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[6450-01-P]

DEPARTMENT OF ENERGY

10 CFR Part 431

[Docket Number EERE–2012–BT–STD–0020]

RIN: 1904-AC77

Energy Conservation Program: Energy Conservation Standards for Commercial Clothes Washers

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

ACTION: 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 commercial clothes washers (CCWs). EPCA also requires that any new or amended energy conservation standard must be designed to achieve the maximum improvement in energy efficiency that would be technologically feasible and economically justified, and would save a significant amount of energy. In this final rule, the U.S. Department of Energy (DOE) is adopting more stringent energy conservation standards for CCWs because DOE has determined that the amended energy conservation standards for CCWs would result in significant conservation of energy, and are technologically feasible and economically justified.

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DATES: The effective date of this rule is <mark>[INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]</mark>. Compliance with the amended standards established for CCWs in this final rule is required on January 1, 2018.

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

The docket for this rulemaking can be found at: http://www.regulations.gov/#!docketDetail;D=EERE-2012-BT-STD-0020. The regulations.gov web page will contain simple instructions on how to access all documents, including public comments, in the docket.

For further information on how to review the docket, contact Ms. Brenda Edwards at (202) 586-2945 or by email: Brenda.Edwards@ee.doe.gov.

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SUPPLEMENTARY INFORMATION:

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I. Summary of the Final Rule and Its Benefits

Title III of the Energy Policy and Conservation Act of 1975 (42 U.S.C.6291, et seq; "EPCA"), Pub. L. 94-163, sets forth a variety of provisions designed to improve energy efficiency.[1] Part C of title III[2] establishes the "Energy Conservation Program for Certain Industrial Equipment." These include commercial clothes washers (CCWs), which are the subject of this rule. (42 U.S.C. 6311(1)(H))

Pursuant to EPCA, any new or amended energy conservation standard must be designed to achieve the maximum improvement in energy efficiency that DOE determines is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A) and 6316(a)) Furthermore, the new or amended standard must result in significant conservation of energy. (42 U.S.C. 6295(o)(3)(B) and 6316(a)) In accordance with these and other statutory provisions discussed in this notice, DOE is adopting amended energy conservation standards for CCWs. The amended standards, which are expressed for each equipment class in terms of a minimum modified energy factor

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[1] All references to EPCA refer to the statute as amended through the American Energy Manufacturing Technical Corrections Act (AEMTCA), Pub. L. 112-210 (Dec. 18, 2012).
[2] Part C of Title III was re-designated as Part A-1 upon incorporation into the U.S. Code (42 U.S.C. 6311–6317, as codified) for editorial reasons.

(MEF_{J2})[3] and a maximum integrated water factor (IWF), are shown in Table I.1. These amended standards apply to all equipment listed in Table I.1 that are manufactured in, or imported into, the United States on or after January 1, 2018.

Table I.1. Energy Conservation Standards for Commercial Clothes Washers (Compliance Starting January 1, 2018)

Equipment Class	Minimum MEF_{J2}*	Maximum IWF[†]
Top-Loading	1.35	8.8
Front-Loading	2.00	4.1

*MEF_{J2} (appendix J2 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.
†IWF (integrated water 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.

A. Benefits and Costs to Consumers

Table I.2 and Table I.3 present DOE's evaluation of the economic impacts of the amended standards on customers of CCWs in multi-family and laundromat applications, respectively, as measured by the average life-cycle cost (LCC) savings and the simple payback period (PBP).[4] In both applications, the average LCC savings are positive for both equipment classes. The PBPs near zero reflect the very small (or zero in the case of top-loading units) incremental cost necessary to achieve the amended standards.

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[3] DOE uses the "MEF_{J2}" nomenclature to distinguish these new standards from the MEF metric used in the current energy conservation standards. MEF is calculated according to the test procedures at 10 Code of Federal Regulations (CFR) 430, subpart B, appendix J1; whereas MEF_{J2} is calculated according to the test procedures at 10 CFR 430, subpart B, appendix J2.
[4] The average LCC savings are measured relative to the base-case efficiency distribution, which depicts the market in the compliance year (see section IV.F.9). The simple PBP, which is designed to compare specific CCW efficiency levels, is measured relative to the baseline model (see section IV.C.4).

Table I.2. Impacts of Amended Standards on Customers of Commercial Clothes Washers: Multi-Family Application

Equipment Class	Average LCC Savings (2013$)	Simple Payback Period (years)
Front-loading	271.9	0.02
Top-Loading	294.5	0.00

Table I.3. Impacts of Amended Standards on Customers of Commercial Clothes Washers: Laundromat Application

Equipment Class	Average LCC Savings (2013$)	Simple Payback Period (years)
Front-loading	212.3	0.02
Top-Loading	165.7	0.00

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 2047). Using a real discount rate of 8.6 percent, DOE estimates that the INPV for manufacturers of CCWs is $123.5 million in 2013$. Under the amended standards, DOE expects that the INPV may be reduced by up to 5.3 percent, which is a loss of approximately $6.6 million. However, based on DOE's interviews with the manufacturers of CCWs, DOE does not expect any plant closings or significant loss of employment.

C. National Benefits[5]

DOE's analyses indicate that the amended energy conservation standards for CCWs would save a significant amount of energy. The lifetime energy savings for CCWs purchased in the 30-year period that begins in the year of compliance with amended standards (2018–2047) amount to 0.07 quadrillion Btu (quads).[6] This amounts to energy

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[5] All monetary values in this section are expressed in 2013 dollars and are discounted to 2014.
[6] A quad is equal to 10^{15} British thermal units (Btu).

savings of 7 percent, relative to the energy use of CCWs in the base case without amended standards.

The cumulative net present value (NPV) of total customer costs and savings of the amended standards for CCWs ranges from \$243 million to \$532 million at 7-percent and 3-percent discount rates, respectively. This NPV expresses the estimated total value of future operating-cost savings minus the estimated increased equipment costs for CCWs purchased in 2018–2047.

In addition, the amended CCW standards would have significant environmental benefits. The energy savings from the amended standards would result in cumulative emission reductions of 4.1 million metric tons (Mt)[7] of carbon dioxide (CO_2), 32.0 thousand tons of methane (CH_4), 1.9 thousand tons of sulfur dioxide (SO_2), 0.04 thousand tons of nitrous oxide (N_2O), 9.1 thousand tons of nitrogen oxides (NO_X) and 0.01 tons of mercury (Hg).[8] The cumulative reduction in CO_2 emissions through 2030 amounts to 1.18 Mt, which is equivalent to the emissions associated with the annual electricity use of more than 162 thousand homes.

The value of the CO_2 reductions is calculated using a range of values per metric ton of CO_2 (otherwise known as the Social Cost of Carbon, or SCC) developed by a

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[7] A metric ton is equivalent to 1.1 short tons. Results for NO_X and Hg are presented in short tons.
[8] DOE calculated emissions reductions relative to the Annual Energy Outlook 2014 (AEO 2014) Reference case, which generally represents current legislation and environmental regulations for which implementing regulations were available as of October 31, 2013.

Federal interagency process.[9] The derivation of the SCC values is discussed in section

IV.L.1. Using discount rates appropriate for each set of SCC values, DOE estimates the

present monetary value of the CO_2 emissions reduction is between \$29.1 and \$410

million. DOE also estimates the present monetary value of the NO_X emissions reduction

is \$6.1 million and \$12.7 million at 7-percent and 3-percent discount rates, respectively.[10]

Table I.4 summarizes the national economic costs and benefits expected to result

from the amended standards for CCWs.

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

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

Table I.4. Summary of National Economic Benefits and Costs of Amended Energy Conservation Standards for CCWs*

Category	Present Value Million 2013$	Discount Rate
Benefits		
Operating Cost Savings	243	7%
	533	3%
CO_2 Reduction Monetized Value ($12.0/t case)**	29	5%
CO_2 Reduction Monetized Value ($40.5/t case)**	133	3%
CO_2 Reduction Monetized Value ($62.4/t case)**	210	2.5%
CO_2 Reduction Monetized Value ($119/t case)**	410	3%
NO_X Reduction Monetized Value (at $2,684/ton)**	6	7%
	13	3%
Total Benefits†	382	7%
	678	3%
Costs		
Incremental Installed Costs	0.24	7%
	0.46	3%
Total Net Benefits		
Including Emissions Reduction Monetized Value†	382	7%
	677	3%

* This table presents the costs and benefits associated with front-loading and top-loading CCW units shipped in 2018−2047. These results include benefits to customers which accrue after 2047 from the equipment purchased in 2018−2047. The results account for the incremental variable and fixed costs incurred by manufacturers due to the standard, some of which may be incurred in preparation for the rule.
** The CO_2 values represent global monetized values of the SCC, in 2013$, in 2015 under several scenarios of the updated SCC values. The first three cases use the averages of SCC distributions calculated using 5%, 3%, and 2.5% discount rates, respectively. The fourth case represents the 95th percentile of the SCC distribution calculated using a 3% discount rate. The SCC time series used by DOE incorporate an escalation factor. The value for NO_X 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 series corresponding to average SCC with 3-percent discount rate.

The benefits and costs of the amended standards for CCWs sold from 2018−2047 can also be expressed in terms of annualized values. The annualized monetary values are the sum of (1) the annualized national economic value of the benefits from customer

operation of CCWs that meet the amended standards (consisting primarily of operating cost savings from using less energy, minus increases in equipment purchase and installation costs, which is another way of representing customer NPV), and (2) the annualized monetary value of the benefits of emission reductions, including CO_2 emission reductions.[11]

Although combining the values of operating savings and CO_2 emission reductions provides a useful perspective, two issues should be considered. First, the national operating savings are domestic U.S. customer monetary savings that occur as a result of market transactions, whereas the value of CO_2 reductions is based on a global value. Second, the assessments of operating cost savings and CO_2 savings are performed with different methods that use different timeframes for analysis. The national operating cost savings is measured for the lifetime of CCWs shipped in 2018–2047. The SCC values, on the other hand, reflect the present value of some future climate-related impacts resulting from the emission of one ton of carbon dioxide in each year. These impacts continue well beyond 2100.

Estimates of annualized benefits and costs of the amended standards are shown in Table I.5. The results under the primary estimate are as follows. Using a 7-percent

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

discount rate for benefits and costs other than CO_2 reduction, for which DOE used a 3-percent discount rate along with the average SCC series that uses a 3-percent discount rate ($40.5/t case), the cost of the standards amended in this rule is $0.02 million per year in increased equipment costs, while the benefits are $24 million per year in reduced equipment operating costs, $7 million per year in CO_2 reductions, and $0.60 million per year in reduced NO_X emissions. In this case, the net benefit amounts to $32 million per year. Using a 3-percent discount rate for all benefits and costs and the average SCC series, the cost of the CCW amended standards is $0.03 million per year in increased equipment costs, while the benefits are $30 million per year in reduced operating costs, $7 million per year in CO_2 reductions, and $0.71 million per year in reduced NO_X emissions. In this case, the net benefit amounts to $38 million per year.

Table I.5. Annualized Benefits and Costs of Amended Energy Conservation Standards for Commercial Clothes Washers

	Discount Rate	Primary Estimate*	Low Net Benefits Estimate*	High Net Benefits Estimate*
		million 2013$/year		
Benefits				
Operating Cost Savings	7%	24	21	30
	3%	30	26	38
CO_2 Reduction Monetized Value ($12.0/t case)*	5%	2	2	3
CO_2 Reduction Monetized Value ($40.5/t case)*	3%	7	7	9
CO_2 Reduction Monetized Value ($62.4/t case)*	2.5%	11	10	13
CO_2 Reduction Monetized Value ($119/t case)*	3%	23	21	28
NO_X Reduction Monetized Value (at $2,684/ton)**	7%	0.60	0.55	0.71
	3%	0.71	0.64	0.86
Total Benefits†	7% plus CO_2 range	27 to 47	24 to 43	33 to 58
	7%	32	29	39
	3% plus CO_2 range	33 to 53	29 to 47	41 to 66
	3%	38	33	48
Costs				
Incremental Equipment Costs	7%	0.02	0.03	0.02
	3%	0.03	0.03	0.02
Net Benefits				
Total†	7% plus CO_2 range	27 to 47	24 to 43	33 to 58
	7%	32	29	39
	3% plus CO_2 range	33 to 53	29 to 47	41 to 66
	3%	38	33	48

* This table presents the annualized costs and benefits associated with CCW equipment shipped in 2018−2047. These results include benefits to customers which accrue after 2047 from the equipment purchased in 2018−2047. The results account for the incremental variable and fixed costs incurred by manufacturers due to the standard, some of which may be incurred in preparation for the rule. The Primary, Low Benefits, and High Benefits Estimates utilize projections of energy prices from the AEO2014 Reference case, Low Estimate, and High Estimate, respectively. In addition, incremental equipment costs reflect a flat rate for projected equipment price trends in the Primary Estimate, a low decline rate in the Low Benefits Estimate, and a high decline rate in the High Benefits Estimate. The methods used to derive projected price trends are explained in section IV.

** The CO_2 values represent global monetized values of the SCC, in 2013\$, in 2015 under several scenarios of the updated SCC values. The first three cases use the averages of SCC distributions calculated using 5%, 3%, and 2.5% discount rates, respectively. The fourth case represents the 95th percentile of the SCC distribution calculated using a 3% discount rate. The SCC time series used by DOE incorporate an escalation factor. The value for NO_X is the average of the low and high values used in DOE's analysis.

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

D. Conclusion

DOE has concluded that the amended standards represent the maximum improvement in energy efficiency that is technologically feasible and economically justified, and would result in the significant conservation of energy. DOE further notes that equipment achieving these standard levels are already commercially available for the equipment classes covered by this final rule. Based on the analyses described above, DOE has concluded that the benefits of the amended standards to the Nation (energy savings, positive NPV of customer benefits, customer LCC savings, and emission reductions) would outweigh the burdens (loss of INPV for manufacturers and LCC increases for some customers).

II. Introduction

The following section briefly discusses the statutory authority underlying the final rule, as well as some of the relevant historical background related to the establishment of amended standards for CCWs.

A. Authority

As noted in section I, Title III of EPCA establishes the "Energy Conservation Program for Certain Industrial Equipment." This equipment includes CCWs, the subject of this rulemaking. (42 U.S.C. 6311(1)(H))

EPCA established energy conservation standards for CCWs and directed DOE to conduct two rulemakings to determine whether the established standards should be amended. (42 U.S.C. 6313(e)) DOE published its first final rule amending CCW standards on January 8, 2010 ("January 2010 final rule"), which apply to CCWs manufactured on or after January 8, 2013. The second final rule determining whether standards should be amended must be published by January 1, 2015. Any amended standards would apply to CCWs manufactured three years after the date on which the final amended standard is published. (42 U.S.C. 6313(e)(2)(B)) This current rulemaking satisfies the requirement to publish the second final rule by January 1, 2015.

Pursuant to EPCA, DOE's energy conservation program for covered equipment consists essentially of four parts: (1) testing; (2) labeling; (3) the establishment of Federal energy conservation standards; and (4) certification and enforcement procedures. 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 equipment. (42 U.S.C. 6314(a)(2)) Manufacturers of covered equipment must use the prescribed DOE test procedure as the basis for certifying to DOE that their equipment 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 equipment. (42 U.S.C. 6314(d)) Similarly, DOE must use these test procedures to determine whether the equipment comply with standards adopted pursuant to EPCA.

DOE must follow specific statutory criteria for prescribing amended standards for covered equipment. As indicated above, any amended standard for covered equipment 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) and 6316(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) and 6316(a)) Moreover, DOE may not prescribe a standard: (1) for certain equipment, including CCWs, if no test procedure has been established for the equipment, or (2) if DOE determines by rule that the amended standard is not technologically feasible or economically justified. (42 U.S.C. 6295(o)(3)(A)-(B) and 6316(a)) 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) and 6316(a)) DOE must make this determination after receiving comments on the proposed standard, and by considering, to the greatest extent practicable, the following seven factors:

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

2. The savings in operating costs throughout the estimated average life of the covered equipment in the type (or class) compared to any increase in the price, initial charges, or maintenance expenses for the covered equipment 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 equipment 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) and 6316(a))

EPCA, as codified, also contains what is known as an "anti-backsliding" provision, which prevents the Secretary from prescribing any amended standard that either increases the maximum allowable energy use or decreases the minimum required energy efficiency of covered equipment. (42 U.S.C. 6295(o)(1) and 6316(a)) 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 equipment 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) and 6316(a))

Further, EPCA, as codified, establishes a rebuttable presumption that a standard is economically justified if the Secretary finds that the additional cost to the consumer of purchasing products or equipment complying with an energy conservation standard level will be less than three times the value of the energy savings during the first year that the consumer will receive as a result of the standard, as calculated under the applicable test procedure. (42 U.S.C. 6295(o)(2)(B)(iii) and 6316(a))

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 or equipment for any group of covered products or equipment that have the same function or intended use if DOE determines that products or equipment within such group (A) consume a different kind of energy from that consumed by other covered products or equipment within such type (or class); or (B) have a capacity or other performance-related feature which other products or equipment within such type (or class) do not have and such feature justifies a higher or lower standard. (42 U.S.C. 6295(q)(1) and 6316(a)) In determining whether a performance-related feature justifies a different standard for a group of products or equipment, 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) and 6316(a))

Federal energy conservation requirements generally supersede State laws or regulations concerning energy conservation testing, labeling, and standards. (42 U.S.C. 6297(a)–(c) 6316(a)) 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) and 6316(a)).

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.

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

B. Background

1. Current Standards

In the January 2010 final rule, DOE prescribed the current energy conservation standards for CCWs manufactured on or after January 8, 2013. The current standards are set forth in Table II.1.

Table II.1. Current Federal Energy Efficiency Standards for Commercial Clothes Washers

Equipment Class	Minimum MEF* cu.ft/kWh/cycle	Maximum WF[†] gal/cu.ft./cycle
Top-Loading	1.60	8.5
Front-Loading	2.00	5.5

*MEF (appendix J1 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 factor) is calculated as the weighted per-cycle water consumption for the cold wash/cold rinse cycle, expressed in gallons per cycle, divided by the clothes container capacity in cubic feet.

2. History of Standards Rulemaking for Commercial Clothes Washers

As described in Section II.A, EPCA established energy conservation standards for CCWs and directed DOE to conduct two rulemakings to determine whether the established standards should be amended. (42 U.S.C. 6313(e)) DOE published its first final rule amending CCW standards on January 8, 2010 ("January 2010 final rule"). 75 FR 1122. This current rulemaking satisfies the requirement to publish the second final rule determining whether the standards should be amended by January 1, 2015.

On August 13, 2012, DOE published a notice of public meeting and availability of the framework document for this rulemaking. DOE also requested public comment on the document. 77 FR 48108. The framework document described the procedural and analytical approaches that DOE anticipated using to evaluate energy conservation standards for CCWs and identified various issues to resolve during the rulemaking.

On September 24, 2012, DOE held the framework document public meeting and discussed the issues detailed in the framework document. DOE also described the

analyses that it planned to conduct during the rulemaking. Through the public meeting, DOE sought feedback from interested parties on these subjects and provided information regarding the rulemaking process that DOE would follow. Interested parties discussed major issues at the public meeting, including the rulemaking schedule, test procedure revisions, equipment classes, technology options, efficiency levels, and approaches for each of the analyses performed by DOE as part of the rulemaking process.

On March 4, 2014, DOE published a notice of proposed rulemaking (hereafter, the "March 2014 NOPR") and notice of public meeting. 79 FR 12301. The March 2014 NOPR presented the results of DOE's initial analyses and proposed amended standards for CCWs. DOE also published an accompanying technical support document (TSD) that described the results of each analysis in greater detail.

On April 21, 2014, DOE held the March 2014 NOPR public meeting and discussed the issues detailed in the NOPR. Interested parties commented on various aspects of the proposed rule and submitted supplemental written comments. Following the public meeting, DOE gathered additional information and performed additional analysis to supplement the analyses presented in the March 2014 NOPR, including the engineering, LCC, PBP, manufacturer impact, and national impact analyses. The results of these analyses are detailed in a TSD accompanying this final rule, available in the docket at the regulations.gov website. DOE considered the comments received since publication of the March 2014 NOPR, including those received at the NOPR public meeting, in developing the amended standards for CCWs.

III. General Discussion

A. General Rulemaking Issues

In the March 2014 NOPR (79 FR 12301), DOE proposed a compliance date of

January 1, 2015 for the amended standards resulting from this rulemaking. 79 FR 12301,

12351. As explained in the preamble to the March 2014 NOPR, and as explained in this

final rule, EPCA requires that any amended standards as a result of this rulemaking

would apply to CCWs manufactured three years after the date on which the final

amended standard is published. (42 U.S.C. 6313(e)(2)(B))

The Association of Home Appliance Manufacturers (AHAM) and Alliance

Laundry Systems (ALS) commented that the March 2014 NOPR erroneously listed the

compliance date for this rulemaking as "on or after January 1, 2015," and noted that the

intended compliance data should be "on or after January 1, 2018." (AHAM, No. 23 at p.

6; Whirlpool, No. 28 at p. 1; ALS, No. 26 at p. 3) [12,13]

The final rule corrects this error from the March 2014 NOPR and establishes a

compliance date for amended standards as listed in the Summary section of this final rule.

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[12] A notation in this form provides a reference for information that is in the docket for DOE's rulemaking to develop energy conservation standards for CCWs (Docket No. EERE-2012-BT-STD-0020), which is maintained at http://www.regulations.gov/#!docketDetail;D=EERE-2012-BT-STD-0020.This notation indicates that AHAM's statement preceding the reference can be found in document number 23 in the docket, and appears at page 6 of that document.

[13] Whirlpool Corporation submitted a written comment stating that it worked closely with AHAM in the development of AHAM's submitted comments, and that Whirlpool strongly supports the positions taken by AHAM. Unless otherwise noted, throughout this final rule, reference to AHAM's written comments (document number 23 in the docket) should be considered reflective of Whirlpool's position as well.

B. Equipment Classes and Scope of Coverage

When evaluating and establishing energy conservation standards, DOE divides covered equipment into equipment classes by the type of energy used, or by capacity or other performance-related feature that justifies a different standard. DOE may not prescribe standards that are likely to result in the unavailability of a certain product class of performance characteristics, features, sizes, capacities, and volumes that are substantially the same as those generally available in the United States at the time of the Secretary's finding. (42 U.S.C. 6294(o)(4) and 6316(a)) In making a determination whether a performance-related feature justifies a different standard, DOE must consider such factors as the utility to the consumer of the feature and other factors DOE determines are appropriate. (42 U.S.C. 6295(q) and 6316(a)) DOE creates product and equipment classes based on function or use and currently divides CCWs into two equipment classes: top-loading and front-loading.

DOE tentatively concluded in the March 2014 NOPR that the axis of loading represents a distinct consumer utility-related feature that warrants retaining both top-loading and front-loading CCW equipment classes. 79 FR12301, 12309 (Mar. 4, 2014). DOE reached the same conclusion in prior rulemakings for residential clothes washers. 56 FR 22249, 22263 (May 14, 1991) and 77 FR 32307, 32319 (May 31, 2012).

DOE also preliminarily determined in the March 2014 NOPR that the longer average cycle time of front-loading machines warrants consideration of separate

equipment classes. DOE presented data showing that top-loading cycle times for the

maximum load size ranged from 29 to 31 minutes, with an average of 30 minutes.[14] 79

FR 12301, 12309. Front-loading cycle times, on the other hand, ranged from 30 to 37

minutes, with an average of 34 minutes. Id. DOE preliminarily determined that the longer

average cycle time of front-loading CCWs results in fewer possible "turns" per day

compared to top-loading CCWs. The longer average time is significant in a laundromat or

multi-family laundry setting to end-users waiting on the machine to finish its cycle, as

well as to laundromat owners and multi-family laundry route operators looking to

maximize daily laundry throughput.

In addition, DOE's analysis in the March 2014 NOPR indicated that the

technologies, designs, and operating characteristics of the max-tech top-loading

residential clothes washers were not transferrable to CCWs. Since the efficiency levels of

top-loading CCWs on the market do not overlap with those of front-loading clothes

washers, a single energy efficiency standard applicable to both top-loading and front-

loading CCWs would likely result in the elimination of top-loading clothes washers from

the market.

For these reasons, DOE preliminarily concluded that separate equipment classes

are justified for top-loading and front-loading CCWs based on the criteria established in

EPCA. (42 U.S.C. 6295(o)(4) and (q)(1), 6316(a)) The proposal in the March 2014

NOPR thus maintained separate standards for top-loading and front-loading equipment

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[14] This excludes one outlier top-loading model with a cycle time of 50 minutes. DOE considers the model
with a cycle time of 50 minutes to be unrepresentative of equipment typically used in coin laundry or multi-
family housing laundry facilities.

classes. 77 FR 12309. DOE received comments in response to the March 2014 NOPR both in support of and opposed to establishing two equipment classes for CCWs. These comments are described in more detail in the following paragraphs.

The California Investor Owned Utilities (hereafter, "California IOUs") and, in a joint comment, the Natural Resources Defense Council (NRDC), Alliance to Save Energy, Northwest Power and Conservation Council, Appliance Standards Awareness Project (ASAP), and Northwest Energy Efficiency Alliance (hereafter, "Joint Commenters"), support a single equipment class due to the similarity in cycle times between top-loaders and front-loaders. (California IOUs, Public Meeting Transcript, No. 30 at p. 14; Joint Commenters, No. 29 at pp. 1-4) In their comment, the California IOUs note that if a front-loader is able to get more water out of the clothing, the dryer time would be shorter and, thus, the overall cycle time associated with the end-user waiting at a laundromat would either be the same or less. (California IOUs, Public Meeting Transcript, No. 30 at pp. 61-62)

The California IOUs believe that a top-loading configuration does not offer distinct consumer utility. (California IOUs, No. 27 at pp. 1-2) The California IOUs believe increasing front-loading sales could imply that customers are becoming indifferent to distinctions between front-loading and top-loading CCWs, thus suggesting that the potential utility between the two is negligible in the market. (California IOUs, Public Meeting Transcript, No. 30 at pp. 91-92)

The Joint Commenters note that in the January 2010 final rule, DOE acknowledged that method of access is a "feature" within the meaning of 42 USC 6295(q), but that DOE rejected the contention that the top-loading configuration afforded any substantial consumer utility in a commercial setting. (Joint Commenters, No. 29 at pp. 1-3)

NRDC requests additional data, other than cycle time, upon which DOE based its conclusion about distinct consumer utility for separate equipment classes of CCWs. (NRDC, Public Meeting Transcript, pp. 34, 51-52) ASAP and NRDC also request that DOE provide an explanation of all the factors considered as justification for separating equipment classes based on location of access. (ASAP, Public Meeting Transcript, No. 30 at pp. 60-61; NRDC, Public Meeting Transcript, No. 30 at p. 132)

On the other hand, AHAM and ALS support DOE's conclusion in the March 2014 NOPR that separate equipment classes are justified for top-loading and front-loading CCWs. (AHAM, No. 23 at p. 2; ALS, No. 26 at p. 1) AHAM disagrees with the California IOUs that a 50/50 split in equipment class sales would indicate a negligible difference in the utility of each equipment class. (AHAM, Public Meeting Transcript, No. 30 at pp. 94-96) AHAM believes that since both types of equipment classes are sold on the market in equal amounts, there is consumer utility in each equipment class. AHAM supports maintaining two product classes now, as well as in the future. (AHAM, Public Meeting Transcript, No. 30 at pp. 94-96; AHAM, No. 23 at p. 2)

DOE views utility as an aspect of the product that is accessible to the layperson and is based on user operation, rather than performing a theoretical function. DOE does not separate equipment classes based on up-front costs that anyone, including the consumer, laundromat owner, or manufacturer, may bear. DOE determines consumer utility on a case-by-case basis and determines what value a product could have based on the consumer base and the associated technology.

With that in mind, DOE disagrees with the California IOUs that a 50/50 split in top-loading versus front-loading sales would be an indication that the market is indifferent between the two, or that the potential utility between the two is negligible. DOE believes that a 50/50 split would indicate that 50 percent of the market expresses a preference for (i.e., derives utility from) the top-loading configuration.

DOE acknowledges that the difference in cycle times between top-loading and front-loading CCWs has diminished due to improvements in front-loading technology. DOE also notes that at least one front-loading CCW model is available at the proposed standard level with a cycle time of approximately 30 minutes, which matches the average cycle time of all top-loading CCWs tested by DOE. Therefore, DOE understands that, as technology progresses cycle time may become a less meaningful differentiator between CCW equipment classes.

However, DOE disagrees with the Joint Commenters' characterization of the January 2010 final rule--that DOE had rejected the contention that the top-loading configuration afforded any substantial consumer utility in a commercial setting. In the January 2010 final rule, DOE described its preliminary conclusions from the October 17, 2008 NOPR (hereafter, the "October 2008 NOPR") and the November 9, 2009 SNOPR (hereafter, the "November 2009 SNOPR"): that separate equipment classes for top-loading and front-loading CCWs were warranted because the method of loading had been previously determined to be a "feature" under rulemakings for residential clothes washers, and a single standard would eliminate top-loading CCWs from the market. 75 FR 1122, 1133. DOE did not reject this conclusion in the January 2010 final rule. DOE did note that access without stooping is not a specific consumer utility, because many manufacturers supply pedestals that would eliminate stooping in front-loading washers. Id. But method of loading encompasses more than stooping, and therefore, provides specific consumer utility that defines separate equipment classes.

For example, front-loading commercial clothes washers are stackable and can be useful in a concentrated laundromat or multi-family housing setting. On the other hand, top-loading washing machines provide the utility of adding clothes during the wash cycle. Furthermore, DOE notes that the separation of clothes washer equipment classes by location of access is similar in nature to the equipment classes for residential refrigerator-freezers, which include separate equipment classes based on the access of location of the freezer compartment (e.g. top-mounted, side-mounted, and bottom-mounted). The location of the freezer compartment on such equipment provides no

additional performance-related utility other than consumer preference. In other words, the location of access itself provides distinct consumer utility.

Furthermore, DOE observes that top-loading residential clothes washers are available with the same efficiency levels, control panel features, and price points as front-loading residential clothes washers. Given the equivalence in efficiency, features, and price, the purchase of such top-loaders indicates a preference among certain consumers for the top-loading configuration; i.e., the top-loading configuration itself provides unique consumer utility to those customers preferring one configuration over another, with all other product attributes being equal.

In this final rule analysis, DOE reiterates and confirms its conclusions from the May 14, 1991 final rule for residential clothes washers (56 FR 22250), the October 2008 NOPR, the September 2009 SNOPR, and the March 2014 NOPR that the method of loading is a feature that provides distinct consumer utility. The final rule maintains separate equipment classes for top-loading and front-loading CCWs.

C. Test Procedures

1. Appendix J2

The DOE test procedures for clothes washers are codified at title 10 of the Code of Federal Regulations (CFR) part 430, subpart B, appendix J1 and appendix J2 (hereafter, "appendix J1" and "appendix J2"). Under EPCA, test procedures for CCWs

must be the same as test procedures as residential clothes washers. (42 U.S.C. 6314(a)(8))

On December 3, 2014, DOE published a final rule (hereafter, the "December 2014 final rule") adopting appendix J2 to be used to determine compliance with any future revised energy conservation standards for CCWs. The December 2014 final rule also clarified the dates for which appendix J1 and appendix J2 must be used to determine compliance with existing energy conservation standards and any future revised energy conservation standards for CCWs. 79 FR 71642. Manufacturers of CCWs must use appendix J1 to demonstrate compliance with the current standards established by the January 2010 final rule. (10 CFR 431.156) Under this rulemaking, CCW manufacturers must use appendix J2, beginning January 1, 2018, to demonstrate compliance with the amended energy conservation standards.

For the purpose of understanding how the amended standards compare with the current standards for CCWs, the following two tables provide the equivalent appendix J1 and appendix J2 metrics for both. Table III.1 shows the equivalent appendix J1 and appendix J2 values for the current energy conservation standards for CCWs as set forth at the current 10 CFR 431.156. Table III.2 shows the equivalent appendix J1 and appendix J2 values for the amended energy conservation standards established by the final rule. These translations between appendix J1 and appendix J2 values are provided for comparison purposes only and will not be used to certify compliance with either the current or future energy conservation standards for CCWs. Manufacturers must use only appendix J1 values to certify compliance with the current energy conservation standards

established the January 2010 final rule. Manufacturers must use only appendix J2 values

to certify compliance with the amended standards beginning January 1, 2018.

As required by EPCA, the amended standards do not increase the maximum

allowable energy and/or water use or decrease the minimum required energy efficiency of

CCWs. (42 U.S.C. 6295(o) and 6316(a))

Table III.1. Current Energy Conservation Standards for Commercial Clothes Washers, Equivalent Appendix J1 and J2 Values

	Minimum Energy Standards		Maximum Water Standards	
	Appendix J1	Appendix J2	Appendix J1	Appendix J2
Equipment Class	MEF*	Equivalent MEF_{J2}*	WF[†]	Equivalent IWF[‡]
Top-Loading	1.60	1.15	8.5	8.9
Front-Loading	2.00	1.65	5.5	5.2

*MEF (appendix J1 modified energy factor) and MEF_{J2} (appendix J2 modified energy factor) are 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 (appendix J1 water factor) is calculated as the weighted per-cycle water consumption for the cold wash/cold rinse cycle, expressed in gallons per cycle, divided by the clothes container capacity in cubic feet.
[‡]IWF (appendix J2 integrated water factor) is calculated as the weighted per-cycle water consumption for all wash cycles, expressed in gallons per cycle, divided by the clothes container capacity in cubic feet.

Table III.2. Amended Energy Conservation Standards for Commercial Clothes Washers, Equivalent Appendix J1 and J2 Values

	Minimum Energy Standards		Maximum Water Standards	
	Appendix J1	Appendix J2	Appendix J1	Appendix J2
Equipment Class	Equivalent MEF*	MEF$_{J2}$*	Equivalent WF[†]	IWF[‡]
Top-Loading	1.70	1.35	8.4	8.8
Front-Loading	2.40	2.00	4.0	4.1

*MEF (appendix J1 modified energy factor) and MEF$_{J2}$ (appendix J2 modified energy factor) are 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 (appendix J1 water factor) is calculated as the weighted per-cycle water consumption for the cold wash/cold rinse cycle, expressed in gallons per cycle, divided by the clothes container capacity in cubic feet.

[‡]IWF (appendix J2 integrated water factor) is calculated as the weighted per-cycle water consumption for all wash cycles, expressed in gallons per cycle, divided by the clothes container capacity in cubic feet.

AHAM does not object to the translations developed to quantify the difference between results based on appendix J1 and appendix J2 in the context of this standards rulemaking. (AHAM, No. 23 at pp. 2-3)

DOE received no comments objecting to the appendix J1 and appendix J2 translations it developed for the purpose of understanding how the amended standards compare with the current standards for CCWs. Therefore, for the reasons discussed above, DOE maintains these informative translations in the final rule. DOE notes that the quantitative analyses performed for this rulemaking were conducted using the appendix J2 metrics, MEF$_{J2}$ and IWF.

2. Energy Metric

In the March 2014 NOPR, DOE proposed amended energy efficiency standards

based on MEF as measured using appendix J2 ("MEF_{J2}"). 77 FR 12301, 12303, 12310

(Mar. 4, 2014). As defined in section 4.5 of appendix J2, MEF_{J2} 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.

As explained in the March 2014 NOPR, DOE evaluated the standby and off mode

power characteristics of a representative sample of CCWs spanning a wide range of

display types, payment systems, and communication features. DOE did not, however,

propose amended standards for CCWs based on an integrated energy metric that would

have included a measurement of standby and off mode power. 79 FR 12301, 12310

(Mar. 4, 2014).

AHAM supports DOE's proposal for amended standards for CCWs based on

MEF, rather than an integrated modified energy factor (IMEF).[15] (AHAM, No. 23 at p. 3)

ALS supports DOE's proposal to not amend CCW standards based on an integrated

energy metric. ALS believes that standby power should not be included for CCWs,

because the equipment needs an active visual display between active operating cycles to

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[15] In its comment, AHAM used the terms "Energy Factor" and "Integrated Energy Factor." Based on the
context of AHAM's comment, DOE assumes that AHAM intended to reference "Modified Energy Factor"
and "Integrated Modified Energy Factor."

alert potential users that the equipment is ready and available to be used. (ALS, No. 26 at p. 2)

The Joint Commenters suggest that DOE consider establishing standards for standby and off mode operation. In their submitted comments, the Joint Commenters referenced data that DOE provided in the TSD for the March 2014 NOPR, and noted that standby energy consumption represents 7 to 44% of total annual machine energy consumption, depending on washer format and application. (Joint Commenters, No. 29 at p. 7) The Joint Commenters believe that, while machine energy comprises a fraction of the total energy consumed in the wash cycle, these data indicate that standby usage makes up a significant share of the electricity usage of CCWs. The Joint Commenters believe DOE acted without foundation in not using the IMEF metric and removing low-standby-power controls from the list of design options for consideration. (Joint Commenters, No. 29 at p. 7)

DOE notes that the current energy standard established by the January 2010 final rule is based on MEF, which does not incorporate the measurement of standby and off-mode power. In order to amend the current standard in terms of IMEF, DOE would need to first translate the current standard of 1.60 MEF into an equivalent baseline IMEF level, and then establish higher efficiency levels.

As part of its market assessment and engineering analysis for this rulemaking, DOE performed an in-depth evaluation of the standby and off mode power characteristics

of a representative sample of CCWs spanning a wide range of display types, payment

systems, and communication features. The results from DOE's testing are provided in

chapter 5 of the final rule TSD. Based on its evaluation (which considered the structure of

CCW equipment classes), DOE determined that promulgating an amended standard based

on IMEF could enable backsliding. DOE observed that manufacturers offer a variety of

display and payment functionalities that can be selected independently from the basic

model. The standby power associated with these different display and payment

functionalities varies from 0.88 to 11.77 watts. The lowest standby power levels are

associated with models having no vend price display and no coin or card payment options

(often referred to as "push-to-start" models). These models are typically used in small

multi-family housing facilities offering free laundry, or in other commercial applications

not requiring fare payment. Such models are not suitable for coin-operated laundry or

most other multi-family housing facilities. The highest standby power levels are

associated with models having a digital vend price display, coin or debit card payment

system, and advanced features such as dynamic or cycle-based pricing controls, built-in

logging capabilities, and remote auditing features. These models are typically used in

coin-operated laundries located in competitive markets.

The following example demonstrates one potential backsliding scenario: DOE

testing indicates that a baseline top-loading CCW model rated at 1.60 MEF would have

an equivalent IMEF rating ranging from 1.34 IMEF (for a CCW with the highest

observed standby power usage) to 1.53 IMEF (for a CCW with the lowest observed

standby power usage). If DOE were to establish the new equivalent baseline standard

level at 1.34 IMEF—which would accommodate all display and payment types—a push-to-start baseline CCW with lower standby power usage, rated at 1.53 MEF, would be able to increase its active mode energy consumption over current levels to "slide back" to the 1.34 MEF level.

Alternatively, if DOE were to establish the new equivalent baseline standard level at 1.53 MEF—the level corresponding to the lowest standby power push-to-start models—manufacturers would be precluded from offering vend price displays, payment systems, or other advanced controls on new baseline CCWs. This would negatively impact consumer and end-user utility, since push-to-start models are not suitable for coin-operated laundries or most multi-family housing applications.

Finally, because of the wide variations in standby power, CCWs with significantly different active mode (i.e., MEF) ratings could have similar IMEF ratings depending on their control panel functionalities, and vice versa. This would diminish the usefulness of the IMEF metric as a means for differentiating the active mode characteristics of different CCW models.

For these reasons, DOE has determined that establishing amended standards for CCWs based on IMEF would not be technically feasible. Instead, the final rule establishes amended standards based on MEF_{J2}, which does not incorporate standby and off mode power.

3. Water Metric

In the March 2014 NOPR, DOE proposed amended water efficiency standards based on IWF as measured using appendix J2. 77 FR 12301, 12303, 12310 (Mar. 4, 2014). As defined in section 4.2.13 of appendix J2, IWF is calculated as the weighted per-cycle water consumption for all wash cycles, expressed in gallons per cycle, divided by the clothes container capacity in cubic feet. DOE believes that the IWF metric provides a more representative measure of water consumption than the WF metric, which is based on the water consumption of only the cold wash/cold rinse temperature cycle.

ALS supports DOE's proposal to amend CCW water standards based on the IWF metric. (ALS, No. 26 at p. 2)

DOE received no comments objecting to its proposal to use the IWF metric for amended water efficiency standards for CCWs. Therefore, for the reasons discussed above, the amended water efficiency standards established by the final rule are based on the IWF metric.

D. Technological Feasibility

1. General

In each energy conservation standards rulemaking, DOE conducts a screening analysis based on information gathered on all current technology options and prototype designs that could improve the efficiency of the products or equipment that are the subject of the rulemaking. As the first step in such an analysis, DOE develops a list of

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technology options for consideration in consultation with manufacturers, design

engineers, and other interested parties. DOE then determines which of those options for

improving efficiency are technologically feasible. DOE considers technologies

incorporated in commercially available equipment or in working prototypes to be

technologically feasible. (10 CFR part 430, subpt. C, app.A, § 4(a)(4)(i))

After DOE has determined that particular technology options are technologically

feasible, it further evaluates each technology option in light of the following additional

screening criteria: (1) practicability to manufacture, install, and service; (2) adverse

impacts on equipment utility or availability; and (3) adverse impacts on health or safety.

(10 CFR 430, subpt C, app. A, §§ 4(a)(4)(ii)-(iv)) Additionally, it is DOE policy not to

include in its analysis any proprietary technology that is a unique pathway to achieving a

certain efficiency level. Section IV.B of this notice discusses the results of the screening

analysis for CCWs—in particular, the designs DOE considered, those it screened out, and

those that form the basis for the trial standard level (TSLs) in this rulemaking. For further

details on the screening analysis for this rulemaking, see chapter 4 of the final rule TSD.

2. Maximum Technologically Feasible Levels

When DOE proposes to adopt an amended standard for a class of covered

equipment, it must determine the maximum improvement in energy efficiency or

maximum reduction in energy use that is technologically feasible for such equipment. (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

CCWs, using the design parameters for the most efficient equipment available on the

market or in working prototypes. The max-tech levels that DOE determined for this

rulemaking are described in section IV.C of this final rule and in chapter 5 of the final

rule TSD.

E. Energy Savings

1. Determination of Savings

For each TSL, DOE projected energy savings from the CCWs purchased in the

30-year period that begins in 2018. The savings are measured over the entire lifetime of

the CCWs purchased in the 30-year period.[16] DOE quantified the energy savings

attributable to each TSL as the difference in energy consumption between each standards

case and the base case. The base case represents a projection of energy consumption in

the absence of amended efficiency standards, and considers market forces and policies

that affect demand for more efficient equipment.

DOE used its national impact analysis (NIA) spreadsheet model to estimate

energy savings from amended standards for the equipment that are the subject of this

rulemaking. The NIA spreadsheet model (described in section IV.H of this notice)

calculates energy savings in site energy, which is the energy directly consumed by CCWs

at the locations where they are used. For electricity, DOE reports national energy savings

in terms of the savings in the primary energy that is used to generate and transmit the site

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[16] In previous rulemakings, DOE presented energy savings results for only the 30-year period that begins in the year of compliance. In the calculation of economic impacts, however, DOE considered operating cost savings measured over the entire lifetime of products purchased in the 30-year period. DOE has modified its presentation of national energy savings consistent with the approach used for its national economic analysis.

electricity. To calculate this quantity, DOE derives annual conversion factors from the model used to prepare the Energy Information Administration's (EIA) Annual Energy Outlook (AEO).

DOE also estimates full-fuel-cycle energy savings in its energy conservation standards rulemakings. 76 FR 51282 (Aug. 18, 2011), as amended at 77 FR 49701 (August 17, 2012). The full-fuel-cycle (FFC) metric includes the energy consumed in extracting, processing, and transporting primary fuels (i.e., coal, natural gas, petroleum fuels), and thus presents a more complete picture of the impacts of energy efficiency standards. DOE's approach is based on calculation of an FFC multiplier for each of the energy types used by covered equipment. For more information on FFC energy savings, see section IV.H.2.

2. Significance of Savings

As noted above, 42 U.S.C. 6295(o)(3)(B) prevents DOE from adopting a standard for a covered equipment 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 (presented in section V.C) are nontrivial, and, therefore, DOE considers them "significant" within the meaning of section 325 of EPCA.

F. Economic Justification

1. Specific Criteria

EPCA provides seven factors to be evaluated in determining whether a potential energy conservation standard is economically justified. (42 U.S.C. 6295(o)(2)(B)(i) and 6316(a)) 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 energy conservation 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 period. The industry-wide impacts analyzed include: (1) INPV, which values the industry on the basis of expected future cash flows; (2) cash flows by year; (3) changes in revenue and income; and (4) other measures of impact, as appropriate. Second, DOE analyzes and reports the impacts on different types of manufacturers, including impacts on small manufacturers. Third, DOE considers the impact of standards on domestic manufacturer employment and manufacturing capacity, as well as the potential for standards to result in plant closures and loss of capital investment. Finally, DOE takes into account cumulative impacts of various DOE regulations and other regulatory requirements on manufacturers.

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

b. Savings in Operating Costs Compared to Increase in Price (LCC and PBP)

EPCA requires DOE to consider the savings in operating costs throughout the estimated average life of the covered equipment in the class compared to any increase in the price of the covered equipment that are likely to result from the imposition of the standard. (42 U.S.C. 6295(o)(2)(B)(i)(II) and 6316(a)) DOE conducts this comparison in its LCC and PBP analysis. The LCC is the sum of the purchase price of the equipment (including its installation) and the operating expense (including energy, maintenance, and repair expenditures) discounted over the lifetime of the equipment. To account for uncertainty and variability in specific inputs, such as equipment lifetime and discount rate, DOE uses a distribution of values, with probabilities attached to each value. For its analysis, DOE assumes that consumers will purchase the covered equipment in the first year of compliance with amended standards.

The PBP is the estimated amount of time (in years) it takes consumers to recover the increased purchase cost (including installation) of more-efficient equipment through lower operating costs. DOE calculates the PBP by dividing the increase in purchase cost

due to a more-stringent standard by the change in annual operating cost for the year that standards are assumed to take effect.

The LCC savings and the PBP for the considered efficiency levels are calculated relative to a base case that reflects projected market trends in the absence of amended standards. DOE identifies the percentage of consumers estimated to experience an LCC increase, in addition to the average LCC savings associated with a particular standard level. In contrast, the PBP is measured relative to the baseline equipment.

DOE's LCC and PBP analyses are discussed in further detail in section IV.F.

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) and 6316(a)) As discussed in section IV.H.2, DOE uses the NIA spreadsheet to project national energy savings.

d. Lessening of Utility of Equipment

In establishing equipment classes, and in evaluating design options and the impact of potential standard levels, DOE evaluates standards that would not lessen the utility of

the considered equipment. (42 U.S.C. 6295(o)(2)(B)(i)(IV) and 6316(a)) Based on data

available to DOE, the standards outlined in the final rule will not reduce the utility of the

equipment 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. (42 U.S.C. 6295(o)(2)(B)(i)(V)) 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

in writing to the Secretary within 60 days of the publication of a proposed rule, together

with an analysis of the nature and extent of the impact. (42 U.S.C. 6295(o)(2)(B)(ii)) To

assist the Attorney General in making such determination for these standards, DOE

provided the Department of Justice (DOJ) with copies of the March 2014 NOPR and the

accompanying TSD for review. In its assessment letter responding to DOE, DOJ

concluded that the amended energy conservation standards for CCWs are unlikely to

have a significant adverse impact on competition.[17]

f. Need for National Energy Conservation

DOE also considers the need for national energy conservation in determining

whether a new or amended standard is economically justified. (42 U.S.C.

6295(o)(2)(B)(i)(VI) and 6316(a)) The energy savings from the amended standards are

likely to provide improvements to the security and reliability of the nation's energy

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[17] The DOJ conclusion is available as document number 31 in the docket for this rulemaking, available at
http://www.regulations.gov/#!documentDetail;D=EERE-2012-BT-STD-0020-0031.

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.

The amended 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 emissions impacts from the standards, and from each TSL it considered, in section V.C.1 of this notice. DOE also reports estimates of the economic value of emissions reductions resulting from the considered TSLs, as discussed in section V.C.2.

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) and 6316(a)) DOE did not consider any other factors for this final rule.

2. Rebuttable Presumption

As set forth in 42 U.S.C. 6295(o)(2)(B)(iii) and 6316(a), EPCA creates a rebuttable presumption that an energy conservation standard is economically justified if the additional cost to the consumer of the equipment 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

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generate values used to calculate the effect that the energy conservation standards would have on the PBP 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 standard level (thereby supporting or rebutting the results of any preliminary determination of economic justification). The rebuttable presumption payback calculation is discussed in section V.B.1 of this final rule.

IV. Methodology and Discussion of Related Comments

This section addresses the analyses DOE has performed for this rulemaking with regard to CCWs. Separate subsections will address each component of DOE's analyses.

DOE used four analytical tools to estimate the impact of the amended standards. The first tool is a spreadsheet that calculates LCCs and PBPs of potential new energy conservation standards. The second tool includes a model that provides shipments forecasts, and a framework in a spreadsheet that calculates national energy savings and net present value resulting from potential amended energy conservation standards. DOE uses the third spreadsheet tool, the Government Regulatory Impact Model (GRIM), to assess manufacturer impacts.

Additionally, DOE used a fourth analytical tool, the latest version of EIA's National Energy Modeling System (NEMS) for the utility and emissions analyses, to estimate the impacts of energy conservation standards for CCW on air pollutant emissions and on utilities. NEMS is a public domain, multi-sector, partial equilibrium model of the U.S. energy sector.[18] EIA uses NEMS to prepare its Annual Energy Outlook (AEO), a widely known energy forecast for the United States.

A. Market and Technology Assessment

1. Market Assessment

In the March 2014 NOPR, DOE requested information on historical CCW shipments and market share efficiency data, disaggregated by equipment class, for 2012 and 2013, to supplement the data received in response to the framework document. NRDC also requested that DOE provide a breakdown of manufacturer market share within each equipment class. (NRDC, Public Meeting Transcript, No. 30 at pp. 97-99)

AHAM submitted revised data for 2012 and 2013, including total shipments disaggregated by equipment class, shipment-weighted average efficiency by equipment class, and market share efficiency data by equipment class. (AHAM, No. 32, pp. 4-6) AHAM did not provide a breakdown of manufacturer market shares within each equipment class as part of its data submission. Individual manufacturers did not provide such information in their individual comment submissions. DOE is unaware of any

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[18] For more information on NEMS, refer to the DOE, EIA documentation. A useful summary is National Energy Modeling System: An Overview, DOE/EIA-0581(2009), (October 2009) (Available at: http://www.eia.gov/oiaf/aeo/overview/).

publicly available source for this information, and is therefore unable to provide a

breakdown of manufacturer market shares in this final rule analysis.

2. Technology Assessment

In the March 2014 NOPR, DOE presented a table of design options that it

believes represents the most viable options for CCWs to achieve higher efficiencies.

In response to comments received from the framework document, DOE added

temperature-differentiated pricing controls to the list of technology options for

consideration. As explained in the March 2014 NOPR, DOE did not have any

information regarding the degree to which this feature changes the temperature selection

frequencies of end-users, and therefore was not able to consider this technology for

further evaluation in its engineering analysis.

DOE did not receive any additional comments from interested parties regarding

design options for inclusion in the final rule technology assessment. Chapter 3 of the final

rule TSD contains the final table of design options considered by DOE for this

rulemaking analysis.

B. Screening Analysis

Following the development of the initial list of design options, DOE conducts a

screening analysis of each design option based on the following factors: (1) technological

feasibility; (2) practicability to manufacture, install and service; (3) adverse impacts on

equipment utility or equipment availability; and (4) adverse impacts on health or safety. (10 CFR 430, subpt. C, app. A, §§ 4(a)(3) and (4))

As a result of its initial screening analysis, DOE proposed eliminating ozonated laundering and plastic particle cleaning from further consideration for this rulemaking.

ALS supports DOE's decision to remove the following technologies from consideration: ozonated laundering and residential clothes washer design options that DOE determined would provide negligible, if any, energy savings. (ALS, No. 26 at p.2)

DOE received no comments objecting to its proposal to eliminate ozonated laundering and plastic particle cleaning from further consideration in this rulemaking. For the reasons discussed above, DOE eliminated these technologies accordingly in the final analysis conducted for the final rule. Chapter 4 of the final rule TSD provides further details of DOE's screening analysis.

C. Engineering Analysis

1. General Approach

The purpose of the engineering analysis is to characterize the relationship between the incremental manufacturing cost and efficiency improvements of CCWs. DOE used these cost-efficiency relationships as inputs to the PBP, LCC, and national energy savings (NES) analyses. As described in the March 2014 NOPR, DOE conducted the engineering analysis for this rulemaking using the efficiency-level approach

supplemented with a design-option approach. Using the efficiency-level approach, DOE examined the aggregated incremental increases in manufacturer selling price at each of the efficiency levels analyzed. DOE also conducted a reverse-engineering analysis, including testing and teardowns of models at each efficiency level, to identify the incremental cost and efficiency improvement associated with each design option or design option combination, supplementing the efficiency-level approach with a design-option approach as needed. Chapter 5 of the final rule TSD contains a detailed discussion of the engineering analysis methodology.

2. Technologies Unable to be Included in the Analysis

As described earlier, DOE investigated adding temperature-differentiated pricing controls to the list of design options for consideration. Such controls could potentially incentivize energy savings by providing favorable vend pricing for lower-temperature wash/rinse settings. DOE's market analysis confirmed that this option was available on multiple top-loading and front-loading CCW models from multiple manufacturers. However, DOE's test procedure at appendix J2 uses a fixed set of Temperature Use Factors (TUFs), which represent the assumed percentage of time an end-user would select each wash/rinse temperature (i.e., cold, warm, hot) available on the clothes washer. (10 CFR 430, app. J2, table 4.1.1) Because the TUFs in the test procedure are fixed, a clothes washer with temperature-differentiated pricing controls would be tested with the same weightings applied to each wash/rinse temperature selection as an identical clothes washer without temperature-differentiated pricing controls. Therefore, the energy savings of this technology cannot be measured according to the conditions and methods specified

in the DOE clothes washer test procedure. Accordingly, DOE did not analyze this technology option in its NOPR analysis.

ALS supports DOE's decision to remove temperature-differentiated pricing controls from further consideration. (ALS, No. 26 at p. 2) DOE received no comments objecting to its proposal to eliminate temperature-differentiated pricing controls from further consideration in the engineering analysis. For the reasons discussed above, DOE eliminated this technology accordingly in the final analysis conducted for the final rule.

3. Appendix J2 Efficiency Level Translations

DOE proposed baseline and higher efficiency levels based on the MEF_{J2} and IWF metrics as measured using appendix J2. Since current equipment ratings are based on appendix J1 metrics, DOE performed testing on a representative sample of CCW models to determine, for each baseline and higher efficiency level considered in the analysis, the equivalent appendix J2 efficiency levels corresponding to each appendix J1 efficiency level. Chapter 5 of the final rule TSD describes the methodology DOE used to perform the translations between appendix J1 MEF/WF values and appendix J2 MEF_{J2}/IWF values.

4. Baseline Efficiency Levels

As stated in the March 2014 NOPR, DOE used the current energy conservation standards, which became effective January 8, 2013, to characterize the baseline models for both the top-loading and front-loading CCW equipment classes. 79 FR 12301, 12314

(Mar. 4, 2014). ALS supports DOE's proposed baseline efficiency levels for both top-loading and front-loading CCWs. (ALS, No. 26 at p. 2)

5. Front-Loading Higher Efficiency Levels

In the March 2014 NOPR, DOE proposed analyzing the higher efficiency levels shown in Table IV.1 for the front-loading equipment class. 79 FR 12301, 12314 (Mar. 4, 2014).

Table IV.1. Front-Loading Efficiency Levels

Level	Efficiency Level Source	Appendix J1 Metrics		Appendix J2 Metrics	
		MEF	WF	MEF_{J2}	IWF
Baseline	DOE Standard	2.00	5.5	1.65	5.2
1	Consortium for Energy Efficiency (CEE) Tier 2	2.20	4.5	1.80	4.5
2	CEE Tier 3	2.40	4.0	2.00	4.1
3	Maximum Available	2.60	3.7	2.20	3.9

DOE noted in the March 2014 NOPR that it developed its list of front-loading efficiency levels based on a review of CCW equipment currently on the market. Id. DOE confirmed through its market assessment that CCWs are available for purchase at each of the identified efficiency levels. Id.

As described in the March 2014 NOPR, the California IOUs had suggested that DOE include two additional front-loading efficiency levels corresponding to the top two efficiency levels considered during the most recent residential clothes washer rulemaking: 2.60 MEF/3.8 WF and 2.89 MEF/3.7 WF, as measured using appendix J1.

California IOUs, No. 8 at p. 4; 79 FR 12301, 12314 (Mar. 4, 2014). DOE noted that the 2.60 MEF/3.8 WF efficiency level suggested by the California IOUs corresponds closely with the maximum level proposed by DOE of 2.60 MEF/3.7 WF. DOE further explained that it did not believe that the more stringent level of 2.89 MEF/3.7 WF would be appropriate for consideration in this CCW rulemaking because (1) no CCW models are currently available on the market at that efficiency level, and (2) some of the design options that would be required to achieve that efficiency level could negatively impact wash basket size and cycle time.

Based on the results of its market and technology assessment and engineering analysis, DOE tentatively determined that the maximum available efficiency level presented in the March 2014 NOPR represented the maximum efficiency level that is technologically feasible for front-loading CCWs. 79 FR 12301, 12314 (Mar. 4, 2014).

AHAM and Whirlpool support DOE's decision not to evaluate the efficiency levels considered in the residential rulemaking in the commercial rulemaking context. (AHAM, No. 23 at p. 4; Whirlpool, No. 28 at p. 1) ALS supports DOE's proposed efficiency levels for front-loading CCWs. (ALS, No. 26 at p. 2)

DOE received no additional comments objecting to the front-loading efficiency levels proposed for analysis in the March 2014 NOPR. Therefore, for the reasons discussed above, DOE maintained these efficiency levels for the final rule analysis.

6. Top-Loading Higher Efficiency Levels

In the March 2014 NOPR, DOE proposed analyzing the higher efficiency levels shown in Table IV.2 for the top-loading equipment class. 79 FR 12301, 12315 (Mar. 4, 2014).

Table IV.2. Top-Loading Efficiency Levels

Level	Efficiency Level Source	Appendix J1 Metrics		Appendix J2 Metrics	
		MEF	WF	MEF_{J2}	IWF
Baseline	DOE Standard	1.60	8.5	1.15	8.9
1	Gap Fill	1.70	8.4	1.35	8.8
2	Maximum Available	1.85	6.9	1.55	6.9

DOE developed its list of top-loading efficiency levels based on a review of CCW equipment currently on the market. DOE confirmed through its market assessment that CCWs are available for purchase at each of the identified efficiency levels.

As described in the March 2014 NOPR, the California IOUs had suggested that DOE analyze higher efficiency levels for top-loading CCWs corresponding to the higher efficiency levels that DOE had analyzed during the most recent residential clothes washer rulemaking. 79 FR 12301, 12315 (Mar. 4, 2014). The California IOUs recommended levels ranging from 1.72MEF/8.0WF to 2.47MEF/3.6WF at the residential clothes washer max-tech level, as measured using appendix J1. (California Utilities, No. 8 at p. 4)

In the March 2014 NOPR, DOE explained that it did not believe that more stringent levels above the identified max-tech level would be appropriate for consideration in this CCW rulemaking, for many of the same reasons DOE gave in the front-loading efficiency levels section. 79 FR 12315−12316. First, no CCW models were available on the market above 1.85MEF/6.9 WF, as measured using appendix J1. Second, some of the design options that would be required to achieve those higher efficiency levels, such as larger wash baskets and longer cycle times, could be perceived by the machine owners and/or end-users as negatively impacting equipment utility. Furthermore, the max-tech residential clothes washers use a circular wash plate instead of an agitator, requiring manufacturers to instruct users not to load garments directly over the center of the wash plate, so that the center of the wash plate remains visible when loaded. DOE believes these specialized loading instructions could not be effectively implemented in a commercial laundry environment such that the wash performance of the unit would be maintained.

Based on the results of its market and technology assessment and engineering analysis, DOE tentatively determined that the maximum available efficiency level presented in the March 2014 NOPR represented the maximum efficiency level that is technologically feasible for top-loading CCWs.

AHAM and Whirlpool support DOE's decision not to evaluate the efficiency levels considered in the residential rulemaking in the commercial rulemaking context. (AHAM, No. 23 at p. 4; Whirlpool, No. 28 at p. 1) ALS supports DOE's proposed

efficiency levels for top-loading CCWs. ALS also supports DOE's determination that the technologies, designs and operating characteristics of the maximum efficiency top-loading residential clothes washers are not transferrable to CCWs. (ALS, No. 26 at pp. 2-3)

The California IOUs recommend that DOE evaluate one additional efficiency level for top-loaders, which would utilize the same design features from Efficiency Level 1 (EL1), in addition to improved motor efficiency. (California IOUs, No. 27 at p. 4) Similarly, the Joint Commenters stated that if DOE determines that adopting Efficiency Level 2 (EL2) for top-loaders is not justified, DOE should consider an intermediate level between EL1 and EL2, based on the current CCWs available on the market. (Joint Commenters, No. 29 at p. 5)

DOE investigated the feasibility of analyzing one additional top-loading efficiency level between EL1 (1.70 MEF / 1.35 MEF_{J2}) and EL2 (1.85 MEF / 1.55 MEF_{J2}) by considering improved motor efficiency. As shown in chapter 7 of the final rule TSD, DOE determined that the typical top-loading CCW at EL1 uses 0.21 kWh/cycle of machine electrical energy, whereas the typical top-loading CCW at EL2 uses 0.10 kWh/cycle of machine electrical energy. DOE performed testing and teardowns on a range of top-loading CCWs that are built using the same platform construction as the typical EL1 clothes washer. Across the range of models tested, machine electrical energy usage varied from 0.18 to 0.22 kWh/cycle. DOE did not identify any commercially available motors with lower energy usage (i.e. higher-efficiency) that are designed for use

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in this platform style. At EL1, reducing machine electrical energy usage from 0.22 to 0.18 kWh/cycle would increase MEF_{J2} from 1.35 to 1.37. DOE does not consider this magnitude of improvement to be significant enough to warrant an added efficiency between EL1 and EL2. DOE did not identify any other incremental improvements that could be made to the EL1 equipment platform, either independently or in combination with a more efficient motor design, to similarly boost its efficiency without requiring a major design overhaul.

As discussed in greater detail in chapter 5 of the final rule TSD, DOE research suggests that improving efficiency beyond EL1 requires a significant overhaul to the design platform of a top-loading CCW. In other words, the overall system design on which the baseline unit is built can be incrementally improved (while maintaining adequate performance for the end-user) up until EL1, but at that level, the equipment platform is "maxed out," and further improvements require a significant overhaul of the entire design. Because the overall designs are so significantly different, components from the higher-efficiency platform are not interchangeable with components from the lower-efficiency platform. DOE observed a similar shift in platforms with top-loading residential clothes washers between 1.72 MEF and 1.80 MEF,[19] which DOE notes is roughly the same efficiency level transition observed for top-loading CCWs.

For these reasons, DOE has determined that further improving the EL1 equipment platform using low-cost design options and different motors would not be technologically

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[19] See chapter 5 of the TSD accompanying the residential clothes washer direct final rule (May 31, 2012, 77 FR 32319), docket number EERE-2008-BT-STD-0019. Available at: http://www.regulations.gov/#!docketDetail;D=EERE-2008-BT-STD-0019.

feasible. Therefore, for the final rule analysis, DOE maintained the top-loading efficiency levels as proposed in the March 2014 NOPR.

7. Impacts on Cleaning Performance and Cycle Time

DOE conducted performance testing to quantitatively evaluate potential impacts on cleaning performance, rinsing performance, and solid particle removal as a result of higher standard levels. As described in greater detail in chapter 5 of the final rule TSD, DOE tested a representative sample of CCWs at each efficiency level using AHAM's HLW-1-2010 test procedure. Specifically, DOE performed the soil/stain removal, rinsing effectiveness, and sand removal tests provided in HLW-1-2010.

For each clothes washer, DOE tested the maximum load size specified in appendix J2, rounded to the nearest pound, using the warm wash/cold rinse cycle. Manufacturers indicated that the maximum load size is particularly relevant to CCW owners and operators because end-users often overload the machines in order to limit their total laundry cost. DOE notes that the warm wash/cold rinse temperature selection has the highest usage factor in appendix J2. The test results indicate that units meeting the proposed new standard levels are capable of providing washing performance, rinsing performance, and solid particle removal results equivalent to current baseline equipment.

As discussed in the March 2014 NOPR, DOE consulted with a number of manufacturers who indicated that AHAM HLW-1-2010 would be the most appropriate test method to determine relative cleaning performance across different CCW models. DOE recognizes that AHAM HLW-1-2010 is typically used to measure the performance

of residential clothes washers, but given the similarities in physical construction, DOE believes the test procedure is appropriate for CCWs. DOE also acknowledges that the CCW industry has not agreed upon acceptable ranges of performance characteristics; therefore, DOE's test results should be used for relative comparison purposes only.

AHAM stated that in addition to soil and stain removal, rinsing effectiveness, and sand removal, DOE should evaluate fabric care by performing the mechanical action test in HLW-1-2010. (AHAM, No. 23 at pp. 4) AHAM explained that longevity of clothing is an important performance measure that could potentially be impacted by more stringent efficiency/water levels. Id. AHAM also responded to DOE's discussion in the March 2014 NOPR TSD, in which DOE indicated that it believes that using less wash water in high-efficiency models increases the concentration of detergent during the wash portion of the cycle, thus enhancing stain removal and leading to higher efficiency top-loading CCWs achieving better total cleaning scores. (March 2014 NOPR TSD, chapter 5, pp. 21-22) AHAM noted that it is not necessarily true that a higher concentration of detergent will result in better cleaning performance. AHAM explained that more detergent can actually result in worse performance, particularly if the consumer does not use the proper detergent. In addition, AHAM claimed that higher detergent concentrations are harder to remove, which can result in residual detergent and the gradual greying of the cloth over time. AHAM added that some of the detergent chemicals that can remain in clothes can build up and gradually break down fabric. (AHAM, No. 23 at p. 4) Finally, AHAM requested that DOE further address the front-loading test results that indicated a general

trend of higher efficiency levels resulting in reduced cleaning performance scores. (AHAM, No. 23 at pp. 4−5)

ALS supports AHAM's comments regarding consumer utility and performance. (ALS, No. 26 at p. 2) ALS stated that the standards proposed in the March 2014 NOPR would not result in further lessening of utility and performance beyond the CCW equipment offerings. (ALS, No. 26 at pp. 2, 4) However, ALS also claims that more stringent CCW standards would result in a reduction of hot water consumption and total water consumption. ALS further commented that it takes four elements (thermal energy, mechanical energy, chemical energy and adequate time) to properly clean clothes to meet consumer expectations, and when thermal energy is depleted or nearly-depleted from the mix, the performance suffers. ALS added that thermal energy cannot be replaced by the remaining three elements. (ALS, No. 26 at pp. 2−3)

NRDC requests that DOE make available the actual integers that were the result of the cycle time tests, since the cycle time results were displayed graphically in the March 2014 NOPR. NRDC also requests that DOE elaborate on why it viewed the cycle time of one of the top-loading units as an outlier. (NRDC, Public Meeting Transcript, No. 30 at pp. 133−134)

DOE recognizes that mechanical action is an important performance measure that could be impacted by higher efficiency standards. For example, if higher efficiency standards require lower hot water temperatures to be used (i.e. less thermal energy), the

clothes washer may need to "compensate" for this by increasing the amount of

mechanical agitation performed on the clothing (i.e. more mechanical energy). Based on

interviews with manufacturers, and comments from interested parties described above,

DOE believes that the amended standards established by the final rule will not have a

detrimental impact on mechanical action performance levels or limit selection beyond

CCWs currently available on the market.

As described in further detail in chapter 5 of the final rule TSD, DOE's test results

indicate that a front-loading CCW at the amended standard level (EL2, 2.00 MEF_{J2}) can

provide the same cleaning performance as CCWs available at EL1 (1.80 MEF_{J2}). Within

the sample of CCWs that DOE tested, the results at EL3 (2.20 MEF_{J2}) demonstrated

lower (worse) cleaning performance than the best equipment available at EL1 and EL2.

At this point in time, DOE test results are unable to demonstrate that CCWs reaching the

amended standard level at EL3 could provide equivalent cleaning performance to CCWs

available at EL1. However, DOE notes that the current max-tech cleaning performance

levels could improve as front-loading CCW technology continues to evolve and improve.

Due to the small number of manufacturers of CCWs, equipment offerings, and the

number of units tested, DOE does not provide the numerical values associated with the

performance tests presented in chapter 5 of the final rule TSD.

In the March 2014 NOPR, DOE stated the top-loading cycle times for the

maximum load size ranged from 29 to 31 minutes, with an average of 30 minutes, which

excluded one outlier top-loading model with a cycle time of 50 minutes. 77 FR 12301, 12309. Based on conversations with CCW manufacturers, DOE believes that a cycle time range of 30 to 35 minutes is within the typical range of acceptable cycle times for coin-operated laundry owners and multi-family housing laundry operators.

DOE confirms its prior conclusion that CCW units meeting the amended standard levels established by the final rule are capable of providing equivalent consumer-relevant performance as compared to current baseline equipment.

D. Markups Analysis

The markups analysis develops appropriate markups in the distribution chain to convert the estimates of manufacturer selling price derived in the engineering analysis to customer prices. ("Customer" refers to purchasers of the equipment being regulated.) DOE calculates overall baseline and incremental markups based on the equipment markups at each step in the distribution chain. The incremental markup relates the change in the manufacturer sales price of higher efficiency models (the incremental cost increase) to the change in the customer price.

For the three key CCW market segments − laundromats, private multi-family housing, and large institutions − data indicate that an overwhelming majority of CCWs are sold through either distributors or route operators. For this final rule, DOE used the same distribution channels as in the January 2010 final rule (10 CFR 431.152): manufacturer to distributor to owner/lessee, and manufacturer to route operator to

owner/lessee. For purposes of developing the markups for CCWs, DOE estimated that the markups and the resulting consumer products prices determined for the distribution channel involving distributors would be representative of the prices paid by customers acquiring their equipment from route operators.

DOE based the distributor markups for CCWs on financial data for the sector Machinery, Equipment and Supplies Merchant Wholesalers from the 2007 U.S. Census Business Expenses Survey (BES), which is the most recent available survey.[20] This sector includes the subsector Laundry Machinery, Equipment, and Supplies, Commercial, Merchant Wholesalers, which specifically sells CCWs. DOE calculated overall baseline and incremental markups based on the equipment markups at the intermediate step in the distribution chain. The incremental markup relates the change in the manufacturer sales price of higher efficiency models (the incremental cost increase) to the change in the customer price. Chapter 6 of the final rule TSD provides further detail on the estimation of markups.

E. Energy and Water Use Analysis

The energy and water use analysis provides estimates of the annual energy and water consumption of CCW units at the considered efficiency levels. DOE uses these values in the LCC and PBP analyses and in the NIA. DOE developed energy and water consumption estimates for all equipment classes analyzed in the engineering analysis.

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[20] U.S. Census Bureau, *Economic Census, Business Expenses Survey, Wholesale Trade, Machinery, Equipment and Supplies Merchant Wholesalers,* 2007, *available at* http://www.census.gov/econ/ (last accessed November 30, 2014).

The analysis seeks to capture the range of CCW use in the field.

The DOE test procedure uses a single value for number of cycles, which is based on residential use. For the energy and water use analysis, DOE established an appropriate range of usage specific to CCWs in the field. Because the predominant applications of CCWs are in multi-family buildings and laundromats, DOE focused on these two building applications to determine appropriate values for number of CCW cycles per year. DOE acknowledges that the "other commercial applications" category in the statutory definition would include applications other than coin-operated laundry and multi-family housing laundry. However, DOE is not aware of any data indicating the prevalence of CCWs in other applications, such as on-premise laundries or in the hospitality industry. Furthermore, DOE is not aware of any data indicating how the usage patterns of such equipment would compare to the usage patterns of coin-operated and multi-housing laundries. Therefore, DOE has no information on which to base a separate analysis for "other commercial applications." Further, discussions with manufacturers have supported DOE's understanding that applications other than coin-operated laundries and multi-family housing laundries constitute a small minority of installations of covered CCWs. For these reasons, DOE's analysis for this final rule focuses on the coin-operated laundry and multi-housing laundry applications, which represent the large majority of CCW usage.

DOE included all available studies on CCW usage to establish representative usage. For the final rule analysis, DOE relied on several research studies to arrive at a

range of annual use cycles. DOE found that the average number of cycles for multi-family and laundromat applications were 1,074 and 1,483, respectively. DOE received this data from many entities, including the Multi-Housing Laundry Association (MLA), Coin Laundry Association (CLA), Southern California Edison, and San Diego Gas and Electric. Chapter 7 of the final rule TSD describes the sources DOE received from these entities in detail.[21]

To determine the energy and water use per cycle, DOE used the new appendix J2 test procedure, as described in the paragraphs that follow. 77 FR 13887 (Mar. 7, 2012). DOE determined the total weighted per-cycle water consumption for all wash cycles based on test data performed using the appendix J2 test procedure. The energy use analysis for the final rule consists of three related parts – the machine energy use, the dryer energy use and the water heating energy use.

DOE determined the per-cycle machine energy use based on test data performed using the appendix J2 test procedure. The units selected for tests across efficiency levels varied in tub volume, so DOE adjusted the annual number of cycles to maintain consistent loading across all tub volumes. In their comments, the California IOUs asked why DOE assumed, in the case of max-tech front-loading washers, that only 50 percent of consumers would fill the tub to capacity instead of assuming that customers would self-select an appropriately sized washer in a laundromat and fill the washer to capacity. (CA IOU, Public Meeting Transcript, No. 30, at p. 84-87) DOE based this assumption on

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[21] DOE did not rely on the Commercial Building Energy Consumption Survey (CBECS) conducted by DOE's Energy Information Administration (EIA) because energy and water consumption is not specified for buildings identified with laundry facilities in the CBECS dataset.

the theory that if the standard were to require max-tech front-loading washers, units with large tub volume would be more common (or be the only option), so consumers would not fill the tub to capacity in many cases.

DOE determined the per-cycle clothes drying energy use by using the remaining moisture content (RMC) values for each efficiency level as measured using the appendix J2 test procedure. The energy required to remove moisture from clothes, i.e., the dryer energy, represents the estimated energy that would be required to dry the clothing in a clothes dryer after completion of the wash cycle. DOE includes this as one of the factors in the MEF equation as a way to give "credit" to clothes washers with more effective final spin sequences, which results in less drying time required in the clothes dryer. The estimated drying energy is a significant component of total clothes washer energy consumption.

DOE's current approach for quantifying reduction in dryer energy use from an increase in CCW efficiency is based on the drying energy equation in appendix J2, which reflects residential clothes washer and dryer usage patterns. DOE acknowledges that operating conditions for commercial dryers may differ from the conditions of residential dryers, but DOE did not find any data to support changing the dryer energy use calculation. See chapter 7 and appendix 7-A of the final rule TSD for discussion.

DOE determined the per-cycle water-heating energy use by first determining the total per-cycle energy use (the clothes container volume divided by the MEF_{J2}) and then

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subtracting from it the per-cycle clothes-drying and machine energy.

F. Life-Cycle Cost and Payback Period Analysis

In determining whether an energy efficiency standard is economically justified, DOE considers the economic impact of potential standards on customers. The effect of new or amended standards on customers usually includes a reduction in operating cost and an increase in purchase cost.

The LCC is the total customer expense over the life of the equipment, consisting of equipment and installation costs plus operating costs over the lifetime of the equipment (expenses for energy use, maintenance, and repair). DOE discounts future operating costs to the time of purchase using customer discount rates. The PBP is the estimated amount of time (in years) it takes customers to recover the increased total installed cost (including equipment and installation costs) of a more efficient type of equipment through lower operating costs. DOE calculates the PBP by dividing the change in total installed cost due to a standard by the change in annual operating cost that results from the standard.

DOE typically develops a customer sample for determining PBPs and LCC impacts. However, because EIA's Commercial Building Energy Consumption Survey (CBECS) does not provide the necessary data to develop a customer sample for CCWs, DOE established the variability in energy and water use by defining the variability in the

use by consumers (cycles per day) of the equipment. DOE characterized the variability in energy and water pricing by randomly assigning CCWs to regions with different energy and water prices.

DOE expresses the LCC and PBP results as the number of units experiencing economic impacts of different magnitudes. DOE models both the uncertainty and the variability in the inputs to the LCC and PBP analysis using Monte Carlo simulation and probability distributions.[22] As a result, the LCC and PBP results are displayed as distributions of impacts compared to the base case, which reflects the market in the absence of amended energy conservation standards, including the purchase of equipment that exceeds the current energy conservation standards.

DOE conducted LCC and PBP analysis separately for two applications in each of the equipment classes: (1) laundromats and (2) multi-family buildings. These applications have different usage characteristics.

Inputs to the LCC and PBP analysis are categorized as: (1) inputs for establishing the total installed cost and (2) inputs for calculating the operating costs. The following sections contain comments on the inputs and key assumptions of DOE's LCC and PBP analysis and explain how DOE took these comments into consideration.

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

1. Equipment Costs

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

For the March 2014 NOPR (79 FR 12301), to project future CCW prices, DOE examined the commercial laundry and dry-cleaning machinery Producer Price Index (PPI) between 1993 and 2013. This index, adjusted for inflation, shows a rising trend. However, the inflation adjusted trend for household laundry equipment (which more closely matches CCW units because this rulemaking includes mostly residential-style CCW units and excludes the larger commercial laundry equipment) shows a long-term declining trend (see appendix 10-D of the final rule TSD). Given the uncertainty, DOE decided to take a conservative approach and used a constant price for the default case for CCW units.

In response to DOE's approach in the March 2014 NOPR, AHAM commented that DOE should not rely on experience curves for the same reasons that it expressed in comments for the microwave oven rulemaking. (AHAM, No. 23 at p. 5) DOE did not use experience curves for the March 2014 NOPR. For the final rule, it retained the approach used for the March 2014 NOPR. For the NIA, DOE also analyzed the sensitivity of results to alternative price forecasts. (See section IV.H)

In the previous CCW rulemaking (10 CFR 431.152), DOE based the LCC

analysis on the assumption that any increase in the cost of a more efficient unit that is

leased gets passed on to the building owners through the contracting arrangements

between route operators and building owners. The assumption that any increase in the

cost of a more efficient unit that is leased gets passed on is consistent with what one

would expect in a competitive business environment. To the extent that costs are not

passed on, the LCC savings for building owners from higher-efficiency CCWs would be

larger than indicated in the final rule.

2. Installation Costs

Installation costs include labor, overhead, and any miscellaneous materials and

parts. For the final rule, DOE used data from the 2013 RS Means <u>Mechanical Cost Data</u>[23]

on labor requirements to estimate installation costs for CCWs. DOE estimated that

installation costs do not increase with equipment efficiency. ALS suggests including the

cost of concrete risers in place of metal risers for front-loading units as a more recent

trend in laundromats. (ALS, No. 26, at p. 7) However, since DOE does not have

estimates on the cost of these concrete risers, the installation costs do not include it.

Furthermore, since the cost of the risers would be common to the baseline unit as well as

more efficient units, its exclusion does not have any impact on the cost-effectiveness

calculation.

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[23] RS Means, RS Means Mechanical Cost Data, 36st Annual Edition. 2013.

3. Unit Energy Consumption

The calculation of annual per-unit energy consumption at each considered efficiency level is described in section IV.E.

4. Energy and Water Prices

DOE used commercial sector energy and water prices for both multi-family and laundromat applications. DOE assumes that common area laundry facilities are mainly found in large multi-family buildings that receive commercial energy and water rates.

a.   Energy Prices

DOE derived average electricity and natural gas prices for 27 geographic areas. DOE estimated commercial electricity prices for each of the 27 areas based on 2012 data from EIA Form 861, Annual Electric Power Industry Report.[24] DOE first estimated an average commercial price for each utility, and then calculated an average price for each area by weighting each utility with customers in an area by the number of commercial customers served in that area.

DOE estimated average commercial natural gas prices in each of the 27 geographic areas based on 2012 data from the EIA publication Natural Gas Monthly.[25] DOE calculated an average natural gas price for each area by first calculating the average prices for each State, and then calculating a regional price by weighting each State in a

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[24] 2012 EIA Form 861, Annual Electric Power Industry Report, available at http://www.eia.gov/electricity/data/eia861/ (last visited Nov. 20, 2014).

[25] EIA, Natural Gas Monthly 2012 Report, available at http://www.eia.gov/naturalgas/monthly/ (last visited Nov. 20, 2014).

region by its population.

To estimate the trends in electricity and natural gas prices, DOE used price forecasts in <u>AEO 2014</u>[26]. To arrive at prices in future years, DOE multiplied the average prices described above by the forecast of annual average changes in national-average commercial electricity and natural gas prices. Because the AEO forecasts prices only to 2040, DOE used the average rate of change between 2025 and 2040 to estimate the price trends beyond 2040.

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

b.   Water and Wastewater Prices

DOE obtained commercial water and wastewater price data from the Water and Wastewater Rate Survey conducted by Raftelis Financial Consultants (RFC) and the American Water Works Association (AWWA).[27] The survey covers approximately 290 water utilities and 214 wastewater utilities from 44 States and the District of Columbia, with water and wastewater utilities analyzed separately. The samples that DOE obtained of the water and wastewater utilities are not large enough to calculate regional prices for the group of states. Hence, DOE calculated average values at the Census region level

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[26] DOE-EIA, <u>Annual Energy Outlook 2014 with Projections to 2040</u> (available at:
<u>http://www.eia.gov/forecasts/aeo/</u>).
[27] Raftelis Financial Consultants, Inc. 2012 RFC/AWWA Water and Wastewater Rate Survey, available at
<u>http://www.awwa.org/portals/0/files/publications/documents/samples/2012waterandwastewaterratesurvey.p
df</u>.

(Northeast, South, Midwest, and West) by weighting each State in a region by its population.

To estimate the future trend for water and wastewater prices, DOE used data on the historic trend in the national water price index (U.S. city average) provided by the Labor Department's Bureau of Labor Statistics (BLS)[28], adjusted for inflation. In keeping with prior practice, DOE extrapolated a future trend based on the linear growth from 1970 to 2012. However, DOE did not use a linear fit after 2012 because doing so would have resulted in a price decline in the near-term. This does not seem plausible because historically, water prices have not declined in the country. Therefore, rather than use the extrapolated trend to forecast the near-term trend after 2012, DOE pinned the annual price to the value in 2012 until 2020. Beyond 2020, DOE used the extrapolated trend to forecast prices.

5. Repair and Maintenance Costs

Repair costs are associated with repairing or replacing components that have failed in the appliance; maintenance costs are associated with maintaining the operation of the equipment. For the March 2014 NOPR (79 FR 12301), DOE included increased repair costs for higher efficiency CCWs based on an algorithm developed by DOE for central air conditioners and heat pumps. This algorithm calculates annualized repair and maintenance costs by dividing half of the equipment retail price over the equipment

[28] U.S. Department of Labor-Bureau of Labor Statistics, Consumer Price Indexes, Item: Water and sewerage maintenance, Series Id: CUUR0000SEHG01, U.S. city average (not seasonally adjusted), 2013. Washington, DC. Available at http://www.bls.gov/cpi/home.htm#data

lifetime. (See Chapter 8 of the final rule TSD for details).[29] DOE requested industry input to estimate changes in repair and maintenance costs associated with an increase in efficiency of CCW units. ALS stated that their experience under the 3-year warranty period shows that front-loading washers cost 27 percent more to repair than top-loading units. (ALS, No. 26, at p.4) Since the potential increase in repair cost is in comparison to top-loading units rather than to more-efficient units in each equipment class, and DOE did not receive new input from other manufacturers specific to repair and maintenance costs, it continued with the approach used in the March 2014 NOPR for this final rule. This approach shows rising maintenance and repair costs as efficiency increases.

6. Lifetime

Equipment lifetime is the age at which the equipment is retired from service. In the March 2014 NOPR (79 FR 12301), DOE used a variety of sources to establish low, average, and high estimates for equipment lifetime in years. DOE characterized CCW lifetime with a Weibull probability distribution. ALS generally agrees with DOE on equipment lifetime characterization, although ALS believes that newer CCW models may have shorter lifetimes. (ALS, No. 26 at p. 4) Since DOE could not find any data to validate or quantify the potential decrease in average lifetimes of newer CCW models, it did not change the lifetime assumption for the newly shipped units. For this final rule, DOE updated its data sources (as described in chapter 8 of the final rule TSD), and calculated the same average CCW lifetimes (11.3 years for multi-family building

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[29] U.S. Department of Energy-Energy Efficiency and Renewable Energy, Technical Support Document: Energy Efficiency Standards for Consumer Products: Residential Central Air Conditioners and Heat Pumps Including: Regulatory Impact Analysis. Chapter 5, Life-Cycle Cost and Payback Analysis, May, 2002. Washington, D.C. Available at http://www1.eere.energy.gov/buildings/appliance_standards/residential/ac_central_1000_r.html

applications and 7.1 years for laundromat applications) that DOE used in the March 2014

NOPR. DOE used the same lifetime for each equipment class.

7. Discount Rate

The discount rate is the rate at which future expenditures are discounted to

estimate their present value. The cost of capital is commonly used to estimate the present

value of cash flows to be derived from a typical company project or investment. Most

companies use both debt and equity capital to fund investments, so the cost of capital is

the weighted-average cost to the firm of equity and debt financing. DOE uses the capital

asset pricing model (CAPM) to calculate the equity capital component, and financial data

sources to calculate the cost of debt financing.

In the March 2014 NOPR (79 FR 12301), DOE estimated the weighted-average

cost of capital of publicly traded firms in the key sectors that purchase CCWs (i.e.,

personal services, educational services, hotels, and R.E.I.T – building and apartment

complex owners).[30] For the final rule, DOE updated its data sources for calculating this

cost. More details regarding DOE's estimates of customer discount rates are provided in

chapter 8 of the final rule TSD.

8. Compliance Date

DOE calculated the LCC and PBP for all customers as if each were to purchase

new equipment in the year that compliance with amended standards is required. EPCA,

as amended, directs DOE to publish a final rule amending the standard for the equipment

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[30] Ibbotson Associates, Cost of Capital 2009 Yearbook. 2009. Ibbotson Associates: Chicago, IL

by January 1, 2015. Any amended standards would apply to CCWs manufactured three years after the date on which the final amended standard is published. (42 U.S.C. 6313(e)(2)(B)) Therefore, for purposes of its analysis, DOE used 2018 as the first year of compliance with amended standards.

9. Base Case Efficiency Distribution

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

For the final rule, DOE utilized the shipment-weighted efficiency distributions between 2010 and 2013 (submitted by AHAM) to establish the base-case efficiency distributions. Because these data are not comprehensive enough to capture any definite trend in efficiency, DOE used the 2013 distribution to represent the market in the compliance year (2018). DOE found that the distribution based on ENERGY STAR qualified equipment matched closely with the data submitted by AHAM.[31] Table IV.3 presents the market shares of the efficiency levels in the base case for CCWs. See chapter

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[31]See U.S. Environmental Protection Agency, ENERGY STAR Certified Commercial Clothes Washer Models, available at https://data.energystar.gov/Active-Specifications/ENERGY-STAR-Certified-Commercial-Clothes-Washers/9g6r-cpdt (last accessed Nov. 20, 2014).

8 of the final rule TSD for further details on the development of CCW base-case market shares.

Table IV.3. Commercial Clothes Washers: Base Case Efficiency Distribution

Top-Loading				Front-Loading			
Standard Level	MEF_{J2}	IWF	Market Share	Standard Level	MEF_{J2}	IWF	Market Share
Baseline	1.15	8.9	62.11%	Baseline	1.65	5.2	0%
1	1.35	8.8	26.7%	1	1.80	4.5	31%
2	1.55	6.9	11.3%	2	2.00	4.1	69%
				3	2.20	3.9	0%

10. Payback Period Inputs

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

11. Rebuttable-Presumption Payback Period

EPCA establishes a rebuttable presumption that a standard is economically justified if the Secretary finds that the additional cost to the customer of purchasing equipment 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. For each considered efficiency level, DOE determines the value of the first year's energy savings by calculating the quantity of those savings in accordance with the applicable DOE test procedure, and multiplying that amount by the average energy price forecast for the year in which compliance with the amended standards would be required.

G. Shipments Analysis

DOE uses projections of equipment shipments to calculate the national impacts of standards on energy use, NPV, and future manufacturer cash flows. DOE develops shipment projections based on historical data and an analysis of key market drivers for each equipment. Historical shipments data are used to build up an equipment stock and also to calibrate the shipments model.

Table IV.4 summarizes the approach and data DOE used to derive the inputs to the shipments analysis for the final rule. DOE projected CCW shipments (for both equipment classes) for the new construction and replacement markets, and also accounted for non-replacement of retired units.

Table IV.4. Approach and Data Used to Derive the Inputs to the Shipments Analysis

Inputs	Approach
Number of Equipment Classes	Two equipment classes: top-loading washers and front-loading washers. Shipments forecasts established for all CCWs and then disaggregated into the two equipment classes based on the market share of top- and front-loading washers.
New Construction Shipments	Determined by multiplying multi-housing forecasts by forecasted saturation of CCWs for new multi-housing. Multi-housing forecasts with AEO 2014. Verified frozen saturations with data from the U.S. Census Bureau's American Housing Survey (AHS) for 1997–2011.
Replacements	Determined by tracking total equipment stock by vintage and establishing the failure of the stock using retirement functions from the LCC and PBP analysis. Retirement functions revised to be based on Weibull lifetime distributions.
Retired Units not Replaced (i.e., non-replacements)	Used to calibrate shipments model to historical shipments data. Froze the percentage of non-replacements at 31.6 percent for the period 2012─2047 to account for the increased saturation rate of in-unit washers in the multi-family stock between 2000 and 2011 timeframe shown by the AHS.
Historical Shipments	Data sources include AHAM data submittal, Appliance Magazine, and U.S. Bureau of Economic Analysis' quantity index data for commercial laundry. Relative market shares of the two equipment applications, common-area laundry facilities in multi-family housing and laundromats, estimated to be 85 and 15 percent, respectively.

For the new construction market, DOE assumed shipments are driven solely by

multi-family construction starts. Implicit in this assumption is the fact that a certain percentage of multi-family residents will need to wash their laundry in either a common-area laundry facility (within the multi-family building) or a laundromat.

For existing buildings replacing broken equipment, the shipments model uses a stock accounting framework. Given the equipment entering the stock in each year and a retirement function based on the lifetime distribution developed in the LCC analysis, the model predicts how many units reach the end of their lifetime in each year. DOE typically refers to new shipments intended to replace retired units as "replacement" shipments. Such shipments are usually the largest part of total shipments.

Historical data show a rise in shipments in the second half of the 1990s followed by a significant drop between1999 and 2002, and a slower decline since then. DOE believes that a large part of the decline was due to growth of in-unit washers in multi-family housing (possibly due to conversions of rental property to condominiums), leading to non-replacement of failed CCWs in common-area laundry facilities.[32] To account for the decline and to reconcile the historical shipments with the accounting model, DOE assumed that every retired unit is not replaced. Starting in 1999 and extending to 2011, DOE estimated the share of retired units that were not replaced (as discussed in chapter 9 of the final rule TSD).

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[32] Data from the American Housing Survey as well as RECS indicate that there has been growth of in-unit washer saturation in the multi-family housing stock over the last 10-15 years. See chapter 9 of the final rule TSD for further discussion.

DOE allocated shipments to each of the two equipment classes based on the current market share of each class. Based on data submitted by AHAM, DOE estimated that top-loading washers comprise 64 percent of the market while front-loading washers comprise 36 percent. DOE implemented change in the market share for the projection period based on the historical trend that shows a gradual market shift towards front-loading units, with the market stabilizing at 52 percent and 48 percent for top-loading and front-loading units, respectively, by 2047. ALS suggested that DOE re-evaluate the front-loading market share increase during the analysis period based on new shipments data for 2012 and 2013 from AHAM. (ALS, No. 26, at p .5) After receiving new shipments data for 2012 and 2013, DOE re-evaluated the historical trends and adjusted the market share estimates accordingly.

DOE implemented a cross-price elasticity to capture the impact of a change in price of one equipment class on the demand of the other equipment class. Due to insufficient data on CCW units, DOE was not able to estimate cross-price impacts on the market share of top-loading and front-loading CCWs and instead relied on its analysis performed for the 2012 residential clothes washer rulemaking.[33] The price impact observed from residential clothes washer data indicate that a 10 percent increase in the price of front-loading washers would lead to a 10.7 percent decrease in top-loading washers' market share, holding other variables constant and measured as changes from the reference case using average values for each variable. This translates to the front-loading cross-price impact (percent change in top-loading market share over percent

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[33] See chapter 9 in Direct Final Rule Technical Support Document, available at
http://www.regulations.gov/#!documentDetail;D=EERE-2008-BT-STD-0019-0047

change in front-loading price) of 1.07. For further details on this estimation, please refer to chapter 9 and appendix 9A of the final rule TSD.

H. National Impact Analysis

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

DOE used an MS Excel spreadsheet model to calculate the energy savings and the national customer costs and savings from each TSL.[34] The NIA calculations are based on the annual energy consumption and total installed cost data from the energy use analysis and the LCC analysis. DOE projected the lifetime energy savings, energy cost savings, equipment costs, and NPV of customer benefits for each equipment class over the lifetime of equipment sold from 2018 through 2047.

DOE evaluated the impacts of potential amended standards for front-loading and top-loading CCW by comparing base-case projections with standards-case projections. The base-case projections characterize energy use and customer costs for each equipment class in the absence of amended energy conservation standards.

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

Table IV.5 summarizes the key inputs for the NIA. The sections following

provide further details, as does chapter 10 of the final rule TSD.

Table IV.5. Inputs for the National Impact Analysis

Input	Description
Shipments	Annual shipments from shipments model.
Compliance date	January 1, 2018.
Base case efficiency	Based on the current market distribution of efficiencies, with the option of a frozen, 1%, and 2% growth in efficiency.
Standards case efficiency	Based on a "Roll up" scenario to establish a 2018 shipment weighted efficiency.
Annual energy and water consumption per unit	Calculated for each efficiency level and equipment class based on inputs from the energy and water use analysis.
Total installed cost per unit	Calculated equipment prices by efficiency level using manufacturer selling prices and weighted-average overall markup values. Installation costs vary in direct proportion to the weight of the equipment.
Electricity and water expense per unit	Annual energy use for each equipment class is multiplied by the corresponding average energy and water and wastewater price.
Escalation of electricity and water prices	AEO 2014 forecasts (to 2040) and extrapolation beyond 2040 for electricity and gas prices. BLS's historical Consumer Price Index for water for projecting the prices beyond 2020.
Electricity site-to-primary energy conversion	A time series conversion factor; includes electric generation, transmission, and distribution losses.
Discount rates	3% and 7% real.
Present year	2014.

1. Efficiency Trends

A key component of DOE's estimates of NES and NPV is the equipment energy and water efficiencies forecasted over time. For the base case, DOE considered the lack of change in the historical trends and assumed that efficiency would remain constant at the 2018 levels derived in the LCC and PBP analysis. DOE provides 1 percent and 2 percent efficiency growth rates as options for sensitivities.

To estimate the impact that standards would have in the year compliance becomes required, DOE used a "roll-up" scenario, which assumes that equipment efficiencies in the base case that do not meet the standard level under consideration would "roll up" to meet the new standard level. Equipment shipments at efficiencies above the standard level under consideration are not affected. In each standards case, the efficiency distributions remain constant at the 2018 levels for the remainder of the shipments forecast period.

2. National Energy and Water Savings

For each year in the forecast period, DOE calculates the national energy and water savings for each standard level by multiplying the shipments of front-loading and top-loading by the per-unit annual energy and water savings. Cumulative energy and water savings are the sum of the annual energy and water savings over the lifetime of all equipment shipped during 2018–2047.

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

DOE converted the site electricity consumption and savings to primary energy (power sector energy consumption) using annual conversion factors derived from the AEO 2014 version of the NEMS. Cumulative primary energy and water savings are the sum of the national energy and water savings for each year in which equipment shipped during 2018–2047 continue to operate.

In response to the recommendations of a committee on "Point-of-Use and Full-Fuel-Cycle Measurement Approaches to Energy Efficiency Standards" appointed by the National Academy of Science, DOE announced its intention to use FFC measures of energy use and greenhouse gas and other emissions in the national impact analyses and emissions analyses included in future energy conservation standards rulemakings. 76 FR 51281 (August 18, 2011). After evaluating the approaches discussed in the August 18,

2011 notice, DOE published a statement of amended policy in the Federal Register in which DOE explained its determination that NEMS is the most appropriate tool for its FFC analysis and its intention to use NEMS for that purpose. 77 FR 49701 (August 17, 2012). The FFC factors incorporate losses in production and delivery in the case of natural gas (including fugitive emissions), and energy used to produce and deliver the fuels used by power plants. The approach used for the Final rule, and the FFC multipliers that were applied, are described in appendix 10-A of the final rule TSD.

3. Net Present Value of Customer Benefit

The inputs for determining the NPV of the total costs and benefits experienced by customers of the considered equipment are: (1) total annual installed cost; (2) total annual savings in operating costs; and (3) a discount factor. DOE calculates the lifetime net savings for equipment shipped each year as the difference between the base case and each standards case in total savings in lifetime operating costs and total increases in installed costs. DOE calculates lifetime operating cost savings over the life of each front-loading and top-loading CCW unit shipped during the forecast period.

a. Total Annual Installed Cost

The total installed cost includes both the equipment price and the installation cost. For each equipment class, DOE calculated equipment prices by efficiency level using manufacturer selling prices and weighted-average overall markup values (weights based on shares of the distribution channels used). Because DOE calculated the total installed cost as a function of equipment efficiency, it was able to determine annual total

installed costs based on the annual shipment-weighted efficiency levels determined in the shipments model.

As noted in section IV.F.1, DOE assumed no change in front-loading and top-loading CCW equipment prices over the analysis period. However, DOE conducted sensitivity analyses using alternative price trends: one in which prices decline after 2013, and one in which prices rise. These price trends, and the NPV results from the associated sensitivity cases, are described in appendix 10-B of the final rule TSD.

b. Total Annual Operating Cost Savings

The per-unit energy and water savings were derived as described in section IV.H.2. To calculate future electricity and natural gas prices, DOE applied the projected trend in national-average commercial electricity and natural gas price from the AEO 2014 Reference case, which extends to 2040. To extrapolate prices beyond 2040, DOE applied the trend between 2030 and 2040 from the AEO 2014 forecast, which yielded a growth rate of 0.5% per annum. To calculate future water prices, DOE applied the historical price trend based on the consumer price index of water, published by the BLS.

In addition, DOE analyzed scenarios that used the energy price projections in the AEO 2014 Low Economic Growth and High Economic Growth cases. These cases have higher and lower energy price trends compared to the Reference case. These price trends and the NPV results from the associated cases are described in appendix 10-C of the final rule TSD.

DOE estimated that annual maintenance costs (including minor repairs) do not vary with efficiency within each equipment class, so they do not figure into the annual operating cost savings for a given standards case. In addition, DOE developed annualized repair costs by dividing half of the equipment retail price over the equipment lifetime as described in Section IV.F.5.

In calculating the NPV, DOE multiplies the net dollar savings in future years by a discount factor to determine their present value. DOE estimates the NPV using both a 3-percent and a 7-percent real discount rate, in accordance with guidance provided by the OMB to Federal agencies on the development of regulatory analysis.[35] The discount rates that determine the NPV are different than the discount rates used in the LCC analysis, which are designed to reflect a consumer's perspective. For instance, the 7-percent real value estimate the average before-tax rate of return to private capital in the U.S. economy, while the 3-percent real value represents the "social rate of time preference," which is the rate at which society discounts future consumption flows to its present value.

I. Customer Subgroup Analysis

In analyzing the potential impacts of new or amended standards, DOE evaluates impacts on identifiable groups (i.e., subgroups) of customers that may be disproportionately affected by a national standard. For the final rule, DOE evaluated

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[35] Office of Management and Budget, Circular A-4, section E (2003), available at http://www.whitehouse.gov/omb/circulars_a004_a-4.

impacts on a small business subgroup using the LCC spreadsheet model. The customer subgroup analysis is discussed in detail in chapter 11 of the final rule TSD.

J. Manufacturer Impact Analysis

1. Overview

DOE performed a Manufacturer Impact Analysis (MIA) to estimate the impacts of amended energy conservation standards on CCW manufacturers. The MIA has both quantitative and qualitative aspects and includes analyses of forecasted industry cash flows, the INPV, investments in research and development (R&D), and manufacturing capital, and domestic manufacturing employment. Additionally, the MIA seeks to determine how amended energy conservation standards might affect manufacturing capacity and competition, as well as how standards contribute to overall regulatory burden. Finally, the MIA serves to identify any disproportionate impacts on manufacturer subgroups.

The quantitative part of the MIA relies primarily on the GRIM, an industry cash flow model with inputs specific to this rulemaking. The key GRIM inputs include data on the industry cost structure, unit production costs, equipment shipments, manufacturer markups, and investments in R&D and manufacturing capital required to produce compliant equipment. The key GRIM outputs are the INPV, which is the sum of industry annual cash flows over the analysis period, discounted using the industry weighted average cost of capital, and the impact to domestic manufacturing employment. The model estimates the impacts of amended energy conservation standards on a given

industry by comparing changes in INPV and domestic manufacturing employment between a base case and the various TSLs in the standards case. To capture the uncertainty relating to manufacturer pricing strategy following amended standards, the GRIM estimates a range of possible impacts under different markup scenarios.

The qualitative part of the MIA addresses manufacturer characteristics and market trends. Specifically, the MIA considers such factors as manufacturing capacity, competition within the industry, the cumulative impact of other regulations, and impacts on manufacturer subgroups. The complete MIA is outlined in chapter 12 of the final rule TSD.

DOE conducted the MIA for this rulemaking in three phases. In Phase One, DOE prepared a profile of the CCW manufacturing industry. DOE used public sources of information to derive preliminary financial inputs for the GRIM (e.g., revenues; materials, labor, overhead, and depreciation expenses; selling, general, and administrative expenses (SG&A); and R&D expenses). Sources of data used in this initial characterization of the CCW manufacturing industry included company filings of form 10-K from the Securities and Exchange Commission (SEC), corporate annual reports, the U.S. Census Bureau's Economic Census, and reports from Dun & Bradstreet.

In Phase Two, DOE prepared an industry cash flow analysis to quantify the impacts of new and amended energy conservation standards. The GRIM uses several factors to determine a series of annual cash flows, starting with the year in which the

standards final rule is published, and extending over a 30-year period following the effective date of the standard. These factors include annual expected revenues, costs of sales, SG&A and R&D expenses, taxes, and capital expenditures. In general, energy conservation standards can affect manufacturer cash flow in three distinct ways by: (1) creating a need for increased investment; (2) raising production costs per unit; and (3) altering revenue due to higher per-unit prices and changes in sales volumes.

In Phase Three of the MIA, DOE interviewed representative manufacturers. During these interviews, DOE discussed engineering, manufacturing, procurement, and financial topics to validate assumptions used in the GRIM and to identify key issues or concerns. The March 2014 NOPR described some of the key issues that manufacturers raised during the interviews. As part of Phase Three, DOE also evaluated subgroups of manufacturers that might be disproportionately impacted by amended standards or that might not be accurately represented by the average cost assumptions used to develop the industry cash flow analysis. In addition to small business manufacturers, such manufacturer subgroups might include low volume manufacturers (LVMs), niche players, and/or manufacturers exhibiting a cost structure that largely differs from the industry average. DOE identified two subgroups for which average cost assumptions may not hold: small businesses and LVMs.

Based on the size standards published by the Small Business Administration (SBA)[36] to be categorized as a small business manufacturer of CCWs under North

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[36] U.S. Small Business Administration, Small Business Size Standards, http://www.sba.gov/content/table-small-business-size-standards (last visited Nov. 21, 2014).

American Industry Classification System (NAICS) 333318, "Other commercial and service industry machinery manufacturing," a commercial laundry equipment manufacturer and its affiliates may employ a maximum of 1000 employees. The 1000-employee threshold includes all employees in a business's parent company and any other subsidiaries. Using this classification in conjunction with a search of industry databases and the SBA member directory, DOE did not identify any manufacturers of CCWs that qualify as small businesses.

Unlike small business manufacturers, there is no employment limit associated with LVMs. Instead, LVMs are characterized by their low overall production volumes relative to their competitors, often associated with specialization within a singular industry. In the industry characterization from Phase One, DOE identified two manufacturers that represent over 90 percent of CCW shipments. DOE categorized one of these manufacturers as a LVM due to the concentration of its business in both laundry and CCWs, relative to its competitors. In 2012, the LVM derived 98 percent of its revenues from the sale of laundry equipment and service parts, while its main competitor derived 30 percent. Within the commercial and residential clothes washer segment, DOE estimates that the LVM derived 88 percent of its washer equipment revenues from the sale of CCWs covered by this rulemaking, while its major competitor is more focused on residential rather than commercial washer production. Because the CCW industry itself is characterized by low total shipments, with less than 200,000 units sold annually in the U.S., the concentration of this manufacturer's business in this industry qualifies them as an LVM. Since the LVM operates at a much smaller scale and does not manufacture

equipment across a broad range of industries, this rulemaking could have

disproportionate impacts on the LVM compared to its large, diversified competitors.

Accordingly, DOE performed an in-depth analysis of the issues relating to the CCW

LVM. The manufacturer subgroup analysis is discussed in greater detail in chapter 12 of

the final rule TSD and in section V.B.2.d of this notice.

2. Government Regulatory Impact Model

DOE uses the GRIM to quantify the changes in industry cash flows resulting from

amended energy conservation standards. The GRIM uses manufacturer costs, markups,

shipments, and industry financial information to arrive at a series of base-case annual

cash flows absent new or amended standards, beginning with the present year, 2014, and

continuing through 2047. The GRIM then models changes in costs, investments,

shipments, and manufacturer margins that may result from new or amended energy

conservation standards and compares these results against those in the base-case forecast

of annual cash flows. The primary quantitative output of the GRIM is the INPV, which

DOE calculates by summing the stream of annual discounted cash flows over the full

analysis period. For manufacturers of CCWs, DOE used a real discount rate of 8.6

percent, the weighted average cost of capital derived from industry financials and

modified based on feedback received during confidential interviews with manufacturers.

The GRIM calculates cash flows using standard accounting principles and

compares changes in INPV between the base case and the various TSLs. The difference

in INPV between the base case and a standards case represents the financial impact of the

amended standard on manufacturers at that particular TSL. As discussed previously,

DOE collected the necessary information to develop key GRIM inputs from a number of

sources, including publicly available data and interviews with manufacturers (described

in the next section). The GRIM results are shown in section V.B.2.a. Additional details

about the GRIM can be found in chapter 12 of the final rule TSD.

a. Government Regulatory Impact Model Key Inputs

Manufacturer Production Costs

Manufacturing higher efficiency equipment is typically more expensive than

manufacturing baseline equipment due to the use of more complex and typically more

costly components. The changes in the manufacturer production costs (MPCs) of the

analyzed equipment can affect the revenues, gross margins, and cash flow of the industry,

making equipment cost data key GRIM inputs for DOE's analysis. For each efficiency

level of each equipment class, DOE used the MPCs developed in the engineering

analysis, as described in chapter 5 of the final rule TSD. Additionally, DOE used

information from its teardown analysis, described in section IV.C to disaggregate the

MPCs into material and labor costs. These cost breakdowns and equipment markups were

validated with manufacturers during manufacturer interviews.

Base-Case Shipments Forecast

The GRIM estimates manufacturer revenues based on total unit shipment

forecasts and the distribution of shipments by efficiency level. Changes in sales volumes

and efficiency mix over time can significantly affect manufacturer finances. For this

analysis, the GRIM uses the NIA's annual shipment forecasts derived from the shipments analysis from 2014, the base year, to 2047, the end of the analysis period. See chapter 9 of the final rule TSD for additional details.

Standards-Case Shipments Forecast

For each standards-case, the GRIM assumes that shipments of CCWs below the projected minimum standard levels would roll up to the standard efficiency levels in response to an increase in energy conservation standards. The GRIM also assumes that demand for high-efficiency equipment is a function of price, and is independent of the standard level. Additionally, the standards case shipments forecast includes a partial shift of shipments from one equipment class to another depending on the standard level, reflecting positive cross-price elasticity of demand, as one equipment class becomes relatively more expensive than the other to produce and for consumers to purchase. A decrease in shipments offsets the relative increase in costs to produce at a given TSL for a given equipment class. See chapter 9 of the final rule TSD for additional details.

Equipment and Capital Conversion Costs

Amended energy conservation standards may cause manufacturers to incur one-time conversion costs to bring their production facilities and equipment designs into compliance with the new standards. For the purpose of the MIA, DOE classified these one-time conversion costs into two major groups: (1) equipment conversion and (2) capital conversion costs. Product conversion costs are investments in research, development, testing, and marketing, focused on making equipment designs comply with

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the new energy conservation standard. Capital conversion expenditures are investments in property, plant, and equipment to adapt or change existing production facilities so that new equipment designs can be fabricated and assembled.

Stranded Assets

If new or amended energy conservation standards require investment in new manufacturing capital, there also exists the possibility that they will render existing manufacturing capital obsolete. If this obsolete manufacturing capital is not fully depreciated at the time new or amended standards go into effect, this would result in the stranding of these assets, and would necessitate the expensing of the residual un-depreciated value.

DOE used multiple sources of data to evaluate the level of equipment and capital conversion costs and stranded assets manufacturers would likely face to comply with amended energy conservation standards. DOE used manufacturer interviews to gather data on the level of investment anticipated at each proposed efficiency level and validated these assumptions using estimates of capital requirements derived from the equipment teardown analysis and engineering model described in section IV.C. These estimates were then aggregated and scaled to derive total industry estimates of equipment and capital conversion costs and to protect confidential information.

In general, DOE assumes that all conversion-related investments occur between the year the final rule is published and the year by which manufacturers must comply

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with the new or amended standards. The investment figures used in the GRIM can be found in section V.B.2 of this notice. For additional information on the estimated equipment conversion and capital conversion costs, see chapter 12 of the final rule TSD.

b. Government Regulatory Impact Model Scenarios

Markup Scenarios

As discussed in section IV.D, manufacturing selling prices (MSPs) include direct manufacturing production costs (i.e., labor, material, overhead, and depreciation estimated in DOE's MPCs) and all non-production costs (i.e. SG&A, R&D, and interest), along with profit. To calculate the MSPs in the GRIM, DOE applied manufacturer markups to the MPCs estimated in the engineering analysis. Modifying these markups in the standards-case yields different sets of impacts on manufacturers. For the MIA, DOE modeled two 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 preservation of gross margin percentage[37] scenario; and (2) a preservation of per-unit operating profits scenario. These scenarios lead to different markups values that, when applied to the MPCs, result in varying revenue and cash flow impacts.

Under the preservation of gross margin percentage scenario, DOE applied a single, uniform "gross margin percentage" markup across all efficiency levels. As production costs increase with efficiency, this scenario implies that the absolute dollar

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[37] "Gross margin" is defined as revenues minus cost of goods sold. On a unit basis, gross margin is selling price minus manufacturer production cost. In the GRIM, markups determine the gross margin because various markups are applied to the manufacturer production costs to reach manufacturer selling price.

markup will increase as well. Based on publicly available financial information for manufacturers of CCWs and comments from manufacturer interviews, DOE assumed the industry average markup on production costs to be 1.285. Because this markup scenario assumes that manufacturers would be able to maintain their gross margin percentage as production costs increase in response to an amended energy conservation standard, it represents a lower bound of industry impacts (higher industry profitability) under an amended energy conservation standard.

In the per-unit operating profits scenario, manufacturer markups are calibrated so that per-unit operating profits in the year after the compliance date of the amended energy conservation standard is the same as in the base-case. Under this scenario, as the cost of production goes up, manufacturers are generally required to reduce the markups on their minimally compliant equipment to maintain a cost-competitive offering. DOE implicitly assumes that the industry can only maintain operating profits after compliance with the amended standard is required. Therefore, the gross margin (as a percentage) shrinks in the standards cases. This markup scenario represents an upper bound of industry impacts (lower profitability) under an amended energy conservation standard.

3. Discussion of Comments

During the March 2014 NOPR public meeting, interested parties commented on the assumptions and results of the March 2014 NOPR analysis TSD. Oral and written comments addressed conversion costs and cumulative regulatory burdens.

a. Cumulative Regulatory Burden

With regards to cumulative regulatory burdens, ALS commented that regulatory burden is increasing at an alarming rate. ALS's cumulative regulatory burdens include the U.S. Consumer Product Safety Improvement Act, Canada Consumer Product Safety Act, UL 2157 / CAN CSA 22.2 No. 169, UL 2158 / CAN CSA 22.2 No. 112, and ANSI Z21.5.1 / CAN CSA 7.1. ALS is also burdened by California legislation imposing reporting and certification of substance usage, California Energy Commission commercial clothes dryer rulemaking, Canada Electro-Magnetic Compliance standards for appliances, European Union directives for Restriction of Hazardous Substances, Waste Electronic and Electronic Equipment, Registration, Evaluation and Authorization of Chemicals, and Energy Using Products. (ALS, No. 26 at p. 6)

DOE has conducted an analysis of cumulative regulatory burden impacts on CCW manufacturers, where DOE considers other DOE conservation standards affecting CCW manufacturers as well as other significant CCW-specific regulations that will take effect 3 years before or after the 2018 compliance date of the amended energy conservation standards for CCWs. While this analysis focuses on the impacts on manufacturers born of other Federal requirements, DOE's analysis also includes other non-Federal regulations that impact CCWs. A full list can be found in chapter 12 of the final rule TSD.

Most manufacturers interviewed also sell equipment to other countries with energy conservation and standby standards. Manufacturers may incur a substantial cost to the extent that there are overlapping testing and certification requirements in other

markets besides the United States. Because DOE has authority to set standards on

equipment sold in the United States, DOE accounts only for domestic compliance costs in

its analysis of cumulative regulatory burdens impacting CCW manufacturers. For more

details, see chapter 12 of the final rule TSD.

b. Conversion Costs

AHAM commented that it supports DOE's analysis regarding the conversion

costs associated with a major platform change. (AHAM, No. 23, p. 3) The California

IOUs ask that DOE provide greater transparency relating to the causes for the significant

increase in conversion costs associated with the shift from EL 1 to EL 2 for top-loading

CCWs. (CA IOUs, No. 27 at p. 3) Additionally, the California IOUs recommend that

DOE conduct a sensitivity analysis of the conversion costs by removing the most

expensive design options and recalculating what the efficiency level would be, as well as

what the impact on the manufacturer would be. (CA IOUs, Public Meeting Transcript,

No. 30 at p. 48-49, 51)

As discussed in section V.2 of this final rule, manufacturers provided high-level

feedback during interviews regarding the design options that would be required at the

max tech efficiency levels for both equipment classes. For top-loading units, the design

options proposed at EL 2 include increased tub capacity, hung suspension, low-profile

(non-traditional) agitator design, and improved motor and transmission efficiency. All of

these upgrades require major platform overhauls and significant changes to

manufacturing capital. In addition, in section V.2, DOE discusses how the existing

efficiency distribution for currently available top-loading units contributes to the increase in industry conversion costs from EL 1 to EL 2 for top-loaders.

Regarding a sensitivity analysis, DOE notes that, in order to reach EL 2 for top-loaders, manufacturers will be required to make all the major changes (as above-specified) at once. As is a characteristic of a distinct "platform," the equipment platform design at EL 2 for top-loaders is so different from that associated with baseline and EL 1 equipment that components from the EL 2 platform design are not interchangeable with components from the baseline and EL 1 platforms. Manufacturers will not be able to make just one or a portion of the major changes because they are designed to function together as a working system (see section VI.C. of this notice).

The California IOUs also request clarification as to why the equipment and capital conversion costs vary significantly between the residential and commercial clothes washer rulemakings. (CA IOU, No. 27 at p. 4)

In reference to the differences in product conversion costs for top-loading units at EL 2 between the residential and commercial clothes washer rulemakings, DOE points to the differences in base case efficiency distributions between the two top-loader markets at the time of the respective standards. In 2012, the residential clothes washer top-loading market was dominated by two major appliance manufacturers, both of which produced products with a range of efficiencies, including EL 2. Thus, these manufacturers had already incurred some product conversion costs in order to get a portion of their products

to EL 2. Conversely, in the top-loading segment of the CCW market, although one of the two major players produces equipment only at the max tech level, the other manufacturer (the LVM) produces only baseline equipment. Thus, product conversion costs are relatively larger for this manufacturer and for the CCW industry as a whole (since product conversion costs are not a function of shipments volumes).

Regarding capital conversion costs, the costs associated with EL 2 for CCWs are much lower than that for residential clothes washers because, unlike product conversion costs, capital conversion costs are somewhat related to the size of the market. Given that the residential clothes washer market is substantially larger than the CCW market, it is logical that the capital conversion costs associated with shifting all lower efficiency equipment to EL 2 are higher.

NRDC stated that DOE should evaluate whether the investments that manufacturers will already be making to meet the 2018 standards for residential top-loaders would effectively reduce the conversion costs to meet EL 2 for commercial top-loaders. (NRDC, No. 29 at p. 5)

Given that the LVM does not currently produce residential clothes washers at EL 2, DOE cannot assume that the LVM will remain in the residential clothes washer market starting in 2018. Thus, DOE must evaluate conversion costs estimates for the CCW industry independently from the 2018 standards for residential clothes washers.

K. Emissions Analysis

In the emissions analysis, DOE estimated the reduction in power sector emissions of carbon dioxide (CO_2), nitrogen oxides (NO_x), sulfur dioxide (SO_2), and mercury (Hg) from potential energy conservation standards for CCWs. In addition, DOE estimated emissions impacts in production activities (extracting, processing, and transporting fuels) that provide the energy inputs to power plants. These are referred to as "upstream" emissions. Together, these emissions account for the FFC. In accordance with DOE's FFC Statement of Policy (76 FR 51282 (Aug. 18, 2011)),[38] the FFC analysis includes impacts on emissions of methane (CH_4) and nitrous oxide (N_2O), both of which are recognized as greenhouse gases.

DOE primarily conducted the emissions analysis using emissions factors for CO_2 and most of the other gases derived from data in AEO 2014.[39] Combustion emissions of CH_4 and N_2O were estimated using emissions intensity factors published by the U.S. Environmental Protection Agency (EPA), GHG Emissions Factors Hub.[40] Site emissions of CO_2 and NO_X (from gas water heaters) were estimated using emissions intensity factors from an EPA publication.[41] DOE developed separate emissions factors for power sector emissions and upstream emissions. The method that DOE used to derive emissions factors is described in chapter 13 of the final rule TSD.

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[38] DOE's FFC was amended in 2012 for reasons unrelated to the inclusion of CH_4 and N_2O. 77 FR 49701 (Aug. 17, 2012).

[39] DOE-EIA, Annual Energy Outlook 2014 with Projections to 2040 (*Available at*: http://www.eia.gov/forecasts/aeo/)

[40] EPA, GHG Emissions Factors Hub, *available at* http://www.epa.gov/climateleadership/inventory/ghg-emissions.html (last visited Nov. 21, 2014).

[41] EPA, Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources (1998), *available at* http://www.epa.gov/ttn/chief/ap42/index.html.

For CH_4 and N_2O, DOE calculated emissions reduction in tons and also in terms of units of carbon dioxide equivalent (CO_2eq). Gases are converted to CO_2eq by multiplying the physical units by the gas global warming potential (GWP) over a 100-year time horizon. Based on the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC),[42] DOE used GWP values of 28 for CH_4 and 265 for N_2O.

EIA prepares the Annual Energy Outlook using NEMS.[43] Each annual version of NEMS incorporates the projected impacts of existing air quality regulations on emissions. AEO 2014 generally represents current legislation and environmental regulations, including recent government actions, for which implementing regulations were available as of October 31, 2013.

SO_2 emissions from affected electric generating units (EGUs) are subject to nationwide and regional emissions cap-and-trade programs. Title IV of the Clean Air Act sets an annual emissions cap on SO_2 for affected EGUs in the 48 contiguous states and the District of Columbia (D.C.). (42 U.S.C. 7651 et seq.) SO_2 emissions from 28 eastern states and D.C. were also limited under the Clean Air Interstate Rule (CAIR) (70 FR 25162 (May 12, 2005)), which created an allowance-based trading program that operates along with the Title IV program. CAIR was remanded to the EPA by the U.S. Court of

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[42] Intergovernmental Panel on Climate Change, Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Chapter 8 (T.F. Stocker et al. eds.) (2013).
[43] Annual Energy Outlook 2014. *Available at* http://www.eia.gov/forecasts/aeo/index.cfm

Appeals for the District of Columbia Circuit, but it remained in effect.[44] In 2011, EPA

issued a replacement for CAIR, the Cross-State Air Pollution Rule (CSAPR). 76 FR

48208 (Aug. 8, 2011). On August 21, 2012, the D.C. Circuit issued a decision to vacate

CSAPR.[45] The court ordered EPA to continue administering CAIR. The emissions

factors used for the final rule, which are based on AEO 2014, assume that CAIR remains

a binding regulation through 2040.[46]

The attainment of emissions caps is typically flexible among EGUs and is

enforced through the use of emissions allowances and tradable permits. Beginning in

2016, however, SO_2 emissions will decline significantly as a result of the Mercury and

Air Toxics Standards (MATS) for power plants. 77 FR 9304 (Feb. 16, 2012). In the final

MATS rule, EPA established a standard for hydrogen chloride as a surrogate for acid gas

hazardous air pollutants (HAP), and also established a standard for SO_2 (a non-HAP acid

gas) as an alternative equivalent surrogate standard for acid gas HAP. The same controls

are used to reduce HAP and non-HAP acid gas; thus, SO_2 emissions will be reduced as a

result of the control technologies installed on coal-fired power plants to comply with the

MATS requirements for acid gas. AEO 2014 assumes that, in order to continue operating,

coal plants must have either flue gas desulfurization or dry sorbent injection systems

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

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

[46] On April 29, 2014, the U.S. Supreme Court reversed the judgment of the D.C. Circuit and remanded the case for further proceedings consistent with the Supreme Court's opinion. The Supreme Court held in part that EPA's methodology for quantifying emissions that must be eliminated in certain states due to their impacts in other downwind states was based on a permissible, workable, and equitable interpretation of the Clean Air Act provision that provides statutory authority for CSAPR. See EPA v. EME Homer City Generation, No 12-1182, slip op. at 32 (April 29, 2014). Because DOE is using emissions factors based on AEO 2014 for this final rule, the rule assumes that CAIR, not CSAPR, is the regulation in force. The difference between CAIR and CSAPR is not relevant for the purpose of DOE's analysis of SO_2 emissions.

installed by 2016. Both technologies, which are used to reduce acid gas emissions, also reduce SO_2 emissions. Under the MATS, emissions will be far below the cap established by CAIR, so it is unlikely that excess SO_2 emissions allowances resulting from the lower electricity demand would be needed or used to permit offsetting increases in SO_2 emissions by any regulated EGU. Therefore, DOE believes that energy efficiency standards will reduce SO_2 emissions in 2016 and beyond.

CAIR established a cap on NO_x emissions in 28 eastern states and the District of Columbia.[47] Energy conservation standards are expected to have little effect on NO_x emissions in those states covered by CAIR because excess NO_x emissions allowances resulting from the lower electricity demand could be used to permit offsetting increases in NO_x emissions. However, standards would be expected to reduce NO_x emissions in the states not affected by the caps, so DOE estimated NO_x emissions reductions from the standards considered in the final rule for these states.

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

L. Monetizing Carbon Dioxide and Other Emissions Impacts

As part of the development of this rule, DOE considered the estimated monetary benefits from the reduced emissions of CO_2 and NO_X that are expected to result from

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

each of the TSLs considered. In order to make this calculation similar to the calculation of the NPV of consumer benefit, DOE considered the reduced emissions expected to result over the lifetime of equipment shipped in the forecast period for each TSL. This section summarizes the basis for the monetary values used for each of these emissions and presents the values considered in this rulemaking.

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

1. Social Cost of Carbon

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

Under section 1(b)(6) of Executive Order 12866, "Regulatory Planning and Review," 58 FR 51735 (Oct. 4, 1993), agencies must, to the extent permitted by law,

"assess both the costs and the benefits of the intended regulation and, recognizing that some costs and benefits are difficult to quantify, propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs." The purpose of the SCC estimates presented here is to allow agencies to incorporate the monetized social benefits of reducing CO_2 emissions into cost-benefit analyses of regulatory actions. DOE acknowledges that there are many uncertainties involved in the estimates and understands that they should be updated over time to reflect increasing knowledge of the science and economics of climate impacts.

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

a. Monetizing Carbon Dioxide Emissions

When attempting to assess the incremental economic impacts of carbon dioxide emissions, the analyst faces a number of challenges. A report from the National Research Council[48] 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

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[48] National Research Council, <u>Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use</u> (2009).

past and future emissions on the climate system; (3) the impact of changes in climate on the physical and biological environment; and (4) the translation of these environmental impacts into economic damages. As a result, any effort to quantify and monetize the harms associated with climate change will raise serious questions of science, economics, and ethics and should be viewed as provisional.

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

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

b. Development of Social Cost of Carbon Values

In 2009, an interagency process was initiated to offer a preliminary assessment of how best to quantify the benefits from reducing carbon dioxide emissions. To ensure consistency in how benefits are evaluated across Federal agencies, the Administration

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

c. Current Approach and Key Assumptions

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

Each model takes a slightly different approach to model how changes in emissions result in changes in economic damages. A key objective of the interagency process was to enable a consistent exploration of the three models while respecting the

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

In 2010, the interagency group selected four sets of SCC values for use in regulatory analyses.[49] Three sets of values are based on the average SCC from three integrated assessment models, at discount rates of 2.5 percent, 3 percent, and 5 percent. The fourth set, which represents the 95th-percentile SCC estimate across all three models at a 3-percent discount rate, is included to represent higher-than-expected impacts from climate change further out in the tails of the SCC distribution. The values grow in real terms over time. Additionally, the interagency group determined that a range of values from 7 percent to 23 percent should be used to adjust the global SCC to calculate domestic effects,[50] although preference is given to consideration of the global benefits of reducing CO_2 emissions. Table IV.6 presents the values in the 2010 interagency group report, which is reproduced in appendix 14-A of the final rule TSD.

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

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

Table IV.6. Annual SCC Values from 2010 Interagency Report, 2010–2050 (in 2007 dollars per metric ton CO_2)

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

The SCC values used for the final rule were generated using the most recent versions of the three integrated assessment models that have been published in the peer-reviewed literature.[51] Table IV.7 shows the updated sets of SCC estimates from the 2013 Report update in five-year increments from 2010 to 2050. Appendix 14-B of the final rule TSD provides the full set of values. The central value that emerges is the average SCC across models at 3-percent discount rate. However, for purposes of capturing the uncertainties involved in regulatory impact analysis, the interagency group emphasizes the importance of including all four sets of SCC values.

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

Table IV.7. Annual SCC Values from 2013 Interagency Update, 2010–2050 (in 2007 dollars per metric ton CO_2)

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

AHAM suggests that DOE rely on the 2010 estimates for SCC until it has resolved all comments on the derivation of the SCC estimates from the 2013 Report. (AHAM, No. 23, at pp. 5-6) The 2013 Report provides an update of the SCC estimates based solely on the latest peer-reviewed version of the models, replacing model versions that were developed up to ten years ago in a rapidly evolving field. It does not revisit other assumptions with regard to the discount rate, reference case socio-economic and emission scenarios, or equilibrium climate sensitivity. Improvements in the way damages are modeled are confined to those that have been incorporated into the latest versions of the models by the developers themselves in the peer-reviewed literature. Given the above, using the 2010 estimates would be inconsistent with DOE's objective of using the best available information in its analyses.

It is important to recognize that a number of key uncertainties remain, and that current SCC estimates should be treated as provisional and revisable since they will

evolve with improved scientific and economic understanding. The interagency group also recognizes that the existing models are imperfect and incomplete. The National Research Council report describes 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. [52] There are a number of analytical challenges that are being addressed by the research community, including research programs housed in many of the Federal agencies participating in the interagency process to estimate the SCC. The interagency group intends to periodically review and reconsider those estimates to reflect increasing knowledge of the science and economics of climate impacts, as well as improvements in modeling.

In summary, in considering the potential global benefits resulting from reduced CO_2 emissions, DOE used the values from the 2013 Report, adjusted to 2013$ using the Gross Domestic Product price deflator. For each of the four SCC cases specified, the values used for emissions in 2015 were $12.0, $40.5, $62.4, and $119 per metric ton avoided (values expressed in 2013 dollars). DOE derived values after 2050 using the relevant growth rates for the 2040-2050 period in the interagency update.

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

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[52] National Research Council, Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use (2009).

The Associations[53] believe the SCC should not be used in any rulemaking and/or policymaking until it undergoes a more rigorous notice, review and comment process. (The Associations, No. 25 at p.3) ALS strongly opposes the application of SCC and the inclusion of the social benefit of CO_2 emission reductions in DOE's analysis for justification of standards for covered equipment. (ALS, No. 26 at p.6) The Cato Institute stated that the SCC is not supported by scientific literature, not in accordance with OMB guidelines, fraught with uncertainty, illogical and thus unsuitable and inappropriate for Federal rulemaking. The Cato Institute also argued that use of the SCC in cost/benefit analyses in the rulemaking should be suspended.
(Cato Institute, No. 24 at pp. 1−24)

DOE acknowledges the limitations of the SCC estimates, which are discussed in detail in the 2010 Report. Specifically, the 2010 Report discusses and explains the reasons for uncertainties in the assumptions regarding climate sensitivity, as well as other model inputs such as economic growth and emissions trajectories.[54] The three integrated assessment models used to estimate the SCC are frequently cited in the peer-reviewed literature and were used in the last assessment of the IPCC. In addition, new versions of the models that were used in 2013 to estimate revised SCC values were published in the

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[53] "The Associations" include the U.S. Chamber of Commerce, American Chemistry Council, American Forest & Paper Association, American Fuel & Petrochemical Manufacturers, American Petroleum Institute, Council of Industrial Boiler Owners, National Association of Manufacturers, and the National Mining Association.
[54] Interagency Working Group on Social Cost of Carbon, Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866 (2010), *available at* http://www.whitehouse.gov/sites/default/files/omb/inforeg/for-agencies/Social-Cost-of-Carbon-for-RIA.pdf ("The 2010 Report").

peer-reviewed literature (see appendix 14B of the final rule TSD for discussion).

Although uncertainties remain, the revised estimates in the 2013 Report are based on the

best available scientific information on the impacts of climate change. The current SCC

estimates have been developed over many years, using the best science available, and

with input from the public. In November 2013, OMB announced a new opportunity for

public comment on the interagency technical support document underlying the revised

SCC estimates. 78 FR 70586. OMB is reviewing comments and considering whether

further revisions to the SCC estimates are warranted. DOE stands ready to work with

OMB and the other members of the interagency working group on further review and

revision of the SCC estimates as appropriate.

In addition, it is important to note that the monetized benefits of carbon emission

reductions are one factor that DOE considers in its evaluation of the economic

justification of proposed standards. As shown in Table I.4, the benefits of the amended

standards in terms of consumer operating cost savings exceed the incremental costs of the

standards-compliant equipment. The benefits of CO_2 emission reductions were

considered by DOE, but were not determinative in DOE's decision to adopt these

standards.

2. Valuation of Other Emissions Reductions

As noted above, DOE has taken into account how amended energy conservation

standards would reduce site NO_X emissions nationwide and increase power sector NO_X

emissions in those 22 States not affected by the CAIR. DOE estimated the monetized

value of net NO_X emissions reductions resulting from each of the TSLs considered for the final rule based on estimates found in the relevant scientific literature. Estimates of monetary value for reducing NO_X from stationary sources range from $476 to $4,893 per ton in 2013$.[55] DOE calculated monetary benefits using a medium value for NO_X emissions of $2,684 per short ton and real discount rates of 3 percent and 7 percent.

DOE is evaluating appropriate monetization of avoided SO_2 and Hg emissions in energy conservation standards rulemakings. It has not included monetization in the current analysis.

M. Utility Impact Analysis

The utility impact analysis estimates several effects on the power generation industry that would result from the adoption of new or amended energy conservation standards. In the utility impact analysis, DOE analyzes the changes in installed electricity capacity and generation that would result for each TSL. The utility impact analysis is based on published output from NEMS. Each year, NEMS is updated to produce the AEO reference case as well as a number of side cases that estimate the economy-wide impacts of changes to energy supply and demand. DOE uses those published side cases that incorporate efficiency-related policies to estimate the marginal impacts of reduced energy demand on the utility sector. The output of this analysis is a set of time-dependent coefficients that capture the change in electricity generation, primary fuel consumption,

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[55] 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) (Available at: http://www.whitehouse.gov/sites/default/files/omb/assets/omb/inforeg/2006_cb/2006_cb_final_report.pdf).

installed capacity and power sector emissions due to a unit reduction in demand for a given end use. These coefficients are multiplied by the stream of energy savings calculated in the NIA to provide estimates of selected utility impacts of new or amended energy conservation standards. Chapter 15 of the final rule TSD describes the utility impact analysis in further detail.

N. Employment Impact Analysis

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

One method for assessing the possible effects on the demand for labor of such shifts in economic activity is to compare sector employment statistics developed by the Labor Department's Bureau of Labor Statistics (BLS). BLS regularly publishes its estimates of the number of jobs per million dollars of economic activity in different

sectors of the economy, as well as the jobs created elsewhere in the economy by this same economic activity. Data from BLS indicate that expenditures in the utility sector generally create fewer jobs (both directly and indirectly) than expenditures in other sectors of the economy.[56] 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 the standard levels considered in the 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

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[56] See Bureau of Economic Analysis, Regional Multipliers: A Handbook for the Regional Input-Output Modeling System (RIMS II) (1992).

building energy use. DOE notes that ImSET is not a general equilibrium forecasting model, and understands the uncertainties involved in projecting employment impacts, especially changes in the later years of the analysis. Because ImSET does not incorporate price changes, the employment effects predicted by ImSET may over-estimate actual job impacts over the long run. For the final rule, DOE used ImSET only to estimate short-term employment impacts.

For more details on the employment impact analysis, see chapter 16 of the final rule TSD.

V. Analytical Results

The following section addresses the results from DOE's analyses with respect to potential energy conservation standards for the CCWs examined as part of this rulemaking. It addresses the trial standard levels examined by DOE, the projected impacts of each of these levels if adopted as energy conservation standards for CCWs, and the standard levels that DOE is adopting in this final rule. Additional details regarding the analyses conducted by DOE are contained in the publicly-available TSD supporting this final rule.

A. Trial Standard Levels

DOE analyzed the benefits and burdens of a number of TSLs for CCWs, the equipment that are the subject of the final rule. 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 the final rule, DOE presents the results for all

efficiency levels that it analyzed in the final rule TSD.

California IOUs and NRDC requested DOE to consider including an additional

TSL to represent efficiency level 2 for front-loading units and the max-tech level for top-

loading units. (CA IOUs, Public Meeting Transcript, No. 30, at p. 78 and 100-101;

NRDC, No. 29, at p. 4) DOE has included the additional TSL in the analysis for the final

rule.

Table V.1 presents the TSLs analyzed and the corresponding efficiency level for

each CCW equipment class. TSL 4 is comprised of the max-tech efficiency levels. TSL 3

is comprised of efficiency level two for front-loading and the max-tech level for top-

loading units. TSL 2 is comprised of efficiency level two for front-loading CCWs and

efficiency level one for top-loading CCWs. TSL 1 is comprised of efficiency level one

for each equipment class.

Table V.1. Summary of TSLs for Front-loading and Top-loading Commercial Clothes Washers

Equipment Class	TSL 1	TSL 2	TSL 3	TSL 4
	Efficiency Level*			
Front Loading CCW Units	1	2	2	3
Top Loading CCW Units	1	1	2	2

* For the MEF_{J2} and IWF that correspond to efficiency levels 1 through 4, see Table IV.3.

<u>B.</u> <u>Economic Justification and Energy Savings</u>

As discussed in section II.A, EPCA provides seven factors to be evaluated in determining whether a more stringent standard for front-loading and top-loading CCWs is economically justified. (42 U.S.C. 6313(a)(6)(B)(ii)) The following sections discuss how DOE addresses each of those factors in this rulemaking.

1. Economic Impacts on Individual Customers

DOE analyzed the economic impacts on front-loading and top-loading CCWs customers by looking at the effects potential standards would have on the LCC and PBP. DOE also examined the impacts of potential standards on customer subgroups. These analyses are discussed below.

a. Life-Cycle Cost and Payback Period

To evaluate the economic impact of potential amended energy conservation standards on customers of CCWs, DOE conducted LCC and PBP analyses for each TSL. In general, higher-efficiency equipment would affect customers in two ways: (1) purchase price would increase, and (2) annual operating costs would decrease. Inputs used for calculating the LCC and PBP include total installed costs (<u>i.e.</u>, equipment price plus installation costs), and operating costs (<u>i.e.</u>, annual energy savings, energy prices, energy price trends, repair costs, and maintenance costs). The LCC calculation also uses equipment lifetime and a discount rate. Chapter 8 of the final rule TSD provides detailed information on the LCC and PBP analyses.

Tables V.2 through V.9 show the LCC and PBP results for both front-loading and top-loading CCW units. In the first of each pair of tables, the simple payback is measured relative to the baseline equipment. In the second tables, the LCC savings are measured relative to the base-case efficiency distribution in the compliance year (see section IV.F.9 of this notice).

Table V.2. Summary Life-Cycle Cost and Payback Period Results for Front-loading, Multi-Family Application Commercial Clothes Washer Units

| TSL | Efficiency Level | Average Costs 2013$ | | | | Simple Payback years | Average Lifetime years |
		Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
--	Baseline	1,817	409	2,915	4,732	--	11.3
1	1	1,817	384	2,695	4,512	0.0	11.3
2	2	1,818	364	2,519	4,337	0.0	11.3
3	2	1,818	364	2,519	4,337	0.0	11.3
4	3	1,848	381	2,659	4,507	1.1	11.3

Note: The results for each TSL are calculated assuming that all customers use equipment with that efficiency level. The PBP is measured relative to the baseline equipment.

Table V.3 LCC Savings Relative to the Base Case Efficiency Distribution for Front-loading, Multi-Family Application Commercial Clothes Washer Units

| TSL | Efficiency Level | Life-Cycle Cost Savings | |
| | | % of Customers that Experience | Average Savings* |
		Net Cost	2013$
1	1	0	221.37
2	2	0	271.91
3	2	0	271.91
4	3	55	(2.67)

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

Table V.4. Summary Life-Cycle Cost and Payback Period Results for Front-loading, Laundromat Application Commercial Clothes Washer Units

TSL	Efficiency Level	Average Costs 2013$				Simple Payback years	Average Lifetime years
		Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
--	Baseline	1,817	524	2,452	4,267	--	7.1
1	1	1,817	493	2,266	4,082	0.0	7.1
2	2	1,818	471	2,133	3,951	0.0	7.1
3	2	1,818	471	2,133	3,951	0.0	7.1
4	3	1,848	491	2,243	4,092	1.0	7.1

Note: The results for each TSL are calculated assuming that all customers use equipment with that efficiency level. The PBP is measured relative to the baseline equipment.

Table V.5 LCC Savings Relative to the Base Case Efficiency Distribution for Front-loading, Laundromat Application Commercial Clothes Washer Units

TSL	Efficiency Level	Life-Cycle Cost Savings	
		% of Cutomers that Experience	Average Savings*
		Net Cost	2013$
1	1	0	184.29
2	2	0	212.31
3	2	0	212.31
4	3	65	(10.22)

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

Table V.6. Summary Life-Cycle Cost and Payback Period Results for Top-loading, Multi-Family Application Commercial Clothes Washer Units

TSL	Efficiency Level	Average Costs 2013$				Simple Payback years	Average Lifetime years
		Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
--	Baseline	1,229	556	4,453	5,682	--	11.3
1	1	1,229	522	4,159	5,388	0.0	11.3
2	1	1,229	522	4,159	5,388	0.0	11.3
3	2	1,293	459	3,580	4,873	0.7	11.3
4	2	1,293	459	3,580	4,873	0.7	11.3

Note: The results for each TSL are calculated assuming that all customers use equipment with that efficiency level. The PBP is measured relative to the baseline equipment.

Table V.7 LCC Savings Relative to the Base Case Efficiency Distribution for Top-loading, Multi-Family Application Commercial Clothes Washer Units

TSL	Efficiency Level	Life-Cycle Cost Savings	
		% of Customers that Experience	Average Savings*
		Net Cost	2013$
1	1	0	294.48
2	1	0	294.48
3	2	0	807.36
4	2	0	807.36

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

Table V.8. Summary Life-Cycle Cost and Payback Period Results for Top-loading, Laundromat Application Commercial Clothes Washer Units

TSL	Efficiency Level	Average Costs 2013$				Simple Payback years	Average Lifetime years
		Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
--	Baseline	1,229	678	3,638	4,867	--	7.1
1	1	1,229	651	3,472	4,701	0.0	7.1
2	1	1,229	651	3,472	4,701	0.0	7.1
3	2	1,293	568	2,950	4,243	0.6	7.1
4	2	1,293	568	2,950	4,243	0.6	7.1

Note: The results for each TSL are calculated assuming that all customers use equipment with that efficiency level. The PBP is measured relative to the baseline equipment.

Table V.9 LCC Savings Relative to the Base Case Efficiency Distribution for Top-loading, Laundromat Application Commercial Clothes Washer Units

TSL	Efficiency Level	Life-Cycle Cost Savings	
		% of Customers that Experience	Average Savings*
		Net Cost	2013$
1	1	0	165.67
2	1	0	165.67
3	2	0	622.36
4	2	0	622.36

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

b. Customer Subgroup Analysis

In the customer subgroup analysis, DOE estimated the impacts of the considered TSLs on small business customers. The LCC savings and PBPs for small business customers are similar to the impacts for all customers. Chapter 11 of the final rule TSD presents detailed results of the customer subgroup analysis.

c. Rebuttable Presumption Payback

As discussed in section III.E.2, EPCA establishes a rebuttable presumption that an energy conservation standard is economically justified if the increased purchase cost for equipment that meets the standard is less than three times the value of the first-year energy savings resulting from the standard. DOE calculated a rebuttable-presumption PBP for each TSL based on average usage profiles. As a result, DOE calculated a single rebuttable presumption payback value, and not a distribution of PBPs, for each TSL. Table V.10 and Table V.11 show the rebuttable-presumption PBPs for the considered TSLs.

In addition to the rebuttable presumption analysis, however, DOE routinely conducts an economic analysis that considers the full range of impacts to the customer, manufacturer, nation, and environment, as required by EPCA. 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 three-year PBP analysis). Section V.B.2 addresses how DOE considered the range of impacts to select these amended standards.

Table V.10. Rebuttable-Presumption Payback Periods (years) for Front-loading and Top-loading Commercial Clothes Washer Units: Multi-Family Application

Trial Standard Level	1	2	3	4
Efficiency Level	FL:EL1 TL:EL1	FL:EL2 TL:EL1	FL:EL2 TL:EL2	FL:EL3 TL:EL2
Front Loading CCW Units	0.0	0.1	0.1	11.2
Top Loading CCW Units	0.0	0.0	2.6	2.6

Table V.11. Rebuttable-Presumption Payback Periods (years) for Front-loading and Top-loading Commercial Clothes Washer Units: Laundromat Application

Trial Standard Level	1	2	3	4
Efficiency Level	FL:EL1 TL:EL1	FL:EL2 TL:EL1	FL:EL2 TL:EL2	FL:EL3 TL:EL2
Front Loading CCW Units	0.0	0.1	0.1	11.1
Top Loading CCW Units	0.0	0.0	3.1	3.1

2. Economic Impacts on Manufacturers

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

a. Industry Cash-Flow Analysis Results

The following tables depict the financial impacts (represented by changes in INPV) of amended energy conservation standards on manufacturers of CCWs as well as the conversion costs that DOE estimates manufacturers would incur for each equipment class at each TSL. To evaluate the range of cash flow impacts on the CCW manufacturing industry, DOE used two different markup assumptions to model scenarios

that correspond to the range of anticipated market responses to amended energy conservation standards.

To assess the lower (less severe) end of the range of potential impacts, DOE modeled a preservation of gross margin percentage markup scenario, in which a uniform gross margin percentage markup is applied across all efficiency levels. In this scenario, DOE assumed that a manufacturer's absolute dollar markup would increase as production costs increase in the amended energy conservation standards case. Manufacturers have indicated that it is optimistic to assume that they would be able to maintain a constant gross margin percentage markup if their production costs increase in response to an amended energy conservation standard, particularly at higher TSLs.

To assess the higher (more severe) end of the range of potential impacts, DOE modeled the preservation of per-unit operating profit markup scenario, which assumes that manufacturers would not be able to preserve the same overall gross margin, but instead cut their markup for marginally compliant equipment to maintain a cost-competitive equipment offering and keep the same overall level of operating profit as in the base-case. Table V.12 and Table V.13 show the range of potential INPV impacts for manufacturers of CCWs. Table V.12 reflects the lower bound of impacts (higher profitability) and Table V.13 represents the upper bound of impacts (lower profitability).

Each scenario results in a unique set of cash flows and corresponding industry values at each TSL. In the following discussion, the INPV results refer to the sum of

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discounted cash flows through 2047, the difference in INPV between the base case and

each standards case, and the total industry conversion costs required for each standards

case.

Table V.12. **Manufacturer Impact Analysis under the Preservation of Gross Margin Percentage Markup Scenario**

	Units	Base Case	Trial Standard Level			
			1	2	3	4
INPV	2013$ Millions	123.5	117.1	116.9	56.0	23.9
Change in INPV	2013$ Millions		(6.4)	(6.6)	(67.5)	(99.6)
	%		(5.2%)	(5.3%)	(54.6%)	(80.7%)
Product Conversion Costs	2013$ Millions		9.9	10.2	50.9	62.4
Capital Conversion Costs	2013$ Millions		-	-	38.7	63.1
Total Conversion Costs	2013$ Millions		9.9	10.2	89.5	125.6
Free Cash Flow[1]	2013$ Millions	8.9	6.2	6.1	(22.8)	(37.2)
Free Cash Flow	% Change		(30.7%)	(31.7%)	(355.6%)	(516.2%)

Note: Scenario reflected above corresponds with Reference Case shipments and Constant Learning Curve; Values in parentheses are negative values.
[1] Free Cash Flow figures are for the year before standards go into effect (i.e. 2017).

Table V.13. Manufacturer Impact Analysis under the Preservation of Per-Unit Operating Profit Markup Scenario

	Units	Base Case	Trial Standard Level			
			1	2	3	4
INPV	2013$ Millions	123.5	117.1	116.9	53.0	19.7
Change in INPV	2013$ Millions		(6.4)	(6.6)	(70.5)	(103.8)
	%		(5.2%)	(5.3%)	(57.1%)	(84.1%)
Product Conversion Costs	2013$ Millions		9.9	10.2	50.9	62.4
Capital Conversion Costs	2013$ Millions		-	-	38.7	63.1
Total Conversion Costs	2013$ Millions		9.9	10.2	89.5	125.6
Free Cash Flow[1]	2013$ Millions	8.9	6.2	6.1	(22.8)	(37.2)
Free Cash Flow	% Change		(30.7%)	(31.7%)	(355.6%)	(516.2%)

Note: Scenario reflected above corresponds with Reference Case shipments and Constant Learning Curve; Values in parentheses are negative values.
[1] Free Cash Flow figures are for the year before standards go into effect (i.e. 2017).

To provide perspective on short-run cash flow impacts, DOE also included a comparison of free cash flow between the base case and the standards case at each TSL in the year before amended standards take effect. At TSL 1, DOE estimated the impact for manufacturers of CCWs to be a decrease in INPV of $6.4 million, or 5.2 percent, under either markup scenario. At TSL 1, industry free cash flow is estimated to decrease by approximately 30.7 percent to $6.2 million, compared to the base-case value of $8.9 million in the year before the compliance date (2017).

TSL 1 represents an improvement in MEF_{J2} (as determined using appendix J2) from the baseline level of 1.65 to 1.80 (ft^3/kWh/cycle) for front-loading equipment and an improvement in MEF_{J2} from the baseline level of 1.15 to 1.35 (ft^3/kWh/cycle) for top-loading equipment. The results for the two markup scenarios are identical at TSL 1 because the baseline MPCs and the MPCs at TSL 1 are the same for both equipment classes. For front-loading CCWs, the 1.8 MEF_{J2} (as determined using appendix J2)

equipment (on which the EL 1 standard is based) are the lowest efficiency front-loading

equipment available on the market. As such, TSL 1 would have no impact on the front-

loading market. Similarly, the design options associated with EL 1 for top-loading

equipment relate to control changes and different cycle options, rather than material

changes to the equipment itself. While there are product conversion costs associated with

the research and development needed to make these changes, there are no changes in the

per unit production costs. Given these conditions, the impacts on INPV at TSL 1 can be

attributed solely to the $9.9 million in product conversion costs for top-loading

equipment.

At TSL 2, DOE estimates a decrease in INPV of $6.6 million, or 5.3 percent,

under either markup scenario. At TSL 2, industry free-cash flow is estimated to decrease

by approximately 31.7 percent to $6.1 million, compared to the base-case value of $8.9

million in the year before the compliance date (2017).

TSL 2 represents an improvement in MEF_{J2} from the baseline level of 1.65 to

2.00 (ft^3/kWh/cycle) for front-loading equipment and an improvement in MEF_{J2} from the

baseline level of 1.15 to 1.35 (ft^3/kWh/cycle) for top-loading equipment. Much like TSL

1, the results for the two markup scenarios at TSL 2 are identical because the baseline

MPCs and the MPCs at TSL 2 are very close for both front-loading and top-loading

equipment. For front-loading equipment, the 2.0 MEF_{J2} EL (as determined using

appendix J2) requires only minor changes to baseline equipment needed to enable slightly

faster spin speeds. The standard level for top-loading equipment at TSL 2 is the same at

TSL 1, and again relates to control changes and different cycle options, rather than material changes to the equipment. Because there are no substantive changes to MPCs for either equipment class, nearly all of the impacts on INPV at TSL 2 can be attributed to the $10.2 million in product conversion costs.

At TSL 3, DOE estimates decreases in INPV for CCW manufacturers to range $67.5 million (or 54.6 percent) to $70.5 million (or 57.1 percent). At TSL 3, industry free cash flow is estimated to decrease by over 356 percent to -$22.8 million, compared to the base-case value of $8.9 million in the year before the compliance date (2017).

TSL 3 represents an improvement in MEF_{J2} from the baseline level of 1.65 to 2.00 (ft^3/kWh/cycle) for front-loading CCWs and an improvement in MEF_{J2} from the baseline level of 1.15 to 1.55 (ft^3/kWh/cycle) for top-loading CCWs. Unlike TSL 1 and TSL 2, the efficiency level specified at TSL 3 would require substantial redesigns of top-loading CCWs. The design options proposed at efficiency level 2 for top-loading units include increased tub capacity, hung suspension, low-profile (non-traditional) agitator design, and improved motor and transmission efficiency—all of which require major platform overhauls and significant changes to manufacturing capital. These design options do not contribute to substantially different MPCs, but the conversion costs associated with equipment development and testing, as well as the investments in manufacturing capital, including retooling of tubs and agitators, significantly impact the INPV. Additionally, the significant increase in industry aggregate equipment and capital conversion costs due to the shift to max tech efficiency level for top-loaders is explained

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by that fact that a larger proportion of top-loading units would require upgrades. As estimated in the shipments analysis, approximately 90% of top-loading units currently on the market are below EL 2 (by contrast, approximately 70% of current top-loading units are below EL 1).

At TSL 4, DOE estimates decreases in INPV for CCW manufacturers to range from $99.6 million (or 80.7 percent) to $103.8 million (or 84.1 percent). At TSL 4, industry free-cash flow is estimated to decrease by over 516 percent to -$37.2 million, compared to the base-case value of $8.9 million in the year before the compliance date (2017).

TSL 4 represents an improvement in MEF_{J2} from the baseline level of 1.65 to 2.20 (ft^3/kWh/cycle) for front-loading CCWs and an improvement in MEF_{J2} from the baseline level of 1.15 to 1.55 (ft^3/kWh/cycle) for top-loading CCWs. The efficiency level specified at TSL 4 would require substantial CCW redesigns in both equipment classes. For front-loading units, the design options associated with EL 3 include increased capacity and switching to direct drive motors. For top-loading units, the design options proposed at EL 2 include increased tub capacity, hung suspension, low-profile (non-traditional) agitator design, and improved motor and transmission efficiency. All of these upgrades require major platform overhauls and significant changes to manufacturing capital. These design options do not contribute to substantially different MPCs, but the conversion costs associated with equipment development and testing, as well as the investments in manufacturing capital including retooling of tubs and agitators, significantly impact the INPV.

b. Impacts on Direct Employment

DOE used the GRIM to estimate the domestic labor expenditures and number of

domestic production workers in the base-case and at each TSL from 2014 to 2047. DOE

used statistical data from the most recent U.S Census Bureau's Economic Census,[57] 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 equipment are a function of the labor

intensity of the equipment, the sales volume, and an assumption that wages in real terms

remain constant.

DOE notes that the MIA's analysis detailing impacts on employment focuses

specifically on the production workers manufacturing the covered equipment in question,

rather than a manufacturer's broader operations. Thus, the estimated number of impacted

employees in the MIA is separate from the total number of employees used to determine

whether a manufacturer is a small business for purposes of analysis under the Regulatory

Flexibility Act.

The estimates of production workers in this section cover only those up to and

including the line-supervisor level, who are directly involved in fabricating and

assembling equipment within the original equipment manufacturer (OEM) facility. In

addition, workers that perform services closely associated with production operations are

included. Employees above the working-supervisor level are excluded from the count of

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[57] The U.S. Census Bureau's 2012 Economic Census data (form EC123111) for NAICS code 333318 can be found at: http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t. Enter "333318" in the Industry Codes search option (left).

production workers. Thus, the labor associated with non-production functions (e.g., factory supervision, advertisement, sales) is explicitly not covered.[58] In addition, DOE's estimates account for production workers that manufacture only the specific equipment covered by this rulemaking. For example, a worker on a clothes dryer production line would not be included in the estimate of the number of CCW production workers. Finally, this analysis also does not factor in the dependence of some manufacturers on production volume to make their operations viable. For example, should a major line of business cease or move, a production facility may no longer have the manufacturing scale to obtain volume discounts on its purchases, nor be able to justify maintaining major capital equipment. Thus, the impact on a production facility due to a line closure may affect more employees than just the production workers, but as stated previously, this analysis focuses only on the production workers impacted directly. The aforementioned scenarios, however, are considered relative to employment impacts specific to the LVM at the end of this section.

In the GRIM, DOE used the labor content of the equipment and the manufacturing production costs from the engineering analysis to estimate the annual labor expenditures in the CCW manufacturing industry. DOE used information gained through interviews with manufacturers to estimate the portion of the total labor expenditures that is attributable to domestic labor.

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[58] The U.S. Census Bureau provides the following definition: "The 'production workers' number includes workers (up through the line-supervisor level) engaged in fabricating, processing, assembling, inspecting, receiving, storing, handling, packing, warehousing, shipping (but not delivering), maintenance, repair, janitorial and guard services, product development, auxiliary production for plant's own use (e.g., power plant), recordkeeping, and other services closely associated with these production operations at the establishment covered by the report. Employees above the working-supervisor level are excluded from this item." https://ask.census.gov/faq.php?id=5000&faqId=6953

The employment impacts shown in Table V.14 represent the potential production employment that could result following amended energy conservation standards. These impacts are independent of the employment impacts from the broader U.S. economy, which are documented in chapter 16 of the final rule TSD.

DOE estimates that, in the absence of amended energy conservation standards, there would be 301 domestic production workers involved in manufacturing CCWs in 2018. Table V.14 shows the range of the impacts of potential amended energy conservation standards on U.S. production workers in the CCW manufacturing industry. 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 come into effect. To calculate the total potential increase, DOE assumed that manufacturers continue to produce the same scope of covered equipment in domestic production facilities and domestic production is not shifted to lower-labor-cost countries. Because there is a 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.14 includes the estimated total number of U.S. production workers in the industry who could lose their jobs if all existing production was moved outside of the United States.

Table V.14. Change in Total Number of Domestic Production Employees in 2018 in the CCW Industry

	Base	TSL 1	TSL 2	TSL 3	TSL 4

	Case				
Total Number of Domestic Production Workers in 2018	301	301	301	327	328
Potential Changes in Domestic Production Workers in 2018*	-	0 - (301)	0 - (301)	28 - (301)	30 - (301)

*Values in parentheses are negative values.

Because production employment expenditures are assumed to be a fixed percentage of Cost of Goods Sold (COGS) and the MPCs typically increase with more efficient equipment, labor tracks the increased prices in the GRIM. As efficiency of CCWs increases, so does the complexity of the machines, generally requiring more labor to produce. As previously discussed, for TSL 1, there is no change in MPCs from the base case, and for TSL 2, there is a small increase in MPCs for front-loaders that would be offset by a shift in shipments from front-loaders to top-loaders. As a result, DOE expects that there would be no employment impacts among domestic CCW manufacturers for TSL 1 and TSL 2. For TSL 3 and TSL 4, the GRIM predicts an increase in domestic employment, based on the increase in complexity and relative price of the equipment.

From interviews with manufacturers, DOE estimates that approximately 83 percent of CCWs are currently produced domestically. In the CCW industry, 100 percent of top-loaders are manufactured domestically, while a much larger share of front-loaders are produced internationally. As illustrated in Table V.14, the actual impacts on domestic employment after standards would be different than estimated if any U.S. manufacturer decided to shift remaining U.S. production to lower-cost countries. The proposed standard could result in losing all 301 production workers if all U.S. manufacturers

source standards-compliant washers or shift U.S. production internationally. However, feedback from manufacturers during NOPR interviews supports the notion that top-loading CCWs will continue to be produced domestically following amended energy conservation standards, unless the max-tech level is chosen.

c. Impacts on Manufacturing Capacity

According to the majority of CCW manufacturers, new energy conservation standards could potentially impact manufacturers' production capacity, depending on the efficiency level required. For TSL 1 and TSL 2, the most significant conversion costs are the research and development, testing, and certification of equipment with more-efficient components, which does not affect production line capacity. Available information indicates that manufacturers will be able to maintain manufacturing capacity levels and continue to meet market demand under new energy conservation standards as long as manufacturers continue to offer top-loading and front-loading washers.

However, a very high efficiency standard for top-loading clothes washers could cause certain manufacturers to abandon further domestic production of top-loading clothes washers after the effective date, and choose instead to relocate manufacturing internationally or to source from a foreign manufacturer, which could lead to a permanently lower production capacity within the CCW industry.

d. Impacts on Subgroups of Manufacturers

Using average cost assumptions to develop an industry cash flow estimate is not

adequate for assessing differential impacts among subgroups of manufacturers. Small

manufacturers, niche players, or manufacturers exhibiting a cost structure that differs

significantly from the industry average could be affected differently. DOE used the

results of the industry characterization to group manufacturers exhibiting similar

characteristics.

As outlined earlier, one LVM of CCWs would be disproportionately affected by

any energy efficiency regulation in the CCW industry. This business is focused on one

specific market segment and is at least ten times smaller than its diversified competitors.

Due to this combination of market concentration and size, this LVM is at risk of material

harm to its business, depending on the TSL chosen.

The LVM indicated that it could not manufacture top-loading or front-loading

washers at the proposed max-tech level (MEF$_{J2}$ of 1.55 and 2.20, respectively, as

determined using appendix J2) with its existing manufacturing capital and platform

constraints. If DOE were to set the standard at the max-tech level, the LVM believes that

a "green field" design for front-loaders would likely be required. For top-loaders, the

LVM asserts that it does not have the technology to reach the max-tech level, and it

would be forced to develop an entirely new business model, possibly ceasing CCW

production altogether, sourcing internationally, shifting production internationally, or

some combination thereof, which could negatively impact employment in the CCW

industry. If the LVM no longer offers top-loading washers, it would likely cease CCW

production altogether, resulting in significant impacts to the industry. Currently, the

LVM's top-loading washers account for more than half of the company's CCW revenues and three-quarters of its CCW shipments. To shift all top-loading CCWs to front-loading washers at current production volumes would require substantial investments that the LVM may not be able to justify. In addition, relative to its residential and commercial washer production, the LVM derives an estimated 88 percent of its clothes washer revenue from CCWs, so its sales in the residential clothes washer market would be too low to justify continuing any top-loading clothes washer manufacturing. Further detail and separate analysis of impacts on the LVM are found in chapter 12 of the final rule TSD.

e. Cumulative Regulatory Burden

One aspect of assessing manufacturer burden is the cumulative impact of multiple DOE standards and the regulatory actions of other Federal agencies and states that affect the manufacturers of covered equipment. While any one regulation may not impose a significant burden on manufacturers, the combined effects of several existing or impending regulations may have serious consequences for some manufacturers, groups of manufacturers, or an entire industry.

Companies that produce a wider range of regulated equipment may be faced with more capital and equipment development expenditures than their competitors. This can prompt those companies to exit the market or reduce their equipment offerings, potentially reducing competition. LVMs can be especially affected, since they have

lower sales volumes over which to amortize the costs of compliance with new regulations.

In addition to DOE's energy conservation regulations for CCWs, several other existing regulations apply to CCWs and other equipment produced by the same manufacturers. The most significant of these additional regulations include several additional existing or proposed Federal and State energy conservation and environmental standards, consumer equipment safety standards, the Green Chemistry law in California, and standards impacting CCW suppliers such as the Conflict Minerals directive contained within the Dodd-Frank Act of 2010. For more details, see chapter 12 of the final rule TSD.

3. National Impact Analysis

Projections of shipments are an important part of the NIA. Table V.15 presents the estimated cumulative shipments in 2018–2047 in the base-case and under each TSL. Because DOE found CCW units to be relatively price inelastic, DOE estimated that the potential standards would not affect total shipments. However, DOE applied a cross-price elasticity to estimate how the market would shift between front-loading and top-loading units in response to a change in price of the unit. At higher TSLs, there is a shift toward front-loading units.

Table V.15. Projected Cumulative Shipments of Front- and Top-loading Commercial Clothes Washer Units in 2018–2047 (million units)

	Base Case	TSL1	TSL2	TSL3	TSL 4 Max Tech
		FL:EL1 TL:EL1	FL:EL2 TL:EL1	FL:EL2 TL:EL2	FL:EL3 TL:EL2
Front Loading	2.55	2.55	2.55	2.68	2.61
Top Loading	3.74	3.74	3.74	3.61	3.68
TOTAL	6.29	6.29	6.29	6.29	6.29

a. Significance of Energy Savings

For each TSL, DOE projected energy savings for front‑loading and top‑loading CCW units purchased in the 30-year period that begins in the year of anticipated compliance with amended standards (2018–2047). The savings are measured over the entire lifetime of equipment purchased in the 30-year period. DOE quantified the energy savings attributable to each TSL as the difference in energy consumption between each standards case and the base case. Table V.16 presents the estimated primary energy savings for each considered TSL, and Table V.17 presents the estimated FFC energy savings for each TSL. The approach for estimating national energy savings is further described in section IV.H. The negative savings for front-loading units in TSLs 3 and 4 are a consequence of the projected increase in shipments relative to the base case.

Table V.16. Cumulative Primary Energy Savings for Front-loading and Top-loading Commercial Clothes Washers Trial Standard Levels for Units Sold in 2018 –2047

Equipment Class	Trial Standard Level			
	1	2	3	4
	Quads			
Front Loading CCW Units	0.000	0.007	-0.005	-0.007
Top Loading CCW Units	0.060	0.060	0.136	0.127
Total All Classes	0.060	0.067	0.131	0.120

Table V.17. Cumulative Full-Fuel-Cycle Energy Savings for Front-loading and Top-loading Commercial Clothes Washers Trial Standard Levels for Units Sold in 2018 –2047

Equipment Class	Trial Standard Level			
	1	2	3	4
	Quads			
Front Loading CCW Units	0.000	0.007	-0.005	-0.008
Top Loading CCW Units	0.065	0.065	0.145	0.136
Total All Classes	0.065	0.072	0.140	0.128

OMB Circular A-4[59] requires agencies to present analytical results, including separate schedules of the monetized benefits and costs that show the type and timing of benefits and costs. Circular A-4 also directs agencies to consider the variability of key elements underlying the estimates of benefits and costs. For this rulemaking, DOE undertook a sensitivity analysis using nine instead of 30 years of equipment shipments. This choice reflects the timeline in EPCA for the review of certain energy conservation standards and potential revision of and compliance with such revised

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[59] U.S. Office of Management and Budget, Circular A-4: Regulatory Analysis (2003), available at http://www.whitehouse.gov/omb/circulars_a004_a-4/.

standards.[60] The review timeframe established in EPCA is generally not synchronized

with the equipment lifetime, equipment manufacturing cycles, or other factors specific to

CCWs. Thus, this information is presented for informational purposes only and is not

indicative of any change in DOE's analytical methodology. The NES results based on a

nine-year analytical period are presented in Table V.18. The impacts are counted over the

lifetime of CCWs purchased in 2018–2026.

Table V.18. Cumulative Primary Energy Savings for Front-loading and Top-loading Commercial Clothes Washers Trial Standard Levels for Units Sold in 2018–2026

Equipment Class	Trial Standard Level			
	1	2	3	4
	Quads			
Front Loading CCW Units	0.0	0.002	-0.001	-0.001
Top Loading CCW Units	0.019	0.019	0.042	0.039
Total All Classes	0.019	0.021	0.041	0.038

b. Net Present Value of Customer Costs and Benefits

DOE estimated the cumulative NPV of the total costs and savings for customers

that would result from the TSLs considered for CCWs. In accordance with OMB's

guidelines on regulatory analysis,[61] DOE calculated the 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

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[60] Section 325(m) of EPCA requires DOE to review its standards at least once every 6 years, and requires, for certain products, a 3-year period after any new standard is promulgated before compliance is required, except that in no case may any new standards be required within 6 years of the compliance date of the previous standards. While adding a 6-year review to the 3-year compliance period adds up to 9 years, DOE notes that it may undertake reviews at any time within the 6 year period and that the 3-year compliance date may yield to the 6-year backstop. A 9-year analysis period may not be appropriate given the variability that occurs in the timing of standards reviews and the fact that for some consumer products, the compliance period is 5 years rather than 3 years.
[61] OMB Circular A-4, section E, supra note 52.

rate of return on private capital in the U.S. economy, and reflects the returns on real

estate and small business capital as well as corporate capital. This discount rate

approximates the opportunity cost of capital in the private sector. The 3-percent rate

reflects the potential effects of standards on private consumption (e.g., through higher

prices for equipment and reduced purchases of energy). This rate represents the rate at

which society discounts future consumption flows to their present value. It can be

approximated by the real rate of return on long-term government debt (i.e., yield on

United States Treasury notes), which has averaged about 3 percent for the past 30 years.

Table V.19 shows the customer NPV results for each TSL considered for CCWs.

In each case, the impacts cover the lifetime of equipment purchased in 2018–2047.

Table V.19. Net Present Value of Customer Benefits for Front-loading and Top-loading Commercial Clothes Washers Trial Standard Levels for Units Sold in 2018–2047

Equipment Class	Discount Rate %	Trial Standard Level			
		1	2	3	4
		billion 2013$			
Front Loading CCW Units	3%	0.0	0.1	-0.1	-0.3
Top Loading CCW Units		0.4	0.4	2.0	1.9
Total All Classes		0.4	0.5	1.9	1.6
Front Loading CCW Units	7%	0.0	0.0	-0.1	-0.1
Top Loading CCW Units		0.2	0.2	0.9	0.8
Total All Classes		0.2	0.2	0.9	0.7

The NPV results based on the nine-year analytical period discussed in section V.B.3.a are presented in Table V.20. The impacts are counted over the lifetime of equipment purchased in 2018–2026. As mentioned previously, this information is presented for informational purposes only and is not indicative of any change in DOE's analytical methodology or decision criteria.

Table V.20. Net Present Value of Customer Benefits for Front-loading and Top-loading Commercial Clothes Washers Trial Standard Levels for Units Sold in 2018–2026[†]

Equipment Class	Discount Rate %	Trial Standard Level			
		1	2	3	4
		billion 2013$			
Front Loading CCW Units	3%	0.0	0.0	0.0	(0.1)
Top Loading CCW Units		0.2	0.2	0.7	0.7
Total All Classes		0.2	0.2	0.7	0.6
Front Loading CCW Units	7%	0.0	0.0	0.0	0.0
Top Loading CCW Units		0.1	0.1	0.4	0.4
Total All Classes		0.1	0.1	0.4	0.4

[†] Values in parentheses are negative values.

c. Indirect Impacts on Employment

DOE expects energy conservation standards for front-loading and top-loading CCWs to reduce energy costs for equipment owners, 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.N, 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 time frames, where these uncertainties are reduced.

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

4. Impact on Utility

As discussed in section IV.C, DOE has determined that the amended standards will not lessen the utility of front-loading and top-loading CCWs.

5. 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 amended standard and to transmit such determination in writing to the Secretary within 60 days of the publication of amended rule, together with an analysis of the nature and extent of the impact. (42 U.S.C. 6295(o)(2)(B)(i)(V) and (ii))

To assist the Attorney General in making such determination for these standards, DOE provided the DOJ with copies of the March 2014 NOPR and the TSD for review. In

its assessment letter responding to DOE, DOJ concluded that the amended energy conservation standards for CCWs are unlikely to have a significant adverse impact on competition.

6. Need of the Nation to Conserve Energy

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

Energy savings from standards for CCWs could also produce environmental benefits in the form of reduced emissions of air pollutants and greenhouse gases. Table V.21 provides DOE's estimate of cumulative emissions reductions projected to result from the TSLs considered in this rulemaking. DOE reports annual emissions reductions for each TSL in chapter 13 of the final rule TSD.

Table V.21. Cumulative Emissions Reduction Estimated for Front-loading and Top-loading Commercial Clothes Washers Trial Standard Levels

	Trial Standard Level			
	1	2	3	4
Power Sector and Site Emissions*				
CO_2 (million metric tons)	3.4	3.8	7.5	6.9
SO_2 (thousand tons)	1.8	1.9	4.2	4.2
NO_X (thousand tons)	3.5	4.0	7.4	6.5
Hg (tons)	0.0	0.0	0.0	0.0
N_2O (thousand tons)	0.0	0.0	0.1	0.1
CH_4 (thousand tons)	0.2	0.2	0.5	0.5
Upstream Emissions				
CO_2 (million metric tons)	0.3	0.3	0.6	0.5
SO_2 (thousand tons)	0.0	0.0	0.1	0.1
NO_X (thousand tons)	4.5	5.1	9.2	8.0
Hg (tons)	0.0	0.0	0.0	0.0
N_2O (thousand tons)	0.0	0.0	0.0	0.0
CH_4 (thousand tons)	27.7	31.8	56.6	48.8
Total Emissions				
CO_2 (million metric tons)	3.7	4.1	8.1	7.4
SO_2 (thousand tons)	1.8	1.9	4.3	4.3
NO_X (thousand tons)	8.0	9.1	16.6	14.5
Hg (tons)	0.0	0.0	0.0	0.0
N_2O (thousand tons)	0.0	0.0	0.1	0.1
N_2O (thousand tons CO_2eq)**	8.8	9.3	20.5	20.1
CH_4 (thousand tons)	28.0	32.0	57.2	49.3
CH_4 (thousand tons CO_2eq)**	783.1	897.3	1600.6	1380.3

* Includes site emissions from gas water heaters.

** CO_2eq is the quantity of CO_2 that would have the same GWP.

As part of the analysis for this rule, DOE estimated monetary benefits likely to result from the reduced emissions of CO_2 and NO_X that DOE estimated for each of the TSLs considered. As discussed in section IV.L, DOE used the most recent values for the

SCC developed by an interagency process. The four sets of SCC values resulting from that process (expressed in 2013$) are represented by $12.0/metric ton (the average value from a distribution that uses a 5-percent discount rate), $40.5/metric ton (the average value from a distribution that uses a 3-percent discount rate), $62.4/metric ton (the average value from a distribution that uses a 2.5-percent discount rate), and $119/metric 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 2015; the values for later years are higher due to increasing damages as the projected magnitude of climate change increases.

Table V.22 presents the global value of CO_2 emissions reductions at each TSL. For each of the four cases, DOE calculated a present value of the stream of annual values using the same discount rate as was used in the studies upon which the dollar-per-ton values are based. DOE calculated domestic values as a range from 7 percent to 23 percent of the global values, and these results are presented in chapter 14 of the final rule TSD.

Table V.22. Estimates of Present Value of CO$_2$ Emissions Reduction under Front-loading and Top-loading Commercial Clothes Washers Trial Standard Levels

TSL	SCC Case*			
	5% discount rate, average*	**3% discount rate, average***	**2.5% discount rate, average***	**3% discount rate, 95th percentile***
	Million 2013$			
Power Sector and Site Emissions				
1	24.3	110.7	175.4	342.0
2	26.7	121.9	193.3	376.8
3	52.9	240.9	381.9	744.4
4	48.8	222.1	352.1	686.2
Upstream Emissions				
1	2.1	9.5	15.0	29.3
2	2.3	10.8	17.1	33.3
3	4.2	19.5	31.0	60.4
4	3.7	17.1	27.1	52.8
Total Emissions				
1	26.4	120.2	190.5	371.3
2	29.1	132.7	210.4	410.1
3	57.1	260.4	413.0	804.8
4	52.5	239.2	379.2	739.0

* For each of the four cases, the corresponding global SCC value for emissions in 2015
is $12.0, $40.5, $62.4, and $119 per metric ton (2013$).

DOE is well aware that scientific and economic knowledge about the contribution of CO$_2$ and other greenhouse gas (GHG) emissions to changes in the future global climate and the potential resulting damages to the world economy continues to evolve rapidly. Thus, any value placed on reducing CO$_2$ emissions in this rulemaking is subject to change. DOE, together with other Federal agencies, will continue to review various methodologies for estimating the monetary value of reductions in CO$_2$ and other GHG emissions. This ongoing review will consider the comments on this subject that are part of the public record for this and other rulemakings, as well as other methodological

assumptions and issues. However, consistent with DOE's legal obligations, and taking

into account the uncertainty involved with this particular issue, DOE has included in this

final rule the most recent values and analyses resulting from the interagency process.

DOE also estimated the cumulative monetary value of the economic benefits

associated with NO_X emissions reductions anticipated to result from amended standards

for CCWs. The dollar-per-ton values that DOE used are discussed in section IV.L. Table

V.23 presents the cumulative present values for each TSL calculated using seven-percent

and three-percent discount rates.

Table V.23. Estimates of Present Value of NO_X Emissions Reduction under Front-loading and Top-loading Commercial Clothes Washers Trial Standard Levels

TSL	3% discount rate	7% discount rate
	Million 2013$	
Power Sector and Site Emissions		
1	5.0	2.5
2	5.6	2.7
3	10.5	5.1
4	9.4	4.6
Upstream Emissions		
1	6.2	3.0
2	7.1	3.3
3	12.7	6.0
4	11.1	5.3
Total Emissions		
1	11.2	5.4
2	12.7	6.1
3	23.2	11.2
4	20.4	9.9

7. Summary of National Economic Impacts

The NPV of the monetized benefits associated with emissions reductions can be viewed as a complement to the NPV of the customer savings calculated for each TSL considered in this rulemaking. Table V.24 presents the NPV values that result from adding the estimates of the potential economic benefits resulting from reduced CO_2 and NO_X emissions in each of four valuation scenarios to the NPV of customer savings calculated for each TSL considered in this rulemaking, at both a seven-percent and three-percent discount rate. The CO_2 values used in the columns of each table correspond to the four sets of SCC values discussed above.

Table V.24. Net Present Value of Customer Savings Combined with Present Value of Monetized Benefits from CO_2 and NO_X Emissions Reductions

TSL	Customer NPV at 3% Discount Rate added with:			
	SCC Case $12.0/t and NOx Medium Value*	SCC Case $40.5/t and NOx Medium Value[*]	SCC Case $62.4/t and NOx Medium Value[*]	SCC Case $119/t and NOx Medium Value[*]
	Billion 2013$			
1	0.5	0.6	0.6	0.8
2	0.6	0.7	0.8	1.0
3	2.0	2.2	2.4	2.8
4	1.6	1.8	2.0	2.3
TSL	Customer NPV at 7% Discount Rate added with:			
	SCC Case $12.0/t and NOx Medium Value*	SCC Case $40.5/t and NOx Medium Value[*]	SCC Case $62.4/t and NOx Medium Value[*]	SCC Case $119/t and NOx Medium Value[*]
	Billion 2013$			
1	0.2	0.3	0.4	0.6
2	0.3	0.4	0.5	0.7
3	0.9	1.1	1.3	1.7
4	0.8	1.0	1.1	1.5

[*] These label values represent the global SCC in 2015, in 2013$. For NO_X emissions, each case uses the medium value, which corresponds to $2,684 per ton.

Although adding the value of customer 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. customer monetary savings that occur as a result of market transactions, while the value of CO_2 reductions is based on a global value. Second, the assessments of operating cost savings and the SCC are performed with different methods that use different time frames for analysis. The national operating cost savings is measured for the lifetime of equipment shipped in 2018–2047. The SCC values, on the other hand, reflect the present value of future climate-related impacts resulting from the emission of one metric ton of CO_2 in each year. These impacts continue well beyond 2100.

8. Other Factors

The Secretary of Energy, in determining whether a standard is economically justified, may consider any other factors that the Secretary deems to be relevant. (42 U.S.C. 6313(a)(6)(B)(ii)(VII)) No other factors were considered in this analysis.

C. Conclusion

EPCA requires that the new or amended energy conservation standard that DOE adopts for any type (or class) of covered equipment shall be designed to achieve the maximum improvement in energy efficiency that the Secretary of Energy determines is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A) and 6316(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

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practicable, considering the seven statutory factors discussed previously. (42 U.S.C.

6295(o)(2)(B)(i) and 6316(a)) The new or amended standard must also "result in

significant conservation of energy." (42 U.S.C. 6295(o)(3)(B) and 6316(a))

For this final rule, DOE considered the impacts of standards at each TSL,

beginning with the maximum technologically feasible level, to determine whether that

level was economically justified. Where the max-tech level was not justified, DOE then

considered the next most efficient level and undertook the same evaluation until it

reached the highest efficiency level that is technologically feasible, economically

justified and saves a significant amount of energy.

To aid the reader in understanding the benefits and/or burdens of each TSL, tables

in this section summarize the quantitative analytical results for each TSL, based on the

assumptions and methodology discussed herein. The efficiency levels contained in each

TSL are described in section V.A. In addition to the quantitative results presented in the

tables, DOE also considers other burdens and benefits that affect economic justification.

These include the impacts on identifiable subgroups of customers who may be

disproportionately affected by a national standard (see section V.B.1.b), and impacts on

employment. DOE discusses the impacts on employment in front-loading and top-loading

CCW equipment manufacturing in section V.B.2, and discusses the indirect employment

impacts in section V.B.3.c.

1. Benefits and Burdens of Trial Standard Levels Considered for Commercial Clothes Washers

Table V.25 and Table V.26 summarize the quantitative impacts estimated for each TSL for CCWs.

Table V.25. Summary of Analytical Results for Commercial Clothes Washers: National Impacts

Category	TSL 1	TSL 2	TSL 3	TSL 4
National FFC Energy Savings quads				
	0.065	0.072	0.140	0.128
NPV of Customer Benefits 2013$ billion				
3% discount rate	0.4	0.5	1.9	1.6
7% discount rate	0.2	0.2	0.9	0.7
Cumulative Emissions Reduction (Total FFC Emissions)				
CO_2 million metric tons	3.73	4.13	8.09	7.41
NO_X thousand tons	8.01	9.10	16.60	14.54
Hg tons	0.01	0.01	0.01	0.01
N_2O thousand tons	0.03	0.04	0.10	0.10
N_2O thousand tons CO_2eq*	8.79	9.32	20.55	20.08
CH_4 thousand tons	27.97	32.05	57.17	49.29
CH_4 thousand tons CO_2eq*	783.1	897.3	1600.6	1380.3
SO_2 thousand tons	1.80	1.88	4.29	4.26
Value of Emissions Reduction (Total FFC Emissions)				
CO_2 2013$ million**	26 to 371	29 to 410	57 to 805	53 to 739
NO_X – 3% discount rate 2013$ million	11.2	12.7	23.2	20.4
NO_X – 7% discount rate 2013$ million	5.4	6.1	11.2	9.9

* CO_2eq is the quantity of CO_2 that would have the same GWP.

** Range of the economic value of CO_2 reductions is based on estimates of the global benefit of reduced CO_2 emissions.

Table V.26. Summary of Analytical Results for Front-loading and Top-loading Commercial Clothes Washers: Manufacturer and Customer Impacts

Category	TSL 1	TSL 2	TSL 3	TSL 4
Manufacturer Impacts				
Change in INPV (2013$ million)[†]	(6.4)	(6.6)	(67.5)	(99.6)
Change in INPV (%)[†]	(5.2%)	(5.3%)	(54.6%)	(80.7%)
Customer Mean LCC Savings 2013$				
Front-Loading, Multi-family[†]	221.4	271.9	271.9	(2.7)
Front-Loading, Laundromat[†]	184.3	212.3	212.3	(10.2)
Top-Loading, Multi-family	294.5	294.5	807.4	807.4
Top-Loading, Laundromat	165.7	165.7	622.4	622.4
Weighted Average*	251.4	270.3	573.0	466.3
Customer Simple PBP years				
Front-Loading, Multi-family	0.0	0.0	0.0	1.1
Front-Loading, Laundromat	0.0	0.0	0.0	1.0
Top-Loading, Multi-family	0.0	0.0	0.7	0.7
Top-Loading, Laundromat	0.0	0.0	0.6	0.6
Weighted Average*	0.0	0.0	0.4	0.8
Customers with Net Cost %				
Front-Loading, Multi-Family	0	0	0	55
Front-Loading, Laundromat	0	0	0	65
Top-Loading, Multi-Family	0	0	0	0
Top-Loading, Laundromat	0	0	0	0
Weighted Average*	0	0	0	23

* Weighted by shares of each equipment class in total projected shipments in 2018.
[†] Values in parentheses are negative values.

First, DOE considered TSL 4, the max tech level, which would save an estimated total of 0.128 quads of energy, an amount DOE considers significant. TSL 4 has an estimated NPV of customer benefit of $0.71 billion using a 7 percent discount rate, and $1.58 billion using a 3 percent discount rate.

The cumulative emissions reductions at TSL 4 are 7.41 million metric tons of CO_2, 14.54 thousand tons of NO_X, 4.26 thousand tons of SO_2, 49.29 thousand tons of CH_4, 0.08 thousand tons of N_2O, and 0.01 tons of Hg (see Table V.25). The estimated monetary value of the CO_2 emissions reductions at TSL 4 ranges from $53 million to $739 million.

For front-loading CCWs at TSL 4, the mean LCC savings decreases by $3 and $10 for multi-family and laundromat applications, respectively. The simple payback period is 1.1 years and 1.0 years for multifamily and laundromat applications, respectively. On the other hand, top-loading CCWs have a mean LCC savings of $807 and $622 for multi-family and laundromat applications, respectively, and the simple PBP is 0.7 years and 0.6 years for multi-family and laundromat applications, respectively. The share of customers that would experience a net LCC cost (i.e., LCC increase) is 55 percent and 65 percent for multifamily and laundromat applications of front-loading CCW units, respectively. For top-loading CCW units, no customers would experience a net LCC cost.

At TSL 4, the projected change in INPV ranges from a decrease of $99.6 million to a decrease of $103.8 million, equivalent to 80.7 percent and 84.1 percent, respectively. CCWs that meet the efficiency standards specified by this TSL are forecast to represent only 8 percent of shipments in the year leading up to amended standards. As such, manufacturers would have to redesign nearly all equipment by the 2018 compliance date

to meet demand. Redesigning all units to meet the current max tech efficiency levels would require considerable capital and equipment conversion expenditures. At TSL 4, the capital conversion costs total $63.1 million, 13.7 times the industry annual capital expenditure in the year leading up to the standards compliance year of 2018. DOE estimates that complete platform redesigns would cost the industry $62.4 million in product conversion costs. These conversion costs largely relate to the research programs required to develop new equipment that meet the efficiency standards set forth by TSL 4. These costs are equivalent to 14.9 times the industry annual budget for research and development. Total capital and product conversion costs associated with the changes in equipment and manufacturing facilities required at TSL 4 would require significant use of manufacturers' financial reserves (manufacturer capital pools), impacting other areas of business that compete for these resources, and significantly reducing INPV. In addition, manufacturers could face a substantial impact on profitability at TSL 4. Because manufacturers are more likely to reduce their margins to maintain a price-competitive equipment at higher TSLs, DOE expects that TSL 4 would yield impacts closer to the high end of the range of INPV impacts (i.e. most severe). If the high end of the range of impacts is reached, as DOE expects, TSL 4 could result in a net loss of 84.1 percent in INPV to CCW manufacturers. As a result, at TSL 4, DOE expects that some companies would be forced to exit the CCW market or shift production abroad, both which would negatively impact domestic manufacturing capacity and employment.

More specifically, DOE expects that the level of investments that the LVM would be required to make at TSL 4 would be unmanageable and may result in the LVM exiting

the top-loading market or the CCW market altogether. This would negatively impact competition in the industry by reducing the number of market actors. Relative to the LVM's major competitor, disproportionate impacts are high at the max tech level for top-loading CCW units. This is due to the fact that the LVM's major competitor already produces at the max tech level for top-loading units. Thus, for the major competitor, there is no conversion cost burden associated with a standard for top-loading units. Conversely, for reasons mentioned in the preceding paragraph, the LVM will have high conversion costs at the max tech level for top-loading units.

Therefore, for TSL 4, DOE concludes that the benefits of energy savings, positive NPV of total customer benefits, customer average LCC savings for two of the four applications, emission reductions and the estimated monetary value of the emissions reductions would be outweighed by the negative customer impacts for front-loading CCWs in multi-family and laundromat applications, the large reduction in industry value at TSL 4, as well as the potential for loss of domestic manufacturing. Consequently, DOE concludes that TSL 4 is not economically justified.

Next, DOE considered TSL 3, which would save an estimated total of 0.14 quads of energy, an amount DOE considers significant. TSL 3 has an estimated NPV of customer benefit of $0.87 billion using a 7 percent discount rate, and $1.93 billion using a 3 percent discount rate.

The cumulative emissions reductions at TSL 3 are 8.09 million metric tons of CO_2, 16.60 thousand tons of NO_X, 4.29 thousand tons of SO_2, 57.17 thousand tons of CH_4, 0.08 thousand tons of N_2O, and 0.01 tons of Hg. The estimated monetary value of the CO_2 emissions reductions at TSL 3 ranges from $57 million to $805 million.

At TSL 3, the average LCC savings is $272 and $212 for front-loading CCW units for multi-family and laundromat applications, respectively. For top-loading CCW units, the average LCC savings are $807 and $622 for multi-family and laundromat applications, respectively. The simple PBP is close to zero years for both applications of front-loading CCW units, 0.7 and 0.6 years for multi-family and laundromat applications of top-loading CCW units. DOE estimates that no customer would experience a net LCC cost for both front-loading and top-loading CCW units.

At TSL 3, the projected change in INPV ranges from a decrease of $67.5 million to a decrease of $70.5 million, equivalent to 54.6 percent and 57.1 percent, respectively. CCWs that meet the efficiency standards specified by this TSL are forecast to represent only 29 percent of shipments (11% for top-loading CCW units only) in 2017 (the year leading up to amended standards). As such, manufacturers would have to redesign a large portion of CCWs by the 2018 compliance date to meet demand. Redesigning all top-loading units to meet the current max tech efficiency level would require considerable capital and equipment conversion expenditures. At TSL 3, the capital conversion costs total $38.7 million, 8.4 times the industry annual capital expenditure in the year leading up to amended standards. DOE estimates that complete platform redesign for top-loading

units and upgrades to front-loading units would cost the industry $50.9 million in product conversion costs. These conversion costs largely relate to the research programs required to develop new equipment that meet the efficiency standards set forth by TSL 3. These costs are equivalent to 12.1 times the industry annual budget for research and development. In addition, total capital and product conversion costs associated with the changes in equipment and manufacturing facilities required at TSL 3 would require significant use of manufacturers' financial reserves, impacting other areas of business that compete for these resources, and significantly reducing INPV. In addition, manufacturers could face a substantial impact on profitability at TSL 3. Because manufacturers are more likely to reduce their margins to maintain a price-competitive CCW at higher TSLs, DOE expects that TSL 3 would yield impacts closer to the high end of the range of INPV impacts. If the high end of the range of impacts is reached, as DOE expects, TSL 3 could result in a net loss of 84.1 percent in INPV to CCW manufacturers. As a result, at TSL 3, DOE expects that some companies would be forced to exit the CCW market or shift production internationally, both which would negatively impact domestic manufacturing capacity and employment.

In terms of the LVM, DOE expects the level of investments that the LVM would be required to make at TSL 3 would be unmanageable and may result in the LVM exiting the top-loading market. In terms of disproportionate impacts relative to the LVM's major competitor, disproportionate impacts are high at the max tech level for top-loading CCW units. This is due to the fact that the LVM's major competitor already produces at the max tech level for top-loading units. Thus, for the major competitor, there is no

conversion cost burden associated with a standard for top-loading units. Conversely, for reasons mentioned in the preceding paragraph, the LVM will have high conversion costs at TSL 3 for top-loading units.

In view of the foregoing, DOE concludes that, at TSL 3 for front-loading and top-loading CCW equipment, the benefits of energy savings, positive NPV of customer benefit, positive impacts on customers, emission reductions, and the estimated monetary value of the emissions reductions would not outweigh the large reduction in industry value at TSL 3, as well as the potential for loss of domestic manufacturing. Consequently, DOE concludes that TSL 3 is not economically justified.

Next, DOE considered TSL 2, which would save an estimated total of 0.072 quads of energy, an amount DOE considers significant. TSL 2 has an estimated NPV of customer benefit of $0.24 billion using a 7 percent discount rate, and $0.53 billion using a 3 percent discount rate.

The cumulative emissions reductions at TSL 2 are 4.13 million metric tons of CO_2, 9.10 thousand tons of NO_X, 1.88 thousand tons of SO_2, 32.05 thousand tons of CH_4, 0.04 thousand tons of N_2O, and 0.01 tons of Hg. The estimated monetary value of the CO_2 emissions reductions at TSL 2 ranges from $29 million to $410 million.

At TSL 2, the average LCC savings is $272 and $212 for front-loading CCW units for multi-family and laundromat applications, respectively. For top-loading CCW

units, the average LCC savings are $294 and $166 for multi-family and laundromat applications. The simple PBP is close to zero years for both applications of front-loading as well as top-loading CCW units. DOE estimates that no customer would experience a net LCC cost for both front-loading and top-loading CCW units.

At TSL 2, the projected change in INPV is a decrease of $6.6 million, or a decrease of 5.3 percent. Although CCWs that meet the efficiency standards specified by this TSL are forecast to represent only 39 percent of shipments in the year leading up to amended standards, DOE's testing and reverse-engineering analyses indicate that manufacturers can achieve TSL 2 at little or no additional capital cost compared to models at the current baseline levels. Through its analyses, DOE observed that manufacturers generally employ control strategies to achieve the TSL 2 efficiency levels (e.g., changes in water levels, water temperatures, and cycle settings available to the end-user). Accordingly, this level corresponds more to incremental equipment conversions rather than platform redesigns. Thus, DOE estimates that compliance with TSL 2 would not require any upfront capital investments. TSL 2 will require an estimated $10.2 million in product conversion costs primarily relating to the research and development programs needed to improve upon existing platforms to meet the specified efficiency levels. This represents 2.4 times the industry budget for research and development in 2017 (the year leading up to amended standards), as indicated in the GRIM and described in greater detail in chapter 12 of the final rule TSD. The substantial reduction in conversion costs corresponding to compliance with TSL 2 (relative to TSL 3 and TSL 4) greatly mitigates the operational risk and impact on INPV.

After considering the analysis and weighing the benefits and the burdens, DOE concludes that at TSL 2 for front-loading and top-loading CCW equipment, the benefits of energy savings, positive NPV of customer benefit, positive impacts on customers (as indicated by positive average LCC savings, favorable PBPs, and the large percentage of customers who would experience LCC benefits), emission reductions, and the estimated monetary value of the emissions reductions would outweigh the potential reductions in INPV for manufacturers. DOE concludes that TSL 2 would save a significant amount of energy and is technologically feasible and economically justified.

Based on the above considerations, DOE adopts the energy conservation standards for front-loading and top-loading CCWs at TSL 2.

Table V.27 presents the amended energy conservation standards for CCW equipment.

Table V.27. Amended Energy Conservation Standards for Commercial Clothes Washers

Equipment Class	Minimum MEF$_{J2}$*	Maximum IWF[†]
Top-Loading	1.35	8.8
Front-Loading	2.00	4.1

*MEF$_{J2}$ (appendix J2 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.
[†]IWF (integrated water 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 Amended Standards

For equipment sold between 2018 and 2047, the benefits and costs of the amended standards can also be expressed in terms of annualized values. The annualized monetary values are the sum of (1) the annualized national economic value of the benefits from customer operation of equipment that meet the amended standards (consisting primarily of operating cost savings from using less energy, minus increases in equipment purchase and installation costs, which is another way of representing customer NPV), and (2) the annualized monetary value of the benefits of emission reductions, including CO_2 emission reductions.[62]

Although combining the values of operating savings and CO_2 emission reductions provides a useful perspective, two issues should be considered. First, the national operating savings are domestic U.S. customer 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 different time frames for analysis. The national operating cost savings is measured for the lifetime of front-loading and top-loading CCWs shipped between 2018 and 2047. The SCC values, on the other hand, reflect the present value of some future

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[62] 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 2014, the year used for discounting the NPV of total customer 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. From the present value, DOE then calculated the fixed annual payment over a 30-year period (2018 through 2047) 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.

climate-related impacts resulting from the emission of one ton of carbon dioxide in each year. These impacts continue well beyond 2100.

Estimates of annualized benefits and costs of the amended standards for front-loading and top-loading CCWs are shown in Table V.28. Using a 7-percent discount rate for benefits and costs[63] the cost of the standards amended in the rule is $0.02 million per year in increased equipment costs; while the estimated benefits are $24 million per year in reduced equipment operating costs, $7 million in CO_2 reductions, and $0.60 million in reduced NO_X emissions. In this case, the net benefit would amount to $32 million per year. Using a 3-percent discount rate for all benefits and costs and the average SCC series, the estimated cost of the standards amended in the rule is $0.03 million per year in increased equipment costs; while the estimated benefits are $30 million per year in reduced operating costs, $7 million in CO_2 reductions, and $0.71 million in reduced NO_X emissions. In this case, the net benefit would amount to approximately $38 million per year.

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[63] DOE used a 3-percent discount rate for CO2 reduction, along with the average SCC series that uses a 3-percent discount rate ($40.5/t in 2015).

Table V.28. Annualized Benefits and Costs of Amended Standards for Front-loading and Top-loading Commercial Clothes Washers (TSL 2)

	Discount Rate	Primary Estimate*	Low Net Benefits Estimate*	High Net Benefits Estimate*
		million 2013$/year		
Benefits				
Operating Cost Savings	7%	24	21	30
	3%	30	26	38
CO_2 Reduction Monetized Value ($12.0/t case)*	5%	2	2	3
CO_2 Reduction Monetized Value ($40.5/t case)*	3%	7	7	9
CO_2 Reduction Monetized Value ($62.4/t case)*	2.5%	11	10	13
CO_2 Reduction Monetized Value ($119/t case)*	3%	23	21	28
NO_X Reduction Monetized Value (at $2,684/ton)**	7%	0.60	0.55	0.71
	3%	0.71	0.64	0.86
Total Benefits†	7% plus CO_2 range	27 to 47	24 to 43	33 to 58
	7%	32	29	39
	3% plus CO_2 range	33 to 53	29 to 47	41 to 66
	3%	38	33	48
Costs				
Incremental Equipment Costs	7%	0.02	0.03	0.02
	3%	0.03	0.03	0.02
Net Benefits				
Total†	7% plus CO_2 range	27 to 47	24 to 43	33 to 58
	7%	32	29	39
	3% plus CO_2 range	33 to 53	29 to 47	41 to 66
	3%	38	33	48

* This table presents the annualized costs and benefits associated with front‑loading and top‑loading CCW units shipped in 2018−2047. These results include benefits to customers which accrue after 2047 from the equipment purchased in 2018−2047. The results account for the incremental variable and fixed costs incurred by manufacturers due to the standard, some of which may be incurred in preparation for the rule. The Primary, Low Benefits, and High Benefits Estimates utilize projections of energy prices from the AEO2014 Reference case, Low Economic Growth case, and High Economic Growth case, respectively. In addition, incremental equipment costs reflect no change for projected equipment price trends in the Primary Estimate, an increasing trend for projected equipment prices in the Low Benefits Estimate, and a decreasing trend for projected equipment prices in the High Benefits Estimate. The methods used to derive projected price trends are explained in section IV.F.

** The interagency group selected four sets of SCC values for use in regulatory analyses. Three sets of values are based on the average SCC from the three integrated assessment models, at discount rates of 2.5, 3, and 5 percent. The fourth set, which represents the 95th percentile SCC estimate across all three models at a 3‑percent discount rate, is included to represent higher‑than‑expected impacts from temperature change further out in the tails of the SCC distribution. The values in parentheses represent the SCC in 2015. The SCC time series incorporate an escalation factor. The value for NO_X is the average of the low and high values used in DOE's analysis.

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

VI. Procedural Issues and Regulatory Review

A. Review Under Executive Orders 12866 and 13563

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

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

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

(3) There are external benefits resulting from improved energy efficiency of CCWs that are not captured by the users of such equipment. These benefits include externalities related to public health, environmental protection and national security that are not reflected in energy prices, such as reduced emissions of air pollutants and greenhouse gases that impact human health and global warming.

In addition, DOE has determined that this regulatory action is not a "significant regulatory action" under section 3(f)(1) of Executive Order 12866. Therefore, DOE did not present for review to the OIRA in the OMB the draft rule and other documents prepared for this rulemaking, including a regulatory impact analysis (RIA).

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 EO 12866. To the extent permitted by law, agencies are required by EO 13563 to: (1) propose or adopt a regulation only upon a reasoned determination that its benefits justify its costs (recognizing that some benefits and costs are difficult to

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

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

B. Review Under the Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 et seq.) requires preparation of a final regulatory flexibility analysis (FRFA) for any rule that by law must be proposed for

public comment, unless the agency certifies that the rule, if promulgated, will not have a

significant economic impact on a substantial number of small entities. As required by

Executive Order 13272, "Proper Consideration of Small Entities in Agency Rulemaking,"

67 FR 53461 (August 16, 2002), DOE published procedures and policies on February 19,

2003, to ensure that the potential impacts of its rules on small entities are properly

considered during the rulemaking process. 68 FR 7990. DOE has made its procedures

and policies available on the Office of the General Counsel's website

(http://energy.gov/gc/office-general-counsel).

DOE reviewed this final rule pursuant to the FRFA and the policies and

procedures discussed above. DOE certifies that the standards established in this final rule

will not have a significant impact on a substantial number of small entities. The factual

basis for this certification is set forth below.

For manufacturers of CCWs, the 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.[64] CCW

manufacturing is classified under NAICS 333318, "Other commercial and service

industry machinery 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.

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[64] The size standards are listed by NAICS code and industry description and are available at
http://www.sba.gov/sites/default/files/files/Size_Standards_Table.pdf.

To estimate the number of small businesses which could be impacted by the amended energy conservation standards, DOE conducted a market survey using available public information to identify potential small manufacturers. DOE's research included the AHAM membership directory, equipment databases (CEE, California Energy Commission (CEC), and ENERGY STAR databases) and individual company websites 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 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 CCWs. DOE screened out companies that did not offer equipment covered by this rulemaking, did not meet the definition of a "small business," or are foreign owned and operated.

All top-loading CCWs and approximately 40 percent of front-loading CCWs are currently manufactured in the United States, accounting for 83 percent of overall domestic CCW shipments. Three U.S.-based companies are responsible for this 83 percent domestic production and over 95 percent of CCW industry market share. Although one of these manufacturers has been identified and analyzed separately as an LVM, none of these manufacturers meet the definition of a small business manufacturer, as they all have more than 1,000 employees. The small portion of the remaining CCW market (approximately 5,800 shipments) is supplied by a combination of three international companies, all of which have small market shares. These companies are all

foreign owned and operated, and exceed the SBA's employment threshold for consideration as a small business under the appropriate NAICS code. Therefore, DOE did not identify any small business manufacturers of CCWs.

Based on the discussion above, DOE certifies that the standards for CCWs set forth in this final rule will not have a significant economic impact on a substantial number of small entities. Accordingly, DOE has not prepared a FRFA for this rulemaking. DOE will transmit the certification and supporting statement of factual basis to the Chief Counsel for Advocacy of the SBA for review under 5 U.S.C. 605(b).

1. Significant Alternatives to the Rule

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

C. Review Under the Paperwork Reduction Act

Manufacturers of CCWs must certify to DOE that their equipment complies with any applicable energy conservation standards. In certifying compliance, manufacturers must test their equipment according to the DOE test procedures for CCWs, 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 CCWs. 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.

AHAM commented that 20 hours is an underestimation of the certification burden, particularly for large companies with a large number of models to certify. AHAM stated that for CCWs, the certification reporting burden varies significantly by companies. According to AHAM, for some companies, 20 hours may be a fairly accurate average estimate. But for others, the burden could be significantly more than that. Thus, AHAM requested that DOE revise its public reporting burden estimate for CCWs. (AHAM, No. 34 at p. 6)

As required by the PRA, all collections of information from the public by a Federal agency must receive prior approval from OMB. An ongoing collection must be approved by OMB at least once every three years. DOE plans to investigate the public reporting burden raised by AHAM separately as part of the three-year review process.

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

D. Review Under the National Environmental Policy Act of 1969

Pursuant to the National Environmental Policy Act (NEPA) of 1969, DOE has determined that the 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 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 equipment that is the subject of this 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 and 6316(a)) No further action is required by Executive Order 13132.

F. Review Under Executive Order 12988

With respect to the review of existing regulations and the promulgation of new regulations, section 3(a) of Executive Order 12988, "Civil Justice Reform," imposes on Federal agencies the general duty to adhere to the following requirements: (1) eliminate drafting errors and ambiguity; (2) write regulations to minimize litigation; (3) provide a clear legal standard for affected conduct rather than a general standard and (4) promote

simplification and burden reduction. 61 FR 4729 (Feb. 7, 1996). 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 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. Pub. L. 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://energy.gov/gc/office-general-counsel.

DOE examined this final rule according to UMRA and its statement of policy. This final rule does not contain a Federal intergovernmental mandate, and DOE expects it will not require expenditures of $100 million or more by the private sector. Such expenditures may include: (1) investment in research and development and in capital expenditures by CCW 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 CCWs, starting at the compliance date for the applicable standard.   Therefore, the analytical requirements of UMRA do not apply.

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

Section 654 of the Treasury and General Government Appropriations Act, 1999 (Pub. L. 105-277) requires Federal agencies to issue a Family Policymaking Assessment for any rule that may affect family well-being. This rule would not have any impact on

the autonomy or integrity of the family as an institution. Accordingly, DOE has concluded that it is not necessary to prepare a Family Policymaking Assessment.

I. Review Under Executive Order 12630

Pursuant to Executive Order 12630, "Governmental Actions and Interference with Constitutionally Protected Property Rights" 53 FR 8859 (March 18, 1988), DOE has determined that this final rule 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 this 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 this regulatory action, which sets forth energy

conservation standards for CCWs, 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 final rule.

L. <u>Review Under the Information Quality Bulletin for Peer Review</u>

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 final rule.

List of Subjects in 10 CFR Part 431

Administrative practice and procedure, Energy conservation, Household appliances, and Small businesses.

Issued in Washington, DC, on December 5, 2014.

David T. Danielson
Assistant Secretary
Energy Efficiency and Renewable Energy

For the reasons set forth in the preamble, DOE amends part 431 of chapter II, subchapter D, of title 10 of the Code of Federal Regulations, as set forth below:

PART 431 - ENERGY EFFICIENCY PROGRAM FOR CERTAIN COMMERCIAL AND INDUSTRIAL EQUIPMENT

1. The authority citation for Part 431 continues to read as follows:

Authority: 42 U.S.C. 6291−6317.

2. Section 431.156 is amended by revising paragraph (b) and adding paragraph (c) to read as follows:

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

*   *   *   *   *

(b) Each commercial clothes washer manufactured on or after January 8, 2013, and before January 1, 2018, shall have a modified energy factor no less than and a water factor no greater than:

Equipment Class	Modified Energy Factor (MEF), cu. ft./kWh/cycle	Water Factor (WF), gal./cu. ft./cycle
Top-Loading	1.60	8.5
Front-Loading	2.00	5.5

(c) Each commercial clothes washer manufactured on or after January 1, 2018 shall have a modified energy factor no less than and an integrated water factor no greater than:

Equipment Class	Modified Energy Factor (MEF$_{J2}$), cu. ft./kWh/cycle	Integrated Water Factor (IWF), gal./cu. ft./cycle
Top-Loading	1.35	8.8
Front-Loading	2.00	4.1