, 2011 EPA issued a replacement for CAIR, the Cross-State Air Pollution Rule. 76 FR 48208 (August 8, 2011). (See *http://www.epa.gov/crossstaterule/*). 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 *AEO2010* NEMS–BT used for today's direct final rule 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 efficiency 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 efficiency 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 *AEO2010* NEMS–BT used for today's NOPR 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 clothes washers are expected to have little or no physical effect on NO_X 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 the 22 States not affected by CAIR. For these 22 States, DOE used the NEMS–BT to estimate NO_X emissions reductions from the standards considered in today's direct final rule.

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. 76 FR 24976. The NESHAPs do not include emissions caps 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.

M. Monetizing Carbon Dioxide and Other Emissions Impacts

As part of the development of this direct final 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 considered TSLs. 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 benefits estimates considered.

For today's direct final rule, DOE is relying on a set of values for the social cost of carbon (SCC) that was developed by an interagency process. A summary of the basis for these values is provided below, and a more detailed description of the methodologies used is provided in appendix 15–A of the direct final rule TSD.

1. Social Cost of Carbon

Under Executive Order 12866, 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 these 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 [36] 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,

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

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 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 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 emission 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,[37] 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 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 final model year 2011 CAFE rule, the U.S. Department of Transportation (DOT) used both a ''domestic'' SCC value of $2 per ton of CO_2 and a ''global'' SCC value of $33 per ton of CO_2 for 2007 emission reductions (in 2007$), increasing both values at 2.4 percent per year.[38] DOT 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: *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 − $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 for Greenhouse Gases identified what it described as ''very preliminary'' SCC estimates subject to revision. See *Regulating Greenhouse Gas Emissions Under the Clean Air Act,* 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 dollars) 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 used in this direct final 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

[37] 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.

[38] Throughout this section, references to tons of CO_2 refer to metric tons.

models.[39] 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 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, 3, 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.

TABLE IV–21—SOCIAL COST OF CO_2, 2010–2050

[In 2007 dollars per metric ton]

	Discount rate			
	5% Avg	3% Avg	2.5% Avg	3% 95th
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 $67.6 per metric ton avoided (values expressed in 2010$).[40] To monetize the CO_2 emissions reductions expected to result from amended standards for clothes washers, 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 direct final rule TSD, appropriately adjusted 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.

Commenting on the framework document, Whirlpool stated that CO_2 emissions should not be monetized because the market value cannot be readily determined, the impact is negligible, and it is already included in energy savings. (Whirlpool, No. 22 at p. 6) DOE acknowledges that the market value of future CO_2 emissions reductions is uncertain, and for this reason it uses a wide range of potential values, as described above. The impact of revised standards clothes washers on future CO_2 emissions, described in section V.B.6 of this notice, is not negligible. In addition, the value of CO_2 emissions reductions is not included in energy cost savings because the energy prices that DOE used to calculate those savings do not include any taxes or other charges to account for the CO_2 emissions associated with the use of electricity or natural gas by residential clothes washers.

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, amended energy conservation standards would reduce NO_X emissions in those 22 States that are not affected by the CAIR, in addition to the reduction in site NO_X emissions nationwide. DOE estimated the monetized value of NO_X emissions

[39] The models are described in appendix 15–A of the direct final rule TSD.

[40] 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.

reductions resulting from each of the TSLs considered for today's direct final rule based on environmental damage estimates from the 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 $4,623 per ton in 2010$).[41] 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 another using a real discount rate of 7 percent.[42]

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.

V. Analytical Results

The following section addresses the results from DOE's analyses with respect to potential energy conservation standards for residential clothes washers of this rulemaking. It addresses the TSLs examined by DOE, the projected impacts of each of these levels if adopted as energy conservation standards for clothes washers, and the standards levels that DOE sets forth in today's direct final rule. Additional details regarding DOE's analyses are contained in the publicly available direct final rule TSD supporting this notice.

A. Trial Standard Levels

DOE analyzed the benefits and burdens of a number of TSLs for residential clothes washers, the products that are the subject of today's direct final rule. Each TSL DOE analyzed is described below. DOE attempted to limit the number of TSLs considered for the final rule by excluding efficiency levels that do not exhibit significantly different economic and/or engineering characteristics from the efficiency levels already selected as a TSL. Although DOE presents the results for only those efficiency levels in TSL combinations in today's final rule, DOE presents the results for all efficiency levels that it analyzed in the final rule TSD.

Table V–1 presents the TSLs and the corresponding product class efficiency levels for clothes washers.

For standard-size products, TSL 1 consists of the efficiency levels that are two levels above the baseline levels (which are considered Efficiency Level 0). TSL 2 represents an intermediary point between the efficiency levels chosen for TSL 1 and the efficiency levels recommended in the Joint Petition. TSL 3 consists of the efficiency levels recommended in the Joint Petition. In the case of TSL 3, for top-loading standard clothes washers, one set of values would apply starting in 2015, and another set would apply starting in 2018. TSL 4 consists of the efficiency levels that are one level below the max-tech efficiency levels. TSL 5 consists of the max-tech efficiency levels.

For top-loading compacts, TSL 1, TSL 2 and the 2015 level of TSL 3 consists of Efficiency Level 1, and TSL 4 and TSL 5 and the 2018 level of TSL 3 consist of Efficiency Level 2. For front-loading compacts, all TSLs consist of Efficiency Level 1.

TABLE V–1—TRIAL STANDARD LEVELS FOR RESIDENTIAL CLOTHES WASHERS

TSL	Top-loading standard			Front-loading standard		
	Efficiency level	IMEF ft^3/kWh/cycle	Standby W	Efficiency level	IMEF ft^3/kWh/cycle	Standby W
1	2	1.29	0.00	2	1.41	0.08
2	5	1.37	0.08	4	1.66	0.08
3*	2	1.29	0.00	5	1.84	0.08
3**	6	1.57	0.08			
4	7	1.83	0.08	7	2.20	0.08
5	8	2.04	0.08	8	2.46	0.08
	Top-loading compact			Front-loading compact		
1	1	0.86	0.00	1	1.13	0.08
2	1	0.86	0.00	1	1.13	0.08
3*	1	0.86	0.00	1	1.13	0.08
3**	2	1.15	2.30			
4	2	1.15	2.30	1	1.13	0.08
5	2	1.15	2.30	1	1.13	0.08

*2015 levels.
**2018 levels.

[41] 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.* 2006. Washington, DC.

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

B. Economic Justification and Energy Savings

1. Economic Impacts on Individual Consumers

a. Life-Cycle Cost and Payback Period

Consumers affected by new or amended standards usually experience higher purchase prices and lower operating costs. Generally, the impacts on individual consumers are best captured by changes in life-cycle cost (LCC) and by the payback period (PBP). Therefore, DOE calculated the LCC and PBP analyses for the potential standard levels considered in this rulemaking. DOE's LCC and PBP analyses provided key outputs for each TSL, which are reported by clothes washer product class in Table V–2 through Table V–5. Each table includes the average total LCC and the average LCC savings, as well as the fraction of product consumers for which the LCC will decrease (net benefit), increase (net cost), or exhibit no change (no impact) relative to the base-case forecast. The last column in the tables contains the median PBP for the consumer purchasing a design that complies with the TSL. DOE presents the median PBP because it is the most statistically robust measure of the PBP. The results for each potential standard level are relative to the efficiency distribution in the base case (no amended standards). DOE based the LCC and PBP analyses on the range of energy consumption under conditions of actual product use.

TABLE V–2—LCC AND PBP RESULTS FOR TOP-LOADING STANDARD CLOTHES WASHERS

TSL	IMEF	Life-cycle cost *2010$*			LCC Savings				Payback period *years*
		Installed cost	Discounted operating cost	LCC	Average savings *2010$*	Percent of households that experience			Median
						Net cost	No impact	Net benefit	
1	1.29	425	1,317	1,743	268	0.7	19.5	79.8	0.4
2	1.37	433	1,340	1,773	243	5.6	15.1	79.3	0.7
3*	1.29	425	1,317	1,743	268	0.7	19.5	79.8	0.4
3**	1.57	448	1,182	1,630	366	3.4	14.1	82.5	0.9
4	1.83	496	1,003	1,499	491	8.1	4.6	87.4	1.8
5	2.04	508	958	1,466	524	9.5	0.0	90.5	1.9

*2015 levels.
**2018 levels.

TABLE V–3—LCC AND PBP RESULTS FOR FRONT-LOADING STANDARD CLOTHES WASHERS

TSL	IMEF	Life-cycle cost *2010$*			LCC Savings				Payback period *years*
		Installed cost	Discounted operating cost	LCC	Average savings *2010$*	Percent of households that experience			Median
						Net cost	No impact	Net benefit	
1	1.41	867	1,214	2,081	0	0.0	100.0	0.0	NA
2	1.66	874	1,088	1,961	2.2	0.1	96.0	3.9	0.9
3	1.84	888	946	1,835	37	1.5	72.4	26.1	1.3
4	2.20	938	900	1,838	35	45.1	11.6	43.3	9.2
5	2.46	964	807	1,771	102	29.6	0.0	70.4	5.2

TABLE V–4—LCC AND PBP RESULTS FOR TOP-LOADING COMPACT CLOTHES WASHERS

TSL	IMEF	Life-cycle cost *2010$*			LCC Savings				Payback period *years*
		Installed cost	Discounted operating cost	LCC	Average savings *2010$*	Percent of households that experience			Median
						Net cost	No impact	Net benefit	
1	0.86	426	988	1,414	159	1.5	0.0	98.5	0.5
2	0.86	426	988	1,414	159	1.5	0.0	98.5	0.5
3*	0.86	426	988	1,414	159	1.5	0.0	98.5	0.5
3**	1.15	480	781	1,261	312	12.6	0.0	87.4	2.1
4	1.15	480	781	1,261	312	12.6	0.0	87.4	2.1
5	1.15	480	781	1,261	312	12.6	0.0	87.4	2.1

*2015 levels.
**2018 levels.

TABLE V–5—LCC AND PBP RESULTS FOR FRONT-LOADING COMPACT CLOTHES WASHERS

TSL	IMEF	Life-cycle cost *2010$*			LCC Savings				Payback period *years*
		Installed cost	Discounted operating cost	LCC	Average savings *2010$*	Percent of households that experience			Median
						Net cost	No impact	Net benefit	
1	1.13	865	694	1,559	54	0.0	0.0	100.0	0.8
2	1.13	865	694	1,559	54	0.0	0.0	100.0	0.8
3	1.13	865	694	1,559	54	0.0	0.0	100.0	0.8
4	1.13	865	694	1,559	54	0.0	0.0	100.0	0.8

TABLE V–5—LCC AND PBP RESULTS FOR FRONT-LOADING COMPACT CLOTHES WASHERS—Continued

TSL	IMEF	Life-cycle cost *2010$*			LCC Savings				Payback period *years*
		Installed cost	Discounted operating cost	LCC	Average savings *2010$*	Percent of households that experience			Median
						Net cost	No impact	Net benefit	
5	1.13	865	694	1,559	54	0.0	0.0	100.0	0.8

b. Consumer Sub-Group Analysis

As described in section IV.H, DOE determined the impact of the considered TSLs on low-income households and senior-only households. Table V–6 compares the average LCC savings at each efficiency level for the two consumer subgroups, along with the average LCC savings for the entire sample for each product class for clothes washers. For compacts, DOE also analyzed impacts on multi-family consumers, since they are most likely to use compact washers. In general, the average LCC savings for low-income households and senior-only households at the considered efficiency levels are not substantially different from the average for all households. Chapter 11 of the direct final rule TSD presents the complete LCC and PBP results for the consumer subgroups.

TABLE V–6—CLOTHES WASHERS: COMPARISON OF AVERAGE LCC SAVINGS FOR CONSUMER SUBGROUPS AND ALL HOUSEHOLDS

TSL	Top-loading standard				Front-loading standard			
	IMEF	Senior	Low-income	All	IMEF	Senior	Low-income	All
1	1.29	163	240	268	1.41	0	0	0
2	1.37	142	203	243	1.66	1.3	2.5	2.2
3*	1.29	163	240	268	1.84	22	36	37
3**	1.57	214	319	366				
4	1.83	275	437	491	2.20	6.0	39	35
5	2.04	291	466	524	2.46	38	109	102

TSL	Top-loading compact					Front-loading compact				
	IMEF	Senior	Low-income	Multi-family	All	IMEF	Senior	Low-income	Multi-family	All
1	0.86	99	150	127	159	1.13	41	57	48	54
2	0.86	99	150	127	159	1.13	41	57	48	54
3*	0.86	99	150	127	159	1.13	41	57	48	54
3**	1.15	163	275	227	312	1.13				
4	1.15	163	275	227	312	1.13	41	57	48	54
5	1.15	163	275	227	312	1.13	41	57	48	54

* Refers to 2015 levels for top-loading washers.
** Refers to 2018 levels for top-loading washers.

c. Rebuttable Presumption Payback

As discussed above, EPCA provides a rebuttable presumption that an energy conservation standard is economically justified if the increased purchase cost for a product that meets the standard is less than three times the value of the first-year energy savings resulting from the standard. In calculating a rebuttable presumption payback period for the considered standard levels, DOE used discrete values rather than distributions for input values, and, as required by EPCA, based the energy use calculation on the DOE test procedures for residential clothes washers. As a result, DOE calculated a single rebuttable presumption payback value, and not a distribution of payback periods, for each efficiency level. Table V–7 presents the average rebuttable presumption payback periods for those efficiency levels where the increased purchase cost for a product that meets a standard at that level is less than three times the value of the first-year energy savings resulting from the standard.

TABLE V–7—CLOTHES WASHERS: EFFICIENCY LEVELS HAVING REBUTTABLE PBPS LESS THAN THREE YEARS

TSL	Top-loading standard		Front-loading standard		Top-loading compact		Front-loading compact	
	IMEF	PBP *years*	IMEF	PBP *years*	IMEF	PBP *years*	IMEF	PBP *years*
1	1.29	0.7	1.41	0.3	0.86	0.30	1.13	0.7
2	1.37	0.8	1.66	0.7	0.86	0.30	1.13	0.7
3*	1.29	0.7	1.84	0.5	0.86	0.30	1.13	0.7
3**	1.57	1.7			1.15	1.31	1.13	0.7
4	1.83	2.1	2.20	1.1	1.15	1.31	1.13	0.7
5	2.04	2.2	2.46	1.2	1.15	1.31	1.13	0.7

*Refers to 2015 levels for top-loading washers.
**Refers to 2018 levels for top-loading washers.

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

2. Economic Impacts on Manufacturers

DOE performed an MIA to estimate the impact of amended energy conservation standards on manufacturers of residential clothes washers. The section below describes the expected impacts on manufacturers at each TSL. Chapter 12 of the direct final rule TSD explains the analysis in further detail.

a. Industry Cash Flow Analysis Results

The tables below depict the financial impacts on manufacturers (represented by changes in INPV) and the conversion costs DOE estimates manufacturers would incur at each TSL. Each set of results below shows INPV impacts under a different set of assumptions: The first table reflects the lower (least severe) bound of impacts and the third table represents the upper (most severe) bound. As described in section IV.I, DOE modeled three different scenarios using different markup assumptions to evaluate this range of cash-flow impacts on the industry. These assumptions correspond to the bounds of a range of market responses that DOE anticipates could occur in the standards case. Each scenario results in a unique set of cash flows and corresponding industry value at each TSL.

The INPV results refer to the difference in industry value between the base case and the standards case, which DOE calculated by summing the discounted industry cash flows from the base year (2011) through the end of the analysis period. The discussion also notes the difference in cash flow between the base case and the standards case in the year before the compliance date of potential amended energy conservation standards. This figure provides a proxy for the magnitude of the required conversion costs relative to the cash flow generated by the industry in the base case.

To assess the lower end of the range of potential impacts on the residential clothes washer industry, DOE modeled the no commoditization markup scenario. The no commoditization scenario assumes that the baseline manufacturer markup structure does not change in the standards case. In this scenario, the higher markup for the 2011 ENERGY STAR level and the additional markup for CEE Tier 2 and Tier 3 products continue in the standards case. This scenario also assumes that manufacturers would be able to fully pass the higher production costs required for more efficient products on to their customers in the standards case. In general, the more standards reduce the ability to differentiate on efficiency and the larger the product price increases, the less likely manufacturers are to achieve the cash flow from operations calculated in this scenario because the less likely it is that manufacturers would be able to fully mark up these larger cost increases.

DOE also assessed two tiered markup scenarios, the tiered markup scenario and the tiered markup scenario with margin impacts. The latter represents the upper bound of the range of potential impacts on the industry. In the standards case, both tiered markup scenarios consider the situation in which the breadth of a manufacturer's portfolio of products shrinks as amended standards result in the elimination of lower efficiency tiers from the market and the erosion of premium markups for higher-tier products. These scenarios model a reduction in markups that manufacturers may experience under more stringent amended energy conservation standards as premium products earn the same markups previously held by lower efficiency tiers. In the tiered markup scenario with margin impacts, no additional operating profit is earned on the higher production costs of products that meet the minimum energy conservation standard in the standards case, eroding profit margins as a percentage of total revenue. In addition, as base-case efficiency differentiators are eliminated in the standards case, products that previously earned a premium markup move to lower efficiency markup tiers.

DOE used the reference NIA shipment scenario for all MIA scenarios used to characterize the potential INPV impacts. The shipment forecast is an important driver of the INPV results below (Table V–8 through Table V–10). The reference NIA shipment scenario includes two elasticity effects: (1) A relative price elasticity, which assumes higher product prices in the standards case result in lower shipments, and, in turn, lower industry revenue and INPV and (2) a cross-price elasticity, which changes the relative market share of top-loading and front-loading clothes washers as price increases alter their relative costs to consumers. The reference NIA shipment scenario also includes the default price forecast as described in chapter 10 of the direct final rule TSD.

TABLE V–8—MANUFACTURER IMPACT ANALYSIS FOR RESIDENTIAL CLOTHES WASHERS—NO COMMODITIZATION MARKUP SCENARIO

	Units	Base case	Trial standard level				
			1	2	3	4	5
INPV	(*2010$ millions*)	2,585.7	2,529.4	2,571.3	2,682.0	2,790.7	2,841.2
Change in INPV	(*2010$ millions*)		(56.3)	(14.3)	96.4	205.0	255.5
	(%)		−2.2%	−0.6%	3.7%	7.9%	9.9%
Product Conversion Costs	(*2010$ millions*)		22.6	41.6	107.5	204.3	210.8
Capital Conversion Costs	(*2010$ millions*)		81.2	107.7	311.0	487.4	502.9
Total Conversion Costs.	(*2010$ millions*)		103.9	149.3	418.5	691.8	713.7

TABLE V–9—MANUFACTURER IMPACT ANALYSIS FOR RESIDENTIAL CLOTHES WASHERS—TIERED MARKUP SCENARIO

	Units	Base case	Trial standard level				
			1	2	3	4	5
INPV	(*2010$ millions*)	2,585.7	2,529.4	2,110.0	1,762.8	1,453.0	1,417.5
Change in INPV	(*2010$ millions*)		(56.3)	(475.7)	(822.9)	(1,132.7)	(1,168.1)
	(%)		−2.2%	−18.4%	−31.8%	−43.8%	−45.2%
Product Conversion Costs	(*2010$ millions*)		22.6	41.6	107.5	204.3	210.8
Capital Conversion Costs	(*2010$ millions*)		81.2	107.7	311.0	487.4	502.9
Total Conversion Costs.	(*2010$ millions*)		103.9	149.3	418.5	691.8	713.7

TABLE V–10—MANUFACTURER IMPACT ANALYSIS FOR RESIDENTIAL CLOTHES WASHERS—TIERED MARKUP SCENARIO WITH MARGIN IMPACTS

	Units	Base case	Trial standard level				
			1	2	3	4	5
INPV	(*2010$ millions*)	2,585.7	2,521.7	2,095.3	1,726.9	1,329.3	1,250.4
Change in INPV	(*2010$ millions*)		(64.0)	(490.3)	(858.8)	(1,256.4)	(1,335.3)
	(%)		−2.5%	−19.0%	−33.2%	−48.6%	−51.6%
Product Conversion Costs	(*2010$ millions*)		22.6	41.6	107.5	204.3	210.8
Capital Conversion Costs	(*2010$ millions*)		81.2	107.7	311.0	487.4	502.9
Total Conversion Costs.	(*2010$ millions*)		103.9	149.3	418.5	691.8	713.7

At TSL 1, DOE estimates impacts on INPV to range −$56.3 million to −$64.0 million, or a change in INPV of −2.2 percent to −2.5 percent. At this level, industry free cash flow is estimated to decrease by approximately 20.2 percent to $170.0 million, compared to the base-case value of $213.1 million in the year leading up to the amended energy conservation standards.

Because the top-loading and front-loading standard clothes washers comprise over 98 percent of the total residential clothes washer shipments, the vast majority of the INPV impacts come from the standard-size product classes. At TSL 1, most impacts on both INPV and free cash flow stem from the modest changes required for top-loading standard clothes washers because all of the front-loading standard residential clothes washers on the market today already meet standards at this level. For top-loading clothes washers, of which only 13 percent of the market currently meets standards proposed at TSL 1, the impacts on INPV and free cash flow arise from increases in upfront investment for product development and, to a lesser extent, the per-unit component costs required to achieve this efficiency level. TSL 1 would require investments in product redesign and improvements to facilities totaling approximately $103.9 million in an industry with base-case annual revenues of more than $4.4 billion in the year the standards go into effect. Regarding increases in component costs, the design options used to meet standards at TSL 1 include component changes such as electronic controls, agitator modification, and basket modifications. For top-loading standard residential clothes washers, these changes contribute only $8.44 (3.4 percent) to arrive at an MPC of $256.09. In summation, the cumulative effect on INPV and free cash flow is minimal largely because all front-loading standard products and some top-loading standard products already meet the efficiencies required at TSL 1, and the design changes for the top-loading standard products that do not meet the efficiency required at TSL1 would impose minimal costs. Further, as the efficiencies required at TSL 1 are well below ENERGY STAR levels, manufacturers are likely to retain the premiums they currently see across the full range of product efficiencies.

At TSL 2, DOE estimates impacts on INPV to range −$14.3 million to −$490.3 million, or a change in INPV of −0.6 percent to −19.0 percent. At this level, industry free cash flow is estimated to decrease by approximately

28.4 percent to $152.6 million, compared to the base-case value of $213.1 million in the year leading up to the amended energy conservation standards.

Because the top-loading and front-loading standard clothes washers comprise over 98 percent of the total residential clothes washer shipments, the vast majority of the INPV impacts come from the standard-size product classes. At TSL 2, the impacts on INPV and free cash flow result from higher per-unit costs for both top-loading and front-loading standard-sized product classes as well as increases in product and capital conversion costs for both of these product classes. The design options used to meet standards at TSL 2 for top-loading standard-size products include additional component changes to enable higher spin speeds and better control beyond the improvements to electronic controls and the agitator and basket associated with TSL 1. For front-loading standard-size products, TSL 2 is achieved by the use of an electronic user interface. The resulting MPC for top-loading standard residential clothes washers is approximately $261.88 at TSL 2, a $14.23 (5.7 percent) increase over current baseline units and similar to the incremental costs at TSL 1. For front-loading standard residential clothes washers, the MPC is approximately $524.33, a $6.20 (1.2 percent) increase from the baseline. The product redesign and incorporation of these changes into manufacturing lines requires approximately $149.3 million in total conversion costs—a $45.4 million increase from TSL 1. TSL 2 brings all front-loading standard washers up to current ENERGY STAR standard levels. The most severe impact to INPV at TSL 2 is the result of margin compression on front-loading standard clothes washers as manufacturers forfeit premiums and cut into margins as they try to maintain a marginally compliant competitively priced entry level product. While only a small fraction of front-loading clothes washers (4 percent of shipments) would be impacted in the standards case at TSL2, in the tiered markup scenario with margin compression the profitability impacts on front-loading clothes washers has a disproportionately large negative impact on INPV because most of the market is ENERGY STAR compliant in the base case.

At TSL 3, DOE estimates impacts on INPV to range $96.4 million to −$858.8 million, or a change in INPV of 3.7 percent to −33.2 percent. At this level, industry free cash flow is estimated to decrease by approximately 3.6 percent to $205.5 million, compared to the base-case value of $213.1 million in the year leading up to the amended energy conservation standards in 2015.

At TSL3, the largest impacts to free cash flow and INPV stem from the substantial upfront investments required to achieve this efficiency level. While the efficiency requirements for top-loading standard clothes washers in 2015 require incremental changes to existing products, the 2018 efficiency requirements for top-loading standard clothes washers are more substantial. Because only 9 percent of current shipments of top-loading standard clothes washers meet the 2018 efficiency standards established at TSL 3, manufacturing products to meet the 2018 standards would require large investments in product redesign and conversion of facilities. Substantial investments would also be required for manufacturers to meet the 2015 front-loading standard. The total conversion cost required to meet the 2015 and 2018 standards at TSL 3 is approximately $418.5 million—a substantial fraction of overall industry value and $269.2 million higher than at TSL 2. Less than 25 percent of the conversion costs associated with TSL 3 can be attributed to the 2015 compliance for top-loading standard products.. This is a considerably smaller factor than at TSL 1 and TSL 2 at which 97 percent and 81 percent of conversion costs can be attributed to standard top-loading compliance, respectively. The design options used to meet the 2015 front-loading and 2018 top-loading standards at TSL 3 include larger unit capacities, damping systems, and reinforced structural elements. Substantial changes to existing production facilities would be required to manufacture products to incorporate the 2015 front-loading and 2018 top-loading design options. Several manufacturers have already introduced products that meet the 2015 front-loading standard and 2018 top-loading standard efficiency levels, which mitigates the required changes to production facilities for these manufacturers. The compliance dates of TSL 3 also mitigate the effect of the large conversion costs required to meet the 2018 top-loading standards, subjecting the impact on cash flows to greater discounting while also allowing manufactures to delay or spread out their conversion costs. At TSL 3, the MPC for top-loading standard residential clothes washers is $256.09 to meet the 2015 energy conservation standard and $272.93 to meet the 2018 energy conservation standard. For front-loading standard residential clothes washers the MPC is approximately $535.38 to meet the 2015 energy conservation standard. For the 2015 standard this is a $8.44 (3.4 percent) increase for top-loading standard clothes washers and a $17.25 (3.3 percent) increase for front-loading standard clothes washers. For the 2018 energy conservation standard for top-loading standard clothes washers, this is a $25.28 (10.2 percent) increase. In the scenario in which manufacturers see no commoditization of higher efficiency clothes washers, the modest increases to MPC translate to higher margins sufficient to offset the initial capital investments and product design costs over the 30 year analysis period. In contrast in the tiered mark up scenario, because TSL 3 sets standards for top-loading standard clothes washers at current ENERGY STAR levels and standards for front-loading standard clothes washers above these levels, manufacturers lose their premium markup for high efficiency standard-size product classes leading to a substantial reduction in future revenues and subsequently in INPV.

At TSL 4, DOE estimates impacts on INPV to range $205.0 million to −$1,256.4 million, or a change in INPV of 7.9 percent to −48.6 percent. At this level, industry free cash flow is estimated to decrease by approximately 130.7 percent to −$65.5 million, compared to the base-case value of $213.1 million in the year leading up to the amended energy conservation standards.

Much like TSL 3, the impacts to INPV at TSL 4 result primarily from the substantial upfront investments required to achieve the amended efficiency levels for standard-size products, the incremental increases in per-unit costs, and the potential margin impacts. For top-loading units, in contrast to TSL 3, manufacturers are required to cover the conversion costs for all products by 2015. Manufacturing products to meet standards for both standard-size product classes at TSL 4 may require a complete platform overhaul, resulting in significant investments in both product redesign and the conversion of facilities. The total conversion cost required to meet standards at TSL 4 is approximately $691.8 million—a $273.3 million increase from TSL 3. The design options used to meet standards at TSL 4 include changes such as larger capacity, accelerometers, and better control technology beyond what is required for TSL 3. The resulting MPC for top-loading standard residential clothes washers at TSL 4 is approximately $308.30, and approximately $572.01 for front-loading standard residential

clothes washers. This is a $60.65 (24.5 percent) and a $53.88 (10.4 percent) increase from the baseline for top-loading and front-loading standard residential clothes washers, respectively. This increase in MPC translates to a 3.5 percent decrease in 2015 shipments. However, the impact on INPV arising from a decrease in shipments from price elasticity is minor in comparison to that stemming from product commoditization and margin impacts as analyzed in the tiered markup scenario with margin impacts for standard-sized product classes. As TSL 4 brings standards for both top-loading and front-loading standard products above current ENERGY STAR levels, the fraction of products that are eligible for any additional markup above the baseline is further reduced as manufacturers sacrifice margins as they continue to seek to maintain a low-price-point basic product offering.

At TSL 5, DOE estimates impacts on INPV to range $255.5 million to −$1,335.3 million, or a change in INPV of 9.9 percent to −51.6 percent. At this level, industry free cash flow is estimated to decrease by approximately 134.9 percent to −$74.3 million, compared to the base-case value of $213.1 million in the year leading up to the amended energy conservation standards.

TSL 5 represents the max-tech efficiency level for both top-loading and front-loading standard clothes washers. The effects on INPV result from similar sources as TSL 4, including the substantial upfront investments required to achieve the amended efficiency levels, the incremental increases in per-unit costs, and the potential margin impacts. These effects, however, are compounded by the higher upfront investments for facility improvements and product development, the additional increases to the MPC, and the collapse of manufacturer margins as analyzed in the tiered markup scenario with margin impacts. At present, the market share of commercially available residential clothes washers that conform to this standard is negligible. As such, standards will affect nearly all platforms and manufacturers will incur substantial conversion costs associated with total redesigns and improvements to all production facilities. The total conversion cost required to meet standards at TSL 5 is approximately $713.7 million—a $21.9 million increase from TSL 4. TSL 5 does not delay compliance for the more stringent standard either top-loading product class, so manufacturers will incur all product and capital conversion costs by 2015, leading to a larger negative impact on INPV. The MPC for top-loading standard residential clothes washers is approximately $317.44 at TSL 5, and approximately $591.64 for front-loading standard residential clothes washers. This is a $69.79 (28.2 percent) and a $73.51 (14.2 percent) increase from the baseline for top-loading and front-loading standard residential clothes washers, respectively. However, the increase in per-unit production costs at TSL 5 relative to those at TSL 4 is comparatively small and involves only minimal incremental design options such as changes to load size sensors and more precise dispensing of laundry detergent and additives. With the increase in MPCs, 2015 shipments are forecast to decrease by approximately 4.4 percent at TSL 5. However, the impact on INPV arising from a decrease in shipments from price elasticity is minor in comparison to that stemming from product commoditization and margin impacts as analyzed in the tiered markup scenario with margin impacts. Where TSL 4 still provided some room for markups above the most basic units, TSL 5 sets the standard for all products as high as technically feasible, leaving manufacturers no ability to differentiate products by efficiency. Thus, all margins collapse to their lowest levels.

b. Impacts on Employment

DOE used the GRIM to estimate the domestic labor expenditures and number of domestic production workers in the base case and at each TSL from 2011 to 2044. DOE used statistical data from the most recent U.S. Census Bureau's 2009 ''Annual Survey of Manufacturers,'' the results of the engineering analysis, and interviews with manufacturers to determine the inputs necessary to calculate industry-wide labor expenditures and domestic employment levels. Labor expenditures for the manufacture of a product are a function of the labor intensity of the product, the sales volume, and an assumption that wages in real terms remain constant.

In the GRIM, DOE used the labor content of each product and the manufacturing production costs from the engineering analysis to estimate the annual labor expenditures in the residential clothes washer industry. DOE used Census data and interviews with manufacturers to estimate the portion of the total labor expenditures that is attributable to domestic labor.

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

The employment impacts shown in Table V–11 represent the potential production employment that could result following amended energy conservation standards. The upper end of the results in this table estimates the total potential increase in the number of production workers after amended energy conservation standards. To calculate the total potential increase, DOE assumed that manufacturers continue to produce the same scope of covered products in domestic production facilities and domestic production is not shifted to lower-labor-cost countries. Because there is a real risk of manufacturers evaluating sourcing decisions in response to amended energy conservation standards, the lower end of the range of employment results in Table V–11 includes the estimated total number of U.S. production workers in the industry who could lose their jobs if all existing production were moved outside of the United States. While the results present a range of employment impacts following the compliance date of amended energy conservation standards, the discussion below also includes a qualitative discussion of the likelihood of negative employment impacts at the various TSLs. Finally, the employment impacts shown are independent of the employment impacts from the broader U.S. economy, which are documented in chapter 13 of the direct final rule TSD.

Using the GRIM, DOE estimates that in the absence of amended energy conservation standards, there would be 8,990 domestic production workers involved in manufacturing residential clothes washers in 2015. Using 2009 Census Bureau data and interviews with manufacturers, DOE estimates that approximately 70 percent of residential clothes washers sold in the United States are manufactured domestically. Table V–11 shows the range of the impacts of potential amended energy conservation standards on U.S. production workers in the clothes washer industry.

TABLE V–11—POTENTIAL CHANGES IN THE TOTAL NUMBER OF DOMESTIC RESIDENTIAL CLOTHES WASHER PRODUCTION WORKERS IN 2015

	Base case	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
Total Number of Domestic Production Workers in 2015 (without changes in production locations)	8,990	9,058	9,164	9,080	9,376	8,604
Potential Changes in Domestic Production Workers in 2015*	.....	68–(8,890)	174–(8,890)	90–(8,890)	386–(8,890)	(386)–(8,890)

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

All examined TSLs show relatively minor impacts on domestic employment levels relative to total industry employment at the lower end of the range of impacts. At all TSLs, most of the design options analyzed by DOE do not greatly alter the labor content of the final product. For example, more complex wash cycles or larger basket sizes involve one-time changes to the final product but do not significantly change the number of steps required for the final assembly of the clothes washer (which would add labor). Because many manufacturers have recently introduced high efficiency products in the United States that meet or exceed the standards in today's final rule, it is unlikely today's direct final rule would greatly impact the sourcing decisions of these manufacturers. However, at higher TSLs, some of the design options analyzed greatly impact the ability of manufacturers to make product changes within existing platforms. The very large upfront capital costs at these levels (especially for introducing new front-loading clothes washer platforms) could influence the decision of manufacturers to relocate some or all of the domestic production of these clothes washers to lower labor cost countries.

c. Impacts on Manufacturing Capacity

Most shipments of top-loading residential clothes washers fall below the 2015 and 2018 amended energy conservation standards. However, in response to the EISA 2007 water factor requirements, multiple manufacturers have modified baseline products to comply with these more stringent regulations. These changes were incremental modifications to lower-efficiency platforms. The 2015 efficiency requirements would also involve modifications to lower-end platforms for top-loading clothes washers for all manufacturers, but would similarly not require completely new platforms at a significantly higher upfront cost. In addition, multiple manufacturers have recently introduced new top-loading clothes washers that meet substantially higher efficiencies than lower-end products at the baseline efficiency today. The introduction of these platforms mitigates the required capital conversion costs for the industry to meet the 2018 top-loading energy conservation standards. DOE believes that the mitigated capital conversion costs for manufacturers that have already introduced high-efficiency top-loading clothes washers, as well as the additional 3 years for all remaining manufacturers to meet the more efficient standards for top-loading clothes washers in 2018, will allow the industry to meet demand and continue to offer a full range of products after the compliance date.

More than 70 percent of front-loading shipments current meet the front-loading energy conservation standards in today's direct final rule. In addition, every manufacturer that ships front-loading clothes washers offers products at the amended energy conservation standard. Since manufacturers will not have to make extensive platform changes but will need to increase the production of existing product by the 2015 compliance date, the experience of multiple front-loading manufacturers that already produce standards-compliant front-loading clothes washers will allow the industry to meet the amended energy conservation standards proposed in the direct final rule.

d. Impacts on Sub-Groups of Manufacturers

Using average cost assumptions to develop an industry cash-flow estimate may not be adequate for assessing differential impacts among manufacturer subgroups. Small manufacturers, niche equipment manufacturers, and manufacturers exhibiting a cost structure substantially different from the industry average could be affected disproportionately. DOE analyzed the impacts to small business, as discussed in section VI.B. DOE did not identify any other subgroups for residential clothes washers for this rulemaking.

e. Cumulative Regulatory Burden

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

Manufacturers provided comment on some of these regulations during the framework stage of this rulemaking. DOE summarizes and addresses these comments in section IV.I.3.a. For the cumulative regulatory burden, DOE attempts to quantify or describe the impacts of other Federal regulations that have a compliance date within approximately 3 years of the compliance date of this rulemaking. Most of the major regulations that meet this criteria identified by DOE are other energy conservation standards for products and equipment made by manufacturers of residential clothes washers. See chapter 12 of the direct final rule TSD for the results of DOE's analysis of the cumulative regulatory burden.

3. National Impact Analysis

a. Significance of Energy Savings

To estimate the energy savings through 2044 attributable to potential standards for clothes washers, DOE compared the energy consumption of those products under the base case to their anticipated energy consumption under each TSL. Table V–12 presents DOE's forecasts of the national energy

savings for each TSL for clothes washers, and Table V–13 presents forecasts of the national water savings.[43] The savings were calculated using the approach described in section IV.G. Chapter 10 of the direct final rule TSD presents tables that also show the magnitude of the energy savings if the savings are discounted at rates of 7 percent and 3 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.

TABLE V–12—CLOTHES WASHERS: CUMULATIVE NATIONAL ENERGY SAVINGS

Energy (quads)	Trial standard level				
	1	2	3	4	5
Standard Size	1.52	1.43	1.98	2.81	3.27
Compact Size	0.04	0.04	0.05	0.05	0.05

TABLE V–13—CLOTHES WASHERS: CUMULATIVE NATIONAL WATER SAVINGS

Water (trillion gallons)	Trial standard level				
	1	2	3	4	5
Standard Size	1.12	1.06	3.01	5.31	6.87
Compact Size	−0.01	−0.01	0.02	0.02	0.02

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 clothes washers. In accordance with the OMB's guidelines on regulatory analysis (OMB Circular A–4, section E, September 17, 2003), 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 to private capital in the U.S. economy, and reflects the returns to 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, since recent OMB analysis has found the average rate of return to capital to be near this rate. In addition, DOE used the 3-percent rate to capture the potential effects of standards on private consumption (*e.g.,* through higher prices for products and the purchase of reduced amounts 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 last 30 years.

Table V–14 shows the consumer NPV results for each TSL DOE considered for clothes washers, using a 3-percent and a 7-percent discount rate. The impacts are counted over the lifetime of products purchased in 2015–2044.

TABLE V–14—CLOTHES WASHERS: CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS, 3- AND 7-PERCENT DISCOUNT RATE*

Discount rate	Trial standard level				
	1	2	3	4	5
	Billion 2010$				
3 percent:					
Standard	19.9	18.1	30.7	41.0	49.9
Compact	0.32	0.32	0.56	0.58	0.58
7 percent:					
Standard	8.6	7.6	12.8	16.2	19.7
Compact	0.14	0.14	0.23	0.24	0.24

* The impacts are counted over the lifetime of products purchased in 2015–2044.

The NPV results presented in Table V–14 are based on the default product price trend. As discussed in section IV.G.3, DOE developed several sensitivity cases with alternative forecasts of future prices of clothes washers. The impact of these alternative forecasts on the NPV results is presented in appendix 10–C of the direct final rule TSD.

Circular A–4 requires agencies to present analytical results, including separate schedules of the monetized benefits and costs that show the type and timing of benefits and costs. Circular A–4 also directs agencies to consider the variability of key elements underlying the estimates of benefits and costs. DOE believes its standard 30-year analysis is fully compliant with Circular A–4. For this rulemaking, DOE undertook an additional sensitivity analysis of its standard 30-year analysis, in compliance with Circular A–4, using a 9-year analytical period. The choice of a 9-year period is a proxy for the

[43] National energy and water savings are cumulative over a 30-year period. Any savings for products entering the housing stock in this 30-year period which occur beyond the 30-year time limit are not reported in the national totals.

timeline in EPCA for the review of the energy conservation standard established in this direct final rule and potential revision of and compliance with a new standard for clothes washers.[44] The review timeframe established in EPCA generally does not overlap with the product lifetime, product manufacturing cycles or other factors specific to residential clothes washers. Thus, this information is presented for informational purposes only and is not indicative of any change in DOE's analytical methodology.

The sensitivity analysis results based on a 9-year analytical period are presented below. Table V–15 presents DOE's forecasts of the national energy savings for each TSL for clothes washers, and Table V–16 presents forecasts of the national water savings.[45] Table V–17 shows the consumer NPV results for each TSL DOE considered for clothes washers, using a 3-percent and a 7-percent discount rate. For determination of the NPV, the impacts are counted over the lifetime of products purchased in 2015–2023 (note that the average lifetime of a clothes washer is 14.2 years, which is longer than the 9-year analysis period; thus, the NPV estimate incorporates all of the operating cost savings of clothes washers purchased in the 9 year analytical period).

TABLE V–15—CLOTHES WASHERS: CUMULATIVE NATIONAL ENERGY SAVINGS, NINE-YEAR ANALYSIS PERIOD

Energy (quads)	Trial standard level				
	1	2	3	4	5
Standard Size	0.23	0.21	0.27	0.41	0.48
Compact Size	0.01	0.01	0.01	0.01	0.01

TABLE V–16—CLOTHES WASHERS: CUMULATIVE NATIONAL WATER SAVINGS, NINE-YEAR ANALYSIS PERIOD

Water (trillion gallons)	Trial standard level				
	1	2	3	4	5
Standard Size	0.17	0.14	0.37	0.78	1.02
Compact Size	0.00	0.00	0.00	0.00	0.00

TABLE V–17—CLOTHES WASHERS: CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS, 3- AND 7-PERCENT DISCOUNT RATES, NINE-YEAR ANALYSIS PERIOD*

Discount rate	Trial standard level				
	1	2	3	4	5
	Billion 2010$				
3 percent:					
Standard	7.40	6.48	10.60	14.21	17.35
Compact	0.12	0.12	0.18	0.21	0.21
7 percent:					
Standard	4.31	3.68	5.99	7.53	9.18
Compact	0.07	0.07	0.10	0.12	0.12

* The impacts are counted over the lifetime of products purchased in 2015–2023.

c. Indirect Impacts on Employment

DOE develops estimates of the indirect employment impacts of potential standards on the economy in general. As discussed above, DOE expects energy conservation standards for clothes washers 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.J, DOE used an input/output model of the U.S. economy to estimate indirect employment impacts of the TSLs that DOE considered in this rulemaking. DOE understands that there are uncertainties involved in projecting employment impacts, especially changes in the later years of the analysis. Therefore, DOE generated results for near-term timeframes (2015–2020), where these uncertainties are reduced.

The results suggest that today's 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 direct final rule TSD presents more detailed results.

4. Impact on Utility or Performance of Products

As presented in section III.D.1.d of this notice, DOE concluded that the TSL adopted in this direct final rule would

[44] EPCA requires DOE to review its standards at least once every 6 years, and requires, for certain products including clothes washers, a 3 year period after any new standard is promulgated before compliance is required, except that in no case may any new standards be required within 6 years of the compliance date of the standards established in this direct final rule. While adding a 6-year review to the 3-year compliance period adds up to 9 years, DOE notes that it may undertake reviews at any time within the 6 year period and that the 3-year compliance date may yield to the 6-year backstop. A 9-year analysis period does not reflect the variability that may occur in the timing of standards reviews and the fact that for some consumer products, the compliance period is 5 years rather than 3 years.

[45] National energy and water savings are cumulative over the 9-year period. Any savings for products entering the housing stock in this 9-year period which occur beyond the 9-year time limit are not reported in the national totals.

not reduce the utility or performance of the clothes washers under consideration in this rulemaking. Manufacturers of these products currently offer units that meet or exceed today's standards. (42 U.S.C. 6295(o)(2)(B)(i)(IV))

5. Impact of Any Lessening of Competition

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

DOE published a NOPR containing energy conservation standards identical to those set forth in today's direct final rule and transmitted a copy of today's direct final rule and the accompanying TSD to the Attorney General, requesting that the DOJ provide its determination on this issue. DOE will consider DOJ's comments on the rule in determining whether to proceed with the direct final rule. DOE will also publish and respond to DOJ's comments in the **Federal Register** in a separate notice.

6. Need of the Nation To Conserve Energy

An improvement in the energy efficiency of the products subject to today's rule is likely to 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–18 presents the estimated reduction in electricity generating capacity in 2044 for the TSLs that DOE considered in this rulemaking.

TABLE V–18—REDUCTION IN ELECTRIC GENERATING CAPACITY IN 2044 UNDER TRIAL STANDARD LEVELS FOR CLOTHES WASHERS

	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
	Gigawatts				
Clothes Washers	0.882	1.01	1.30	1.64	1.86

Energy savings from amended standards for clothes washers are expected to produce environmental benefits in the form of reduced emissions of air pollutants and greenhouse gases associated with electricity production. Table V–19 provides DOE's estimate of cumulative CO_2, NO_X, and Hg emissions reductions that would be expected to result from the TSLs considered in this rulemaking. In the emissions analysis (chapter 15 of the direct final rule TSD), DOE reports annual CO_2, NO_X, and Hg emissions reductions for each TSL.

As discussed in section IV.L, DOE has not reported SO_2 emissions reductions from power plants because SO_2 emissions caps have created uncertainty about the effect of energy conservation standards on the overall level of SO_2 emissions in the United States. DOE also did not include NO_X emissions reduction from power plants in States subject to CAIR because the emissions caps mandated by CAIR mean that an energy conservation standard would not affect the overall level of NO_X emissions in those States.[46]

TABLE V–19—EMISSIONS REDUCTION ESTIMATED FOR CLOTHES WASHER TRIAL STANDARD LEVELS

[Cumulative in 2015–2044]

	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
CO_2 (*million metric tons*)	87.65	81.96	112.90	155.51	178.82
NO_X (*thousand tons*)	73.46	68.07	94.16	130.10	149.70
Hg (*tons*)	0.198	0.226	0.269	0.364	0.413

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 clothes washers. As discussed in section IV.M, 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 used in the studies upon which the dollar-per-ton values are based. Table V–20 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. Those results are presented in Table V–21.

[46] The analysis for today's rule assumes the implementation of CAIR and does not take into account the recently issued (July 6, 2011) Cross-State Air Pollution Rule. In future rulemakings, DOE will adjust its relevant models to reflect the implementation of the Cross-State Air Pollution Rule.

TABLE V–20—ESTIMATES OF GLOBAL PRESENT VALUE OF CO_2 EMISSIONS REDUCTIONS UNDER CLOTHES WASHER TRIAL STANDARD LEVELS

TSL	*Million 2010$*			
	5% discount rate, average*	3% discount rate, average*	2.5% discount rate, average*	3% discount rate, 95th percentile*
1	410	2143	3645	6527
2	384	2007	3414	6112
3	530	2777	4727	8457
4	729	3813	6488	11613
5	838	4386	7462	13357

* 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.

TABLE V–21—ESTIMATES OF DOMESTIC PRESENT VALUE OF CO_2 EMISSIONS REDUCTIONS UNDER CLOTHES WASHER TRIAL STANDARD LEVELS

TSL	*Million 2010$**			
	5% discount rate, average**	3% discount rate, average**	2.5% discount rate, average**	3% discount rate, 95th percentile**
1	29 to 94	150 to 493	255 to 838	457 to 1501.
2	27 to 88	140 to 462	239 to 785	428 to 1406.
3	37 to 122	194 to 639	331 to 1087	592 to 1945.
4	51 to 168	267 to 877	454 to 1492	813 to 2671.
5	59 to 193	307 to 1009	522 to 1716	935 to 3072.

* Domestic values are presented as a range between 7 percent and 23 percent of the global values.
** 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 final rule the most recent values and analyses 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 amended standards for clothes washers. The dollar-per-ton values that DOE used are discussed in section IV.M. Table V–22 presents the cumulative present values for each TSL calculated using 3-percent and 7-percent discount rates.

TABLE V–22—ESTIMATES OF PRESENT VALUE OF NO_X EMISSIONS REDUCTIONS UNDER CLOTHES WASHER TRIAL STANDARD LEVELS

TSL	3% discount rate *million 2010$*	7% discount rate *million 2010$*
1	22 to 224	9 to 97.
2	20 to 207	9 to 90.
3	28 to 286	12 to 122.
4	39 to 396	17 to 171.
5	44 to 456	19 to 197.

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–23 shows an example of the calculation of the combined NPV including benefits from emissions reductions for the case of TSL 3 for front-loading clothes washers. Table V–24 and Table V–25 present 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 a 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.M.

TABLE V–23—ADDING NET PRESENT VALUE OF CONSUMER SAVINGS TO PRESENT VALUE OF MONETIZED BENEFITS FROM CO_2 AND NO_X EMISSIONS REDUCTIONS AT TSL 3

Category	Present value *(billion 2010$)*	Discount rate *(%)*
Benefits		
Operating Cost Savings	15.3	7
	35.4	3

TABLE V–23—ADDING NET PRESENT VALUE OF CONSUMER SAVINGS TO PRESENT VALUE OF MONETIZED BENEFITS FROM CO_2 AND NO_X EMISSIONS REDUCTIONS AT TSL 3—Continued

Category	Present value *(billion 2010$)*	Discount rate *(%)*
CO_2 Reduction Monetized Value (at $4.9/t)*	0.53	5
CO_2 Reduction Monetized Value (at $22.3/t)*	2.78	3
CO_2 Reduction Monetized Value (at $36.5/t)*	4.73	2.5
CO_2 Reduction Monetized Value (at $67.6/t)*	8.46	3
NO_X Reduction Monetized Value (at $2,537/Ton)*	0.07	7
	0.16	3
Costs		
Total Incremental Installed Costs	2.30	7
	4.15	3
Net Benefits/Costs		
Net Benefits, Including CO_2 and NO_X**	15.9	7
	34.2	3

*These values represent global values (in 2010$) of the social cost of CO_2 emissions in 2010 under several scenarios. See section IV.M for a discussion of the derivation of these values. The value for NO_X (in 2010$) is the average of the low and high values used in DOE's analysis.

**Net Benefits for both the 3% and 7% cases utilize the central estimate of social cost of CO_2 emissions calculated at a 3% discount rate, which is equal to $21.4/ton in 2010 (in 2010$).

TABLE V–24—RESULTS OF ADDING NET PRESENT VALUE OF CONSUMER SAVINGS (AT 7% DISCOUNT RATE) TO NET PRESENT VALUE OF MONETIZED BENEFITS FROM CO_2 AND NO_X EMISSIONS REDUCTIONS UNDER CLOTHES WASHER TRIAL STANDARD LEVELS

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	9.1	10.9	12.4	15.4
2	8.2	9.8	11.2	14.0
3	13.6	15.9	17.8	21.6
4	17.2	20.3	23.0	28.2
5	20.8	24.4	27.5	33.5

*These label values represent the global SCC of CO_2 in 2010, in 2010$. Their present values have been calculated with scenario-consistent discount rates. See section IV.M for a discussion of the derivation of these values.

**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–25—RESULTS OF ADDING NET PRESENT VALUE OF CONSUMER SAVINGS (AT 3% DISCOUNT RATE) TO NET PRESENT VALUE OF MONETIZED BENEFITS FROM CO_2 AND NO_X EMISSIONS REDUCTIONS UNDER CLOTHES WASHER TRIAL STANDARD LEVELS

TSL	Consumer NPV at 3% 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	20.6	22.4	23.9	26.9
2	18.9	20.6	22.0	24.8
3	31.8	34.2	36.2	40.0
4	42.4	45.6	48.3	53.6
5	51.4	55.1	58.2	64.3

*These label values represent the global SCC of CO_2 in 2010, in 2010$. Their present values have been calculated with scenario-consistent discount rates. See section IV.M for a discussion of the derivation of these values.

**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 CO_2 savings 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 2015–2044. 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 carbon dioxide 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))) In developing the direct final rule, DOE has also considered the Joint Petition submitted to DOE. DOE recognizes the value of consensus agreements submitted by parties in accordance with 42 U.S.C. 6295(p)(4) and has weighed the value of such consensus in establishing the standards set forth in today's final rule. DOE has encouraged the submission of consensus agreements as a way to get diverse interested parties together, to develop an independent and probative analysis useful in DOE standard setting, and to expedite the rulemaking process. DOE also believes that standard levels recommended in the consensus agreement may increase the likelihood for regulatory compliance, while decreasing the risk of litigation.

C. Conclusion

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))

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

To aid the reader as DOE discusses the benefits and/or burdens of each trial standard level, tables present a summary of the results of DOE's quantitative analysis for each TSL. In addition to the quantitative results presented in the tables, DOE also considers other burdens and benefits that affect economic justification. Those include the impacts on identifiable subgroups of consumers, 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.

As background for the consideration of benefits from energy efficiency standards, DOE 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) excessive focus on the short term, in the form of inconsistent weighting of future energy cost savings relative to available returns on other investments; (4) computational or other difficulties associated with the evaluation of relevant tradeoffs; and (5) a divergence in incentives (that is, renter vs. owner or 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 DOE's current regulatory analysis, potential changes in the benefits and costs of a regulation due to changes in consumer purchase decisions are included in two ways. First, if consumers forego a purchase of a product in the standards case, this decreases sales for product manufacturers and the cost to manufacturers is included in the MIA. Second, DOE accounts for energy savings attributable only to products actually used by consumers in the standards case; if a regulatory option decreases the number of products used by consumers, this decreases the potential energy savings from an energy conservation standard. DOE provides detailed estimates of shipments and changes in the volume of product purchases in chapter 9 of the direct final rule TSD. However, DOE's current analysis does not explicitly control for heterogeneity in consumer preferences, preferences across subcategories of products or specific features, or consumer price sensitivity variation according to household income (Reiss and White, 2005).[47]

While DOE is not prepared at present to provide a fuller quantifiable framework for estimating the benefits and costs of changes in consumer purchase decisions due to an energy conservation standard, DOE is committed to developing a framework that can support empirical quantitative tools for improved assessment of the consumer welfare impacts of appliance standards. DOE has posted a paper that discusses the issue of consumer welfare impacts of appliance energy efficiency standards, and potential enhancements to the methodology by which these impacts are defined and estimated in the regulatory process.[48]

DOE also conducted an analysis of the impacts on consumer welfare of the standards on clothes washers that required compliance in January 2007. This analysis assumes consumers made washer purchase decisions optimally (*i.e.,* taking full account of the tradeoff between up-front cost and future energy costs) and infers welfare implications based on price and quantity changes that occurred around the time of the standard change. The analysis assumes the 2007 policy change sharply reduced supply of low-efficiency units, which in turn sharply increased demand for higher-efficiency units.

The analysis used market survey data on total sales of washers purchased in the United States, with measures for units sold and average price broken down by washer brand and model. Values are reported for each month. The data include a limited number of attributes for each model, plus a measure of energy efficiency in terms of kilowatt-hours per year (kWh/y) for standard usage. The analysis used the

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

[48] Alan Sanstad. ''Notes on the Economics of Household Energy Consumption and Technology Choice.'' Lawrence Berkeley National Laboratory. 2010. Available online at: *www1.eere.energy.gov/buildings/appliance_standards/pdfs/consumer_ee_theory.pdf*.

kWh/y measure to proxy for washers that may have been closer and farther from the 2007 standard and ENERGY STAR specifications.

The net change in consumer welfare can be inferred from (a) the gain and/or loss from consumer welfare from increased purchases of higher-efficiency units minus (b) the loss in consumer welfare from reduced purchase of lower-efficiency units. Because washer units banned from manufacture in 2007 were still available for purchase for some months after the ban, observed changes in prices and quantities of the lower efficiency units facilitates estimation of (b). The data show that prices for these units increased slightly while quantities sold declined sharply. This suggests consumer welfare losses in (a) were modest. The data further show that prices of higher-efficiency units declined with the 2007 standard, in some cases markedly so. These price declines suggest that the welfare gains in (a) are quite substantial, and although the total gain cannot be inferred, any lower-bound estimate would indicate that these gains far exceed losses in (b).

These inferred gains to consumers from the 2007 change in standards appears to have less to do with energy efficiency than with the way standards affect costs of production for high-efficiency units, and possibly with the way standards influence competition among washer-producing firms (*e.g.,* see Ronnen, 1991).[49] As the scale of production of high efficiency units increased, production costs and/or markups by washer manufacturers fell, thereby increasing consumer welfare. The analysis is described in appendix 8–F of the direct final rule TSD.

DOE welcomes comments on approaches for improved assessment of the consumer welfare impacts of appliance standards.

1. Benefits and Burdens of TSLs Considered for Residential Clothes Washers

Table V–26 and Table V–27 summarize the quantitative impacts estimated for each TSL for residential clothes washers. The efficiency levels contained in each TSL are described in section V.A.

TABLE V–26—SUMMARY OF RESULTS FOR CLOTHES WASHER TRIAL STANDARD LEVELS: NATIONAL IMPACTS

Category	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
National Energy Savings (*quads*)	1.56	1.46	2.04	2.87	3.32.
National Water Savings (trillion gal.)	1.11	1.05	3.03	5.33	6.89.
NPV of Consumer Benefits (*2010$ billion*):					
3% discount rate	20.2	18.5	31.29	41.60	50.48.
7% discount rate	8.7	7.77	13.01	16.42	19.92.
Cumulative Emissions Reduction:					
CO_2 (*million metric tons*)	87.65	81.96	112.90	155.51	178.82.
NO_X (*thousand tons*)	73.46	68.07	94.16	130.10	149.70.
Hg (*tons*)	0.198	0.226	0.269	0.364	0.413.
Value of Cumulative Emissions Reduction:					
CO_2 (*2010$ million*) *	410 to 6527	384 to 6112	530 to 8457	729 to 11613	838 to 13357.
NO_X − 3% discount rate (*2010$ million*)	22 to 224	20 to 207	28 to 286	39 to 396	44 to 456.
NO_X − 7% discount rate (*2010$ million*)	9 to 97	9 to 90	12 to 122	17 to 171	19 to 197.
Generation Capacity Reduction (*GW*) **	0.882	1.01	1.30	1.64	1.86.

Parentheses indicate negative (−) values.
* Range of the economic value of CO_2 reductions is based on estimates of the global benefit of reduced CO_2 emissions.
** Changes in 2044.

TABLE V–27—SUMMARY OF RESULTS FOR CLOTHES WASHER TRIAL STANDARD LEVELS: CONSUMER AND MANUFACTURER IMPACTS

Category	TSL 1	TSL 2	TSL 3 *	TSL 4	TSL 5
Manufacturer Impacts					
Industry NPV (2010$ million)	(56.3) − (64.0)	(14.3) − (490.3)	96.4 − (858.8)	205.0 − (1,256.4)	255.5 − (1,335.3)
Industry NPV (% change)	(2.2) − (2.5)	(0.6) − (19.0)	3.7 − (33.2)	7.9 − (48.6)	9.9 − (51.6)
Consumer Mean LCC Savings (2010$)					
Top-Loading Standard Clothes Washer	268	243	268/366	491	524
Front-Loading Standard Clothes Washer	NA **	2.2	37	35	102
Top-Loading Compact Clothes Washer	159	159	159/312	312	312
Front-Loading Compact Clothes Washer	54	54	54	54	54
Consumer Median PBP (years)					
Top-Loading Standard Clothes Washer	0.4	0.7	0.4/0.9	1.8	1.9
Front-Loading Standard Clothes Washer	NA *	0.9	1.3	9.2	5.2
Top-Loading Compact Clothes Washer	0.5	0.5	0.5/2.1	2.1	2.1

[49] Uri Ronnen. Minimum quality standards, fixed costs, and competition. *RAND Journal of Economics.* Vol. 22, No. 4, Winter 1991.

TABLE V–27—SUMMARY OF RESULTS FOR CLOTHES WASHER TRIAL STANDARD LEVELS: CONSUMER AND MANUFACTURER IMPACTS—Continued

Category	TSL 1	TSL 2	TSL 3 *	TSL 4	TSL 5
Front-Loading Compact Clothes Washer	0.8	0.8	0.8	0.8	0.8
Distribution of Consumer LCC Impacts					
Top-Loading Standard Clothes Washer:					
Net Cost (%)	0.7	5.6	0.7/3.4	8.1	9.5
No Impact (%)	19.5	15.1	19.5/14.1	4.6	0.0
Net Benefit (%)	79.8	79.3	79.8/82.5	87.4	90.5
Front-Loading Standard Clothes Washer:					
Net Cost (%)	0.0	0.1	1.5	45.1	29.6
No Impact (%)	100.0	96.0	72.4	11.6	0.0
Net Benefit (%)	0.0	3.9	26.1	43.3	70.4
Top-Loading Compact Clothes Washer:					
Net Cost (%)	1.5	1.5	1.5/12.6	12.6	12.6
No Impact (%)	0.0	0.0	0.0	0.0	0.0
Net Benefit (%)	98.5	98.5	98.5/87.4	87.4	87.4
Front-Loading Compact Clothes Washer:					
Net Cost (%)	0.0	0.0	0.0	0.0	0.0
No Impact (%)	0.0	0.0	0.0	0.0	0.0
Net Benefit (%)	100.0	100.0	100.0	100.0	100.0

Parentheses indicate negative (−) values.

* For top-loading clothes washers under TSL 3, the first number for consumer impacts refers to the standard in 2015, and the second number refers to the standard in 2018.

** The standard level is the same as the baseline efficiency level, so no consumers are impacted and therefore calculation of a payback period is not applicable.

DOE first considered TSL 5, which represents the max-tech efficiency levels. TSL 5 would save 3.32 quads of energy and 6.89 trillion gallons of water, amounts DOE considers significant. Under TSL 5, the NPV of consumer benefit would be $19.92 billion, using a discount rate of 7 percent, and $50.48 billion, using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 5 are 179 Mt of CO_2, 150 thousand tons of NO_X, and 0.413 ton of Hg. The estimated monetary value of the CO_2 emissions reductions at TSL 5 ranges from $838 million to $13,357 million. Total generating capacity in 2043 is estimated to decrease by 1.86 GW under TSL 5.

At TSL 5, the average LCC impact is a savings (LCC decrease) of $524 for top-loading standard clothes washers, a savings of $102 for front-loading standard clothes washers, a savings of $312 for top-loading compact clothes washers, and a savings of $54 for front-loading compact clothes washers. The median payback period is 1.9 years for top-loading standard clothes washers, 5.2 years for front-loading standard clothes washers, 2.1 years for top-loading compact clothes washers, and 0.8 years for front-loading compact clothes washers. A significant fraction of consumers, however, experience an LCC increase or net cost under TSL 5 for all product classes except front-loading compact: 9.5 percent for top-loading standard clothes washers, 30 percent for front-loading standard clothes washers, and 13 percent for top-loading compact clothes washers. In addition, because TSL 5 significantly raises the first cost of both top-loading and front-loading clothes washers, DOE is concerned some low-income consumers may be compelled to delay or forgo new purchases, using commercial coin laundries or repairing their existing clothes washers instead.

At TSL 5, the projected change in INPV ranges from an increase of $255.5 million to a decrease of $1,335.3 million. At this TSL, manufacturers would have to overhaul both their front-loading and top-loading platforms by the 2015 compliance date to meet demand. Redesigning all units to meet the current max-tech efficiency levels would require considerable capital and product conversion expenditures. DOE believes that the scope of the redesigns necessary to meet TSL 5 by 2015 also heightens concerns over supply chain and operational risk. DOE estimates that complete platform redesigns would cost the industry over $700 million in product and capital conversion costs. These costs alone represent a substantial portion of the total value of the industry. In addition, manufacturers could face a substantial impact on profitability at TSL 5. Because manufacturers earn a premium for ENERGY STAR products and additional profit for products that exceed the ENERGY STAR level, collapsing the market to one commodity product makes it unlikely that manufacturers could maintain their base-case profitability on these products after compliance with the standards is required. As a result, DOE expects that TSL 5 would yield impacts closer to the high end of the range of INPV impacts. If the high end of the range of impacts is reached, as DOE expects, TSL 5 could result in a net loss of 51.6 percent in INPV to clothes washer manufacturers.

The Secretary concludes that at TSL 5 for residential clothes washers, the benefits of energy savings, water savings, positive NPV of consumer benefits, generating capacity reductions, emission reductions, and the estimated monetary value of the CO_2 emissions reductions would be outweighed by the significant fraction of consumers that experience an increase in life-cycle cost and the impacts on manufacturers, including the conversion costs and profit margin impacts that could result in a very large reduction in INPV for the manufacturers and the risk of manufacturer capacity constraints resulting from the necessary changes by 2015. Consequently, the Secretary has

concluded that TSL 5 is not economically justified.

DOE next considered TSL 4. TSL 4 would save 2.87 quads of energy and 5.33 trillion gallons of water, amounts DOE considers significant. Under TSL 4, the NPV of consumer benefit would be 16.42 billion, using a discount rate of 7 percent, and $41.60 billion, using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 4 are 156 Mt of CO_2, 130 thousand tons of NO_X, and 0.364 tons of Hg. The estimated monetary value of the CO_2 emissions reductions at TSL 4 ranges from $729 million to $11,613 million. Total generating capacity in 2044 is estimated to decrease by 1.64 GW under TSL 4.

At TSL 4, the average LCC impact is a savings of $491 for top-loading standard clothes washers, a savings of $35 for front-loading standard clothes washers, a savings of $312 for top-loading compact clothes washers, and a savings of $54 for front-loading compact clothes washers. The median payback period is 1.8 years for top-loading standard clothes washers, 9.2 years for front-loading standard clothes washers, 2.1 years for top-loading compact clothes washers, and 0.8 years for front-loading compact clothes washers. A significant fraction of consumers, however, experience an LCC net cost for all product classes except front-loading compact: 8 percent for top-loading standard clothes washers, 45 percent for front-loading standard clothes washers, and 13 percent for top-loading compact clothes washers. In addition, TSL 4 significantly raises the first cost of both top-loading and front-loading clothes washers, and DOE is concerned some low-income consumers may be compelled to delay or forgo new purchases.

At TSL 4, the projected change in INPV ranges from an increase of $205.0 million to a decrease of $1,256.4 million. At this TSL, manufacturers would be required to overhaul both front-loading and top-loading platforms by the 2015 compliance date to meet demand. DOE estimates that it would cost the industry approximately $692 million in product and capital conversion costs at TSL 4. These costs reflect substantial platform changes to both top-loading and front-loading clothes washers by 2015, represent a significant portion of the total value of the industry, and trigger capacity concerns in light of the magnitude and timing of the necessary changes. In addition, manufacturers could face a substantial impact on profitability at TSL 4. Because manufacturers earn a premium for ENERGY STAR products and additional profit for products that exceed the ENERGY STAR level, collapsing the market to a few commodity products without efficiency differentiators makes it unlikely that manufactures could maintain their base-case profitability on these products after standards. Because of the effect, DOE expects that TSL 4 would yield impacts closer to the high end of the range of INPV impacts. If the high end of the range of impacts is reached, as DOE expects, TSL 4 could result in a net loss of 48.6 percent in INPV to clothes washer manufacturers.

The Secretary concludes that at TSL 4 for residential clothes washers, the benefits of energy savings, water savings, positive NPV of consumer benefits, generating capacity reductions, emission reductions, and the estimated monetary value of the CO_2 emissions reductions would be outweighed by the economic burden on a significant fraction of consumers due to the large increase in product cost and the impacts on manufacturers, including the conversion costs and profit margin impacts that could result in a very large reduction in INPV for manufacturers and the risk of manufacturer capacity constraints resulting from the necessary changes by 2015. Consequently, the Secretary has concluded that TSL 4 is not economically justified.

DOE then considered TSL 3. TSL 3 would save 2.04 quads of energy and 3.03 trillion gallons of water, amounts DOE considers significant. Under TSL 3, the NPV of consumer benefit would be $13.01 billion, using a discount rate of 7 percent, and $31.29 billion, using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 3 are 113 Mt of CO_2, 94.2 thousand tons of NO_X, and 0.269 ton of Hg. The estimated monetary value of the CO_2 emissions reductions at TSL 3 ranges from $530 million to $8,457 million. Total generating capacity in 2045 is estimated to decrease by 1.30 GW under TSL 3.

At TSL 3, the average LCC impact is a savings of $268 in 2015 and $366 in 2018 for top-loading standard clothes washers, a savings of $37 for front-loading standard clothes washers, a savings of $159 in 2015 and $312 in 2018 for top-loading compact clothes washers, and a savings of $54 for front-loading compact clothes washers. The median payback period is 0.4 years in 2015 and 0.9 years in 2018 for top-loading standard clothes washers, 1.3 years for front- loading standard clothes washers, 0.5 years in 2015 and 2.1 years in 2018 for top-loading compact clothes washers, and 0.8 years for front-loading compact clothes washers. The fraction of consumers experiencing an LCC cost is small—less than 1 percent in 2015 and 3 percent in 2018 for top-loading standard clothes washers, 1.5 percent for front-loading standard clothes washers, 1.5 percent in 2015 and 13 percent in 2018 for top-loading compact clothes washers. No consumers experience a LCC cost for front-loading compact clothes washers. The much lower first cost of washers meeting TSL 3, combined with the fact that the vast majority of consumers experience either net LCC benefits or no impacts at TSL 3, mitigates DOE's concern that some low-income consumers would be compelled to delay or forgo new purchases.

At TSL 3, the projected change in INPV ranges from an increase of $96.4 million to a decrease of $858.8 million. For most manufacturers, the efficiency levels for top-loading clothes washers at TSL 3 correspond to incremental product conversion by 2015 and a platform redesign by 2018. These compliance dates mitigate capacity risk to manufacturers and their supply chains and afford manufacturers the flexibility to spread capital requirements, engineering resources, and other conversion activities over a longer period of time depending on the individual needs of each manufacturer. These factors at TSL3 mitigate DOE's concerns about manufacturers' ability to match production capacity to market demand. At TSL 3, DOE recognizes the risk of negative impacts if manufacturers' expectations concerning reduced profit margins are realized. However, the additional flexibility of the compliance dates and range of efficiency levels above TSL 3 afford manufacturers room to maintain higher value products. Therefore, DOE expects impacts to be closer to the low end of the range of impacts.

The Secretary concludes that at TSL 3 for residential clothes washers, the benefits of energy savings, water savings, positive NPV of consumer benefits, generating capacity reductions, emission reductions, the estimated monetary value of the CO_2 emissions reductions, and favorable consumer LCC savings and payback period for more than 97 percent of consumers outweigh the LCC costs for less than 3 percent of consumers and the conversion costs and profit margin impacts that could result in a reduction in INPV for manufacturers.

In addition, the efficiency levels in TSL 3 correspond to the recommended levels in the Joint Petition, which DOE believes sets forth a statement by interested persons that are fairly representative of relevant points of view

(including representatives of manufacturers of covered products, States, and efficiency advocates) and contains recommendations with respect to an energy conservation standard that are in accordance with 42 U.S.C. 6295(o). Moreover, DOE has encouraged the submission of consensus agreements as a way for diverse interested parties to develop an independent and probative analysis useful in DOE standard setting and to expedite the rulemaking process. DOE also believes that the standard levels recommended in the consensus agreement may increase the likelihood for regulatory compliance, while decreasing the risk of litigation.

After considering the analysis, comments on the framework document, and the benefits and burdens of TSL 3, the Secretary concludes that this TSL will offer the maximum improvement in efficiency that is technologically feasible and economically justified, and will result in the significant conservation of energy. Therefore, DOE adopts TSL 3 for residential clothes washers. The amended energy conservation standards for residential clothes washers, which are a minimum allowable integrated modified energy factor (IMEF) and maximum allowable integrated water factor (IWF), are shown in Table V–28.

TABLE V–28—AMENDED ENERGY CONSERVATION STANDARDS FOR RESIDENTIAL CLOTHES WASHERS

Product class	Effective March 7, 2015		Effective January 1, 2018	
	Minimum IMEF*	Maximum IWF†	Minimum IMEF*	Maximum IWF†
1. Top-loading, Compact (less than 1.6 ft^3 capacity)	0.86	14.4	1.15	12.0
2. Top-loading, Standard	1.29	8.4	1.57	6.5
3. Front-loading, Compact (less than 1.6 ft^3 capacity)	1.13	8.3	N/A	
4. Front-loading, Standard	1.84	4.7	N/A	

* IMEF (integrated modified energy factor) is calculated as the clothes container capacity in cubic feet divided by the sum, expressed in kilowatt-hours (kWh), of: (1) The total weighted per-cycle hot water energy consumption; (2) the total weighted per-cycle machine electrical energy consumption; (3) the per-cycle energy consumption for removing moisture from a test load; and (4) the per-cycle standby and off mode energy consumption.

† IWF (integrated water consumption factor) is calculated as the sum, expressed in gallons per cycle, of the total weighted per-cycle water consumption for all wash cycles divided by the clothes container capacity in cubic feet.

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

The benefits and costs of today's 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 and water, 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.[50] 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.

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 quite different time frames for analysis. The national operating cost savings is measured for the lifetime of products shipped in 2015–2044. 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 carbon dioxide in each year. These impacts continue well beyond 2100.

Table V–29 shows the annualized values for clothes washers. 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 for clothes washers in today's rule is $185 million per year in increased equipment costs, while the annualized benefits are $1,234 million per year in reduced equipment operating costs, $141.7 million in CO_2 reductions, and $5.4 million in reduced NO_X emissions. In this case, the net benefit amounts to $1.20 billion 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 for clothes washers in today's rule is $212 million per year in increased equipment costs, while the benefits are $1,808 million per year in reduced operating costs, $141.7 million in CO_2 reductions, and $8.0 million in reduced NO_X emissions. In this case, the net benefit amounts to $1.75 billion per year.

[50] 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–29. From the present value, DOE then calculated the fixed annual payment over a 30-year period 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 is a steady stream of payments.

TABLE V–29—ANNUALIZED BENEFITS AND COSTS OF AMENDED STANDARDS (TSL 3) FOR CLOTHES WASHERS SOLD IN 2015–2044

	Discount rate	Monetized (million 2010$/year)		
		Primary estimate*	Low net benefits estimate*	High net benefits estimate*
Benefits				
Operating Cost Savings	7%	1234	1101	1379.
	3%	1808	1587	2042.
CO_2 Reduction at $4.9/t**	5%	34.5	31.7	37.4.
CO_2 Reduction at $22.3/t**	3%	142	130	154.
CO_2 Reduction at $36.5/t**	2.5%	226	207	246.
CO_2 Reduction at $67.6/t**	3%	431	396	469.
NO_X Reduction at $2,537/t**	7%	5.40	5.03	5.82.
	3%	8.01	7.39	8.68.
Total †	7% plus CO_2 range	1274 to 1671	1137 to 1502	1423 to 1854.
	7%	1381	1236	1539.
	3% plus CO_2 range	1851 to 2248	1626 to 1991	2089 to 2520.
	3%	1958	1725	2205.
Costs				
Incremental Product Costs	7%	185	258	200.
	3%	212	309	230.
Total Net Benefits				
Total †	7% plus CO_2 range	1088 to 1485	880 to 1244	1223 to 1654.
	7%	1196	978	1339.
	3% plus CO_2 range	1639 to 2036	1317 to 1682	1859 to 2291.
	3%	1746	1416	1976.

* The Primary, Low Benefit, and High Benefit 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 using the default price trend for product prices in the Primary Estimate, constant product prices in the Low Benefits Estimate, and a high estimate of the declining price trend in the High Benefits Estimate.

** 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. Procedural Issues and Regulatory Review

A. Review Under Executive Order 12866 and Executive Order 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 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 residential clothes washers 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 the Office of Information and Regulatory Affairs (OIRA) in the Office of Management and Budget (OMB) review this rule. DOE presented to OIRA for review the draft rule and other documents prepared for this rulemaking, including the RIA, and included these documents in the rulemaking record. The assessments prepared pursuant to Executive Order 12866 can be found in the technical support document for this rulemaking at *http://www1.eere.energy.gov/buildings/appliance_standards/residential/clothes_washers.html.* They are available for public review in the Resource Room of DOE's Building Technologies Program, 950 L'Enfant Plaza SW., Suite 600, Washington, DC 20024, (202) 586–2945, between 9:00 a.m. and 4:00 p.m., Monday through Friday, except Federal holidays.

DOE has also reviewed this regulation pursuant to Executive Order 13563, issued on January 18, 2011 (76 FR 3281, Jan. 21, 2011). EO 13563 is supplemental to and explicitly reaffirms the principles, structures, and definitions governing regulatory review established in Executive Order 12866. To the extent permitted by law, agencies are required by Executive Order 13563 to: (1) Propose or adopt a regulation only upon a reasoned determination that its benefits justify its costs

(recognizing that some benefits and costs are difficult to quantify); (2) tailor regulations to impose the least burden on society, consistent with obtaining regulatory objectives, taking into account, among other things, and to the extent practicable, the costs of cumulative regulations; (3) select, in choosing among alternative regulatory approaches, those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity); (4) to the extent feasible, specify performance objectives, rather than specifying the behavior or manner of compliance that regulated entities must adopt; and (5) identify and assess available alternatives to direct regulation, including providing economic incentives to encourage the desired behavior, such as user fees or marketable permits, or providing information upon which choices can be made by the public.

We emphasize as well that Executive Order 13563 requires agencies ''to use the best available techniques to quantify anticipated present and future benefits and costs as accurately as possible.'' In its guidance, the Office of Information and Regulatory Affairs has emphasized that such techniques may include ''identifying changing future compliance costs that might result from technological innovation or anticipated behavioral changes.'' For the reasons stated in the preamble, DOE believes that today's direct final rule is consistent with these principles, including that, to the extent permitted by law, agencies adopt a regulation only upon a reasoned determination that its benefits justify its costs and select, in choosing among alternative regulatory approaches, those approaches that maximize net benefits.

B. Review Under the Regulatory Flexibility Act

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

DOE reviewed today's direct final rule and corresponding NOPR pursuant to the RFA and the policies and procedures discussed above. Set forth below is DOE's initial regulatory flexibility analysis for the standards proposed in the NOPR, published elsewhere in today's **Federal Register**. DOE will consider any comments on the analysis or economic impacts of the rule in determining whether to proceed with the direct final rule. DOE will publish its final regulatory flexibility analysis (FRFA), including responses to any comments received, in a separate notice at the conclusion of the 110-day comment period.

1. Description of Why DOE Is Considering the Standards in Today's Direct Final Rule

The reasons why DOE is establishing the standards in today's direct final rule and the objectives of these standards are provided elsewhere in the preamble and not repeated here.

2. Statement of the Objectives of, and Legal Basis for, the Standards

A statement of the objectives of, and legal basis for, the standards in today's direct final rule is provided elsewhere in the preamble and not repeated here.

3. Description and Estimated Number of Small Entities Regulated

For manufacturers of residential clothes washers, the Small Business Administration (SBA) has set a size threshold, which defines those entities classified as ''small businesses'' for the purposes of the statute. DOE used the SBA's small business size standards to determine whether any small entities would be subject to the requirements of the rule. 65 FR 30836, 30848 (May 15, 2000), as amended at 65 FR 53533, 53544 (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 *www.sba.gov/idc/groups/public/documents/sba_homepage/serv_sstd_tablepdf.pdf.* Residential clothes washer manufacturing is classified under NAICS Code 335224, ''Household Laundry Equipment Manufacturing.'' The SBA sets a threshold of 1,000 employees or less for an entity to be considered as a small business for this category.

To estimate the number of small businesses who could be impacted by the amended energy conservation standards, DOE conducted a market survey using all available public information to identify potential small manufacturers. DOE's research included the AHAM membership directory, product databases (CEE, CEC, and ENERGY STAR databases) and individual company Web sites to find potential small business manufacturers. DOE also asked interested parties and industry representatives if they were aware of any other small business manufacturers during manufacturer interviews and at previous DOE public meetings. DOE reviewed all publicly available data and contacted various companies, as necessary, to determine whether they met the SBA's definition of a small business manufacturer of covered residential clothes washers. DOE screened out companies that did not offer products covered by this rulemaking, did not meet the definition of a ''small business,'' or are foreign owned and operated.

The majority of residential clothes washers are currently manufactured in the United States by one corporation that accounts for approximately 64 percent of the total market. Together, this manufacturer and three other manufacturers that do not meet the definition of a small business manufacturer comprise 92 percent of the residential clothes washer market. The small portion of the remaining residential clothes washer market (approximately 700,000 shipments) is supplied by a combination of 12 international and domestic companies, all of which have small market shares. Of the remaining 12 companies that manufacturer residential clothes washers for sale in the United States, DOE identified only one manufacturer that is considered a small business under NAICS Code 335224.

4. Description and Estimate of Compliance Requirements

The one small business manufacturer of residential clothes washers covered by this rulemaking has one product platform. It makes a top-loading standard residential clothes washer that currently meets a 1.85 MEF and a 6.75 WF. The product meets the 2015 energy conservation standards proposed in this direct final rule, but falls short of the 2018 standard. The unit does not offer warm rinse and has electromechanical controls, making it likely that three wash temperatures (hot, warm, cold) are available on all settings including Normal for test procedure purposes. Thus, it is likely the unit will have to undergo alterations to its basic design to meet the 2018 efficiency requirements.

This company appears to manufacture its residential clothes washer with less

automation and more labor than some of the larger competitors. To change the design of their current product to meet the 2018 efficiency standards, one available design pathway would be increasing the volume of the wash basket, assuming there is enough clearance within the cabinet. Increasing the drum's radius would involve cutting slightly larger octagonal pieces of metal and would not be a capital intensive solution. With this pathway, the assembly process and fabrication time would essentially remain the same. This solution would also prevent the small business manufacturer from bearing the cost of retrofitting their manufacturing process and could result in lower per-unit conversion costs relative to larger manufacturers.

Based on the engineering analysis and manufacturer interviews, if two full-time engineers took one year to implement a larger drum radius within the existing cabinet it could cost the manufacturer roughly $200,000 to implement the design change for the 2018 compliance date. If the manufacturer were to incur additional tooling costs to implement this change, this could lead to an additional $200,000 in capital conversion costs. Because the small business manufacturer already meets the 2015 energy conservation standards, it would have 7 years from the announcement of today's direct final rule until it would have to make any changes to its current product in response to standards.

5. Duplication, Overlap, and Conflict With Other Rules

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

6. Significant Alternatives to the Rule

The discussion above analyzes impacts on small businesses that would result from DOE's rule. In addition to the other TSLs being considered, the direct final rule TSD includes a regulatory impact analysis (RIA). For residential clothes washers, the RIA discusses the following policy alternatives: (1) No new regulatory action; (2) consumer rebates; (3) consumer tax credits; (4) manufacturer tax credits; (5) voluntary energy efficiency targets; (6) early replacement; and (7) bulk government purchases. While these alternatives may mitigate to some varying extent the economic impacts on small entities compared to the amended standards, DOE determined that the energy savings of these regulatory alternatives are at least 3.8 times smaller than those that would be expected to result from adoption of the amended standard levels. Thus, DOE rejected these alternatives and is adopting the amended standards set forth in this rulemaking. (See chapter 17 of direct final rule TSD for further detail on the policy alternatives DOE considered.)

C. Review Under the Paperwork Reduction Act

Manufacturers of residential clothes washers must certify to DOE that their products comply with any applicable energy conservation standard. In certifying compliance, manufacturers must test their products according to the DOE test procedures for residential clothes washers, including any amendments adopted for those test procedures. DOE has established regulations for the certification and recordkeeping requirements for all covered consumer products and commercial equipment, including residential clothes washers. 76 FR 12422 (March 7, 2011). The collection-of-information requirement for the certification and recordkeeping is subject to review and approval by OMB under the Paperwork Reduction Act (PRA). This requirement has been approved by OMB under OMB control number 1910–1400. Public reporting burden for the certification is estimated to average 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, DOE has determined that today's rule fits within the category of actions included in Categorical Exclusion (CX) B5.1 and otherwise meets the requirements for application of a CX. *See* 10 CFR Part 1021, App. B, B5.1(b); 1021.410(b) and Appendix B, B(1)–(5). The rule fits within the category of actions because it is a rulemaking that establishes energy conservation standards for consumer products or industrial equipment, and for which none of the exceptions identified in CX B5.1(b) apply. Therefore, DOE has made a CX determination for this rulemaking, and DOE does not need to prepare an Environmental Assessment or Environmental Impact Statement for this rule. DOE's CX determination for this direct final 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 direct final 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 direct final rule meets the relevant standards of Executive Order 12988.

G. Review Under the Unfunded Mandates Reform Act of 1995

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA) requires each Federal agency to assess the effects of Federal regulatory actions on State, local, and Tribal governments and the private sector. Public Law 104–4, sec. 201 (codified at 2 U.S.C. 1531). For an amended 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 ''significant intergovernmental mandate,'' and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect small governments. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. 62 FR 12820. DOE's policy statement is also available at *http://www.gc.doe.gov/.*

DOE has concluded that this direct final rule would likely result in a final rule that could impose expenditures of $100 million or more on the private sector. Such expenditures may include: (1) Investment in research and development and in capital expenditures by residential clothes washer manufacturers in the years between the final rule and the compliance date for the new standards, and (2) incremental additional expenditures by consumers to purchase higher-efficiency residential clothes washers.

Section 202 of UMRA authorizes a Federal agency to respond to the content requirements of UMRA in any other statement or analysis that accompanies the final rule. 2 U.S.C. 1532(c). The content requirements of section 202(b) of UMRA relevant to a private sector mandate substantially overlap the economic analysis requirements that apply under section 325(o) of EPCA and Executive Order 12866. The **SUPPLEMENTARY INFORMATION** section of the notice of final rulemaking and the ''Regulatory Impact Analysis'' section of the TSD for this direct final 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(d), (f), and (o), 6313(e), and 6316(a), today's final rule would establish energy conservation standards for residential clothes washers that are designed to achieve the maximum improvement in energy efficiency that DOE has determined to be both technologically feasible and economically justified. A full discussion of the alternatives considered by DOE is presented in the ''Regulatory Impact Analysis'' section of the TSD for today's direct final 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 Federal agencies to review most disseminations of information to the public under guidelines established by each agency pursuant to general guidelines issued by OMB. OMB's guidelines were published at 67 FR 8452 (Feb. 22, 2002), and DOE's guidelines were published at 67 FR 62446 (Oct. 7, 2002). DOE has reviewed today's direct final rule 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 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 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 concluded that today's regulatory action, which sets forth energy conservation standards for residential clothes washers, is not a significant energy action because the amended 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 direct final rule.

L. Review Under the Information Quality Bulletin for Peer Review

On December 16, 2004, OMB, in consultation with the Office of Science and Technology Policy (OSTP), issued its Final Information Quality Bulletin

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

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

M. Congressional Notification

As required by 5 U.S.C. 801, DOE will report to Congress on the promulgation of this rule prior to its effective date. The report will state that it has been determined that the rule is a ''major rule'' as defined by 5 U.S.C. 804(2).

VII. Approval of the Office of the Secretary

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

List of Subjects

10 CFR Part 429

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

10 CFR Part 430

Administrative practice and procedure, Confidential business information, Energy conservation, Household appliances, Imports, Intergovernmental relations, and Small businesses.

Issued in Washington, DC, on May 11, 2012.

Dr. David Danielson,

Assistant Secretary, Energy Efficiency and Renewable Energy.

For the reasons set forth in the preamble, DOE amends 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 § 429.20 revise paragraph (b)(2) to read as follows:

§ 429.20 Residential clothes washers.

* * * * *

(b) * * *

(2) Pursuant to § 429.12(b)(13), a certification report shall include the following public product-specific information:

(i) For residential clothes washers manufactured before March 7, 2015: The modified energy factor (MEF) in cubic feet per kilowatt hour per cycle (cu ft/kWh/cycle) and the capacity in cubic feet (cu ft). For standard-size residential clothes washers, a water factor (WF) in gallons per cycle per cubic feet (gal/cycle/cu ft).

(ii) For residential clothes washers manufactured on or after March 7, 2015: The integrated modified energy factor (IMEF) in cu ft/kWh/cycle, the integrated water factor (IWF) in gal/cycle/cu ft, the capacity in cu ft and the type of loading (top-loading or front-loading).

* * * * *

PART 430—ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS

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

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

■ 4. In § 430.32 revise paragraph (g) to read as follows:

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

* * * * *

(g) *Clothes washers.* (1) Clothes washers manufactured on or after January 1, 2007 shall have a Modified Energy Factor no less than:

Product class	Modified energy factor (cu.ft./kWh/cycle)
i. Top-loading, Compact (less than 1.6 ft^3 capacity)	0.65.
ii. Top-loading, Standard (1.6 ft^3 or greater capacity)	1.26.
iii. Top-Loading, Semi-Automatic	Not Applicable.[1]
iv. Front-loading	1.26.
v. Suds-saving	Not Applicable.[1]

[1] Must have an unheated rinse water option.

(2) All top-loading or front-loading standard-size residential clothes washers manufactured on or after January 1, 2011, and before March 7, 2015, shall meet the following standard—

(i) A Modified Energy Factor of at least 1.26; and

(ii) A Water Factor of not more than 9.5.

(3) Clothes washers manufactured on or after March 7, 2015, and before January 1, 2018, shall have an Integrated Modified Energy Factor no less than, and an Integrated Water Factor no greater than:

Product class	Integrated modified energy factor (cu.ft./kWh/cycle)	Integrated water factor (gal/cycle/cu.ft.)
i. Top-loading, Compact (less than 1.6 ft^3 capacity)	0.86	14.4
ii. Top-loading, Standard (1.6 ft^3 or greater capacity)	1.29	8.4
iii. Front-loading, Compact (less than 1.6 ft^3 capacity)	1.13	8.3
iv. Front-loading, Standard (1.6 ft^3 or greater capacity)	1.84	4.7

(4) Clothes washers manufactured on or after January 1, 2018 shall have an Integrated Modified Energy Factor no less than, and an Integrated Water Factor no greater than:

Product class	Integrated modified energy factor (cu.ft./kWh/cycle)	Integrated water factor (gal/cycle/cu.ft.)
i. Top-loading, Compact (less than 1.6 ft^3 capacity)	1.15	12.0
ii. Top-loading, Standard (1.6 ft^3 or greater capacity)	1.57	6.5
iii. Front-loading, Compact (less than 1.6 ft^3 capacity)	1.13	8.3
iv. Front-loading, Standard (1.6 ft^3 or greater capacity)	1.84	4.7

* * * * *

[FR Doc. 2012–12320 Filed 5–30–12; 8:45 am]

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