Energy Conservation Standards Rulemaking Framework Document for Residential Clothes Washers

U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
Building Technologies Program

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AEO	Annual Energy Outlook
AHAM	Association of Home Appliance Manufacturers
ANOPR	advance notice of proposed rulemaking
AWWA	American Water Works Association
BT	Building Technologies Program
CAIR	Clean Air Interstate Rule
CAMR	Clean Air Mercury Rule
CEC	California Energy Commission
CEE	Consortium for Energy Efficiency
CFR	Code of Federal Regulations
CO_2	carbon dioxide
CSL	candidate standard level
DOE	U.S. Department of Energy
DOJ	U.S. Department of Justice
EERE	Office of Energy Efficiency and Renewable Energy
EF	energy factor
EIA	Energy Information Administration
EISA 2007	Energy Independence and Security Act of 2007
EPACT 2005	Energy Policy Act of 2005
EPA	U.S. Environmental Protection Agency
EPCA	Energy Policy and Conservation Act
EU	European Union
FR	Federal Register
GRIM	Government Regulatory Impact Model
HCFC	hydrochlorofluorocarbon
ImSET	Impact of Sector Energy Technologies
kWh	kilowatt-hour
LBNL	Lawrence Berkeley National Laboratory
LCC	life-cycle cost
MEF	modified energy factor
MIA	manufacturer impact analysis
NAAQS	National Ambient Air Quality Standards
NAECA	National Appliance Energy Conservation Act of 1987
NAICS	North American Industry Classification System
NCI	Navigant Consulting, Inc.
NEMS	National Energy Modeling System
NES	national energy savings
NOPR	notice of proposed rulemaking
NO_x	oxides of nitrogen
NPV	net present value
NRCan	Natural Resources Canada
OMB	Office of Management and Budget
PBP	payback period
PNNL	Pacific Northwest National Laboratory

R&D	research and development
RECS	Residential Energy Consumption Survey
RMC	remaining moisture content
RoHS	Reduction of Hazardous Substances directive
SBA	U.S. Small Business Administration
SEC	Securities and Exchange Commission
SG&A	selling, general, and administrative costs
SO_2	sulfur dioxide
SWEF	shipment-weighted efficiency
TSD	technical support document
TSL	trial standard level
U.S.	United States
U.S.C.	United States Code
WF	water factor

Rulemaking Framework Document for Residential Clothes Washers

1. INTRODUCTION

The U.S. Department of Energy (DOE) Appliances and Commercial Equipment Standards Program, within the Office of Energy Efficiency and Renewable Energy (EERE) Building Technologies Program (BT), develops and promulgates test procedures and energy conservation standards for consumer appliances and commercial equipment. The process for developing standards involves analysis, public notice, and consultation with interested parties. Such parties include manufacturers, consumers, energy conservation and environmental advocates, State and Federal agencies, and any other groups or individuals with an interest in these standards and test procedures.

This framework document describes DOE's anticipated procedural and analytical approaches for evaluating energy conservation standards for residential clothes washers. It also informs interested parties of the standards rulemaking process for clothes washers and encourages input from these parties during the rulemaking and serves as the starting point for developing standards. The framework document is not a definitive statement about any issue that the rulemaking will determine.

Section 1 provides an overview of the rulemaking process. Sections 2 through 16 discuss analyses DOE intends to conduct to fulfill the statutory requirements and guidance for this standards rulemaking. DOE will conduct analyses for this product to determine whether amended energy conservation standards are technologically feasible and economically justified and would result in significant conservation of energy. These analyses will include an engineering analysis, life-cycle cost (LCC) and payback period (PBP) analyses, a national impact analysis, and a manufacturer impact analysis (MIA).

Information regarding this rulemaking will be maintained on the DOE website at *http://www1.eere.energy.gov/buildings/appliance_standards/residential/clothes_washers.html*.

While DOE invites comment from interested parties on all aspects of the material presented in this document, comment boxes such as this one highlight particular issues on which DOE seeks comment and requests feedback from interested parties. In addition, DOE uses these comment boxes to ask specific questions on the approaches it is proposing to follow to conduct the analyses required for the standards rulemaking. Such requests for feedback from interested parties are numbered according to the section in which they appear.

1.1 Residential Appliances and Commercial Equipment Standards Program

The Energy Policy and Conservation Act (EPCA) of 1975 (42 U.S.C. 6291–6309) established an energy conservation program for major household appliances. Amendments to EPCA have given DOE the authority to regulate the energy efficiency of several products,

including residential clothes washers—the products that are the focus of this document. The amendments to EPCA in the National Appliance Energy Conservation Act of 1987 (NAECA) established prescriptive energy conservation standards for residential clothes washers, as well as requirements for determining whether these standards should be amended. (42 U.S.C. 6295(g))

NAECA required that all rinse cycles of clothes washers manufactured after January 1, 1988, shall include an unheated water option, but also permitted these products to have a heated water rinse option. NAECA further required that DOE conduct two cycles of rulemakings to determine if more stringent standards are justified.[1] (42 U.S.C. 6295(g)(2) and (4)) On May 14, 1991, DOE completed the first rulemaking cycle by publishing a final rule in the *Federal Register* (FR) establishing the first set of performance standards for residential clothes washers; these new standards became effective on May 14, 1994 (hereafter, the "May 1991 Final Rule.") 56 FR 22250, 22279. In the May 1991 Final Rule, DOE announced that it was accelerating the second energy conservation standards rulemaking for clothes washers because, after the notice of proposed rulemaking (NOPR) comment period for the first rulemaking closed, DOE learned of a design option (horizontal-axis wash tub in a top-loading washer) in use in Europe that was not included in the proposed rule and upon which no comment was received. 56 FR 22279.

As part of its second rulemaking cycle, DOE published an advance notice of public rulemaking (ANOPR) covering nine products, including clothes washers. 55 FR 39624 (Sept. 28, 1990). In response to that notice, several interested parties requested that DOE delay completion of the second rulemaking until a 1995–1996 time frame. The additional time was requested to allow manufacturers additional time to meet the standards promulgated in the May 1991 Final Rule and to fully evaluate new, more energy efficient technologies, such as top-loading horizontal-axis clothes washers. After careful consideration, on February 26, 1992, DOE issued a letter to interested parties granting their request for a delayed rulemaking schedule.

On November 14, 1994, DOE published a second ANOPR to restart the second energy conservation standards rulemaking for clothes washers, dishwashers, and clothes dryers (hereafter, the "November 1994 ANOPR"). 59 FR 56423. However, Congress imposed a moratorium on proposed or final rules for appliance energy conservation standards for fiscal year 1996. See Omnibus Consolidated Rescissions and Appropriations Act of 1996, Pub. L. 104-134, Sec. 320 (April 26, 1996). During this time, DOE revised the standards-setting process, and on July 15, 1996, published a final rule documenting this revised process. See 61 FR 36974 (codified and subsequently redesignated as Procedures, Interpretations, and Policies for Consideration of New or Revised Energy Conservation Standards for Consumer Products at 10 CFR part 430, subpart C, appendix A) DOE decided to use this new process for the second standards rulemaking affecting residential clothes washers. As part of this rulemaking effort, DOE issued a supplemental ANOPR that made use of the new process rule. 63 FR 64344 (Nov. 19, 1998) (hereafter, the "November 1998 Supplemental ANOPR").

On October 5, 2000, DOE published a NOPR, in which it analyzed the energy savings, benefits, and burdens of amended energy conservation standards for residential clothes washers.

[1] DOE defines "clothes washer" under EPCA as "a consumer product designed to clean clothes, utilizing a water solution of soap and/or detergent and mechanical agitation or other movement, and must be one of the following classes: automatic clothes washers, semi-automatic clothes washers, and other clothes washers." 10 CFR 430.2.

65 FR 59550 (hereafter, the "October 2000 NOPR"). The NOPR analysis results had been shared with interested parties, and several of the major interested parties, including clothes washer manufacturers and energy efficiency advocates, submitted to DOE a joint proposal for the highest standard level which they believed to be technically feasible and economically justified. DOE reviewed the proposal and agreed with the assessment of standards in the proposal. DOE subsequently proposed to amend the energy conservation standards for clothes washers accordingly in the October 2000 NOPR.

After receiving and evaluating comments on the October 2000 NOPR, DOE published a final rule revising the energy conservation standards. 66 FR 3314 (Jan. 12, 2001) (hereafter, the "January 2001 Final Rule"). These new standards became effective in two phases—on January 1, 2004, and January 1, 2007. By completing this second standards rulemaking, DOE had fulfilled its obligations under NAECA to conduct two cycles of standards rulemakings.

Subsequently, as part of its priority-setting activities for fiscal year 2006, DOE published draft data sheets containing energy savings potentials for products covered under EPCA in October 2005. These data sheets summarize in table format (1) the potential energy savings from regulatory action in cumulative quads[2] from 2004 to 2030, (2) the potential economic benefits or burdens, (3) the potential environmental or energy security benefits, (4) the status of required changes to test procedures, (5) other regulatory actions, (6) recommendations by interested parties, (7) evidence of market-driven or voluntary efficiency improvements, (8) regulatory issues, and (9) the 2005 priority. In this analysis, DOE determined that energy savings for residential clothes washers of 5.5 quads between 2004 and 2030 could potentially be achieved by amended standards.

The Energy Independence and Security Act of 2007 (EISA 2007), Pub. L. No. 110-140, revised the energy conservation standards for residential clothes washers. The revised standards established a maximum water factor (WF) of 9.5 and become effective on January 1, 2011. EISA 2007 further required that DOE publish a final rule no later than December 31, 2011, determining whether to amend the standards for clothes washers manufactured on or after January 1, 2015. (42 U.S.C. 6295(g)(9))

1.2 Overview of the Rulemaking Process

1.2.1 Test Procedures

Since the development of the first Federal test procedure for clothes washers in 1977, DOE has revised the clothes washer test procedure to more accurately measure both the energy usage and efficiency of these products. See 62 FR 45484 (August 27, 1997) (hereafter, the "August 1997 Final Rule."). The most recent version of the procedure, which became effective on January 1, 2004, made a number of changes: (1) it replaced the energy factor (EF) descriptor, which only calculated the energy use of the clothes washer itself, with a modified energy factor (MEF), which accounts for the remaining moisture content (RMC) of clothes leaving the washer, thereby crediting a reduction in clothes drying energy use; (2) it specified different water temperatures for testing; (3) it specified test cloth loads for all classes of clothes washers; and (4) it revised the average number of use cycles in a year to reflect then-current consumer usage

[2] A "quad" represents a quadrillion Btu (or 10^{15} Btu).

patterns. In 1998, DOE amended the August 1997 Final Rule by correcting the introductory note to the new clothes washer test procedure. 63 FR 16669 (April 6, 1998).

In 2001, as part of its energy conservation standards rulemaking for clothes washers, DOE also amended its clothes washer test procedure by incorporating changes to the energy test cloth, RMC, and extractor testing. 66 FR 3330. DOE amended its clothes washer test procedure again in 2003 by (1) replacing the lowest spin cycle speed of 50 gravitation (g) force with a spin cycle of 100 g for testing the cloth used in the extraction phase of the test procedure, and (2) specifying the use of additional statistical analysis to qualify the interactive effect between different test cloth lots and spin speeds to improve consistency with the baseline data. 68 FR 62198 (Oct. 31, 2003).

As amended by EISA 2007, EPCA now requires DOE to consider standby mode and off mode energy consumption in future amendments to its energy conservation standards and test procedures for covered products, which include residential clothes washers. Specifically, section 310 of EISA 2007 amends section 325 of EPCA (42 U.S.C. 6295) by adding the following definitions and other requirements pertaining to standby and off mode energy use:

> (gg) STANDBY MODE ENERGY USE.—
>
> (1) DEFINITIONS.—
>
> (A) IN GENERAL.—Unless the Secretary determines otherwise pursuant to subparagraph (B), in this subsection:
>
> (i) ACTIVE MODE.—The term "active mode" means the condition in which an energy-using product—
>
> (I) is connected to a main power source;
>
> (II) has been activated; and
>
> (III) provides 1 or more main functions.
>
> (ii) OFF MODE.—The term "off mode" means the condition in which an energy-using product—
>
> (I) is connected to a main power source; and
>
> (II) is not providing any standby or active mode function.
>
> (iii) STANDBY MODE.—The term "standby mode" means the condition in which an energy-using product—
>
> (I) is connected to a main power source; and
>
> (II) offers 1 or more of the following user-oriented or protective functions:
>
> (aa) To facilitate the activation or deactivation of other functions (including active mode) by remote switch (including remote control), internal sensor, or timer.
>
> (bb) Continuous functions, including information or status displays (including clocks) or sensor-based functions.
>
> (B) AMENDED DEFINITIONS.—The Secretary may, by rule, amend the definitions under subparagraph (A), taking into consideration the most current versions of Standards 62301 and 62087 of the International Electrotechnical Commission.

(2) TEST PROCEDURES.—

(A) IN GENERAL.—Test procedures for all covered products shall be amended pursuant to section 323 to include standby mode and off mode energy consumption, taking into consideration the most current versions of Standards 62301 and 62087 of the International Electrotechnical Commission, with such energy consumption integrated into the overall energy efficiency, energy consumption, or other energy descriptor for each covered product, unless the Secretary determines that—

(i) the current test procedures for a covered product already fully account for and incorporate the standby mode and off mode energy consumption of the covered product; or

(ii) such an integrated test procedure is technically infeasible for a particular covered product, in which case the Secretary shall prescribe a separate standby mode and off mode energy use test procedure for the covered product, if technically feasible.

(B) DEADLINES.—The test procedure amendments required by subparagraph (A) shall be prescribed in a final rule no later than the following dates:

* * * *

(iii) June 30, 2009, for residential clothes washers.

* * * * *

(3) INCORPORATION INTO STANDARD.—

(A) IN GENERAL.—Subject to subparagraph (B), based on the test procedures required under paragraph (2), any final rule establishing or revising a standard for a covered product, adopted after July 1, 2010, shall incorporate standby mode and off mode energy use into a single amended or new standard, pursuant to subsection (o), if feasible.

(B) SEPARATE STANDARDS.—If not feasible, the Secretary shall prescribe within the final rule a separate standard for standby mode and off mode energy consumption, if justified under subsection (o).

DOE initiated changes to incorporate residential clothes washer standby mode and off mode energy consumption in parallel with the current clothes washer energy conservation standards rulemaking. In accordance with EISA 2007, DOE considered incorporating certain provisions of an international standby power test procedure, International Electrotechnical Commission (IEC) Standard 62301, *Household electrical appliances—Measurement of standby power*. DOE is aware that IEC is currently in the process of updating IEC Standard 62301, and that the revised version is expected to be issued in July 2009. DOE believes that, in order to best meet Congressional intent for these statutory provisions, the test procedure rulemaking for residential clothes washers should be deferred until the updated IEC Standard 62301 is issued. A final rule for the test procedure will be published as soon as possible after the June 30, 2009, deadline set by EISA 2007 amendments to EPCA. (42 U.S.C. 6295(gg)(2)(B))

Item 1-1 *DOE requests input from interested parties on the merits of revising its test procedures for residential clothes washers and seeks input (including supporting data) regarding how these procedures can be improved.*

1.2.2 Rulemaking Process and Participation by Interested Parties

EPCA, as amended, specifies that any standard DOE prescribes for consumer products shall be designed to "achieve the maximum improvement in energy efficiency. . . which the Secretary [of Energy] determines is technologically feasible and economically justified." (42 U.S.C. 6295(o)(2)(A)) Moreover, EPCA states that the Secretary may not establish an amended standard if such standard would not result in the "significant conservation of energy." (42 U.S.C. 6295(o)(3)(B)) In determining whether a standard is economically justified, DOE considers, to the greatest extent practicable, the following seven factors:

(1) the economic impact of the standard on the manufacturers and on the consumers of the products subject to such standard;
(2) the savings in operating costs throughout the estimated average life of the covered products in the type (or class) compared to any increase in the price, or in the initial charges for, or maintenance expenses of the covered products which are likely to result from the imposition of the standard;
(3) the total projected amount of energy (or as applicable, water) savings likely to result directly from the imposition of the standard;
(4) any lessening of the utility or the performance of the covered products likely to result from the imposition of the standard;
(5) the impact of any lessening of competition, as determined in writing by the Attorney General, that is likely to result from the imposition of the standard;
(6) the need for national energy and water conservation; and
(7) other factors the Secretary considers relevant.
(42 U.S.C. 6295(o)(2)(B)(i)

Additional statutory requirements for prescribing new or amended standards are set forth in 42 U.S.C. 6295(o)(1)–(2)(A), (2)(B)(ii)-(iii), and (3)–(5)).

The process for developing energy conservation standards involves analysis, public notice, and consultation with interested parties. These parties provide valuable comments during this process and help promote a balanced discussion of critical information required to conduct the standards rulemaking. Accordingly, DOE actively encourages the participation of all interested parties during the comment period provided at each stage of the rulemaking.

In conducting the test procedure rulemakings and the energy (and water) conservation standards rulemakings, DOE involves interested parties through a variety of means, including formal public notifications (*i.e.*, *Federal Register* notices) and public meetings. As discussed in further detail below, the standards rulemaking process involves a preliminary publication of analyses on the Department's website, and two major public notices, which are published in the *Federal Register*. The publication of the preliminary analyses as well as the NOPR will be accompanied by public meetings to solicit comment from interested parties to guide the rulemaking process.

- *Pre-NOPR publication of analyses and public meeting* (section 1.3). The Pre-NOPR publication of analyses and public meeting is designed to obtain public review of the models and tools that DOE will use in the rulemaking and to facilitate public

participation before the proposed rule stage. Candidate standard levels (CSLs), which span the range of efficiencies from baseline products to the most efficient technology, are the basis for demonstrating the functionality of the models and tools.[3]

- *NOPR* (section 1.4). The NOPR presents: a discussion of comments received in response to the Pre-NOPR; DOE's analysis of the impacts of standards on consumers, manufacturers, and the nation; DOE's weighting of the impacts; and the proposed standard levels for public comment.

- *Final rule* (section 1.5). The final rule presents a discussion of comments received in response to the NOPR, the revised analysis of the impacts of standards, DOE's weighting of the impacts, the standard levels DOE is adopting. The final rule also establishes the effective date of the standards.

DOE has prepared and intends to follow the schedule below for the residential clothes washer energy conservation standards rulemaking.

Table 1.1. Rulemaking Schedule for Residential Clothes Washer Energy Conservation Standards

Rulemaking Notice	Publication Date
Framework Document	May 2009
Pre-NOPR	June 2010
NOPR	March 2011
Final Rule	December 31, 2011 (EISA 2007 Deadline)

Any amended standards for residential clothes washers promulgated by the final rule would apply to products manufactured on or after January 1, 2015. (42 U.S.C. 6295(g)(9))

1.3 Pre-Rulemaking Analyses and Other Activities

DOE's initial pre-rulemaking activities include identifying available product technology options and determining whether they warrant detailed analysis or can be eliminated from further consideration. This process includes a market and technology assessment (section 3) and a screening analysis (section 4). DOE applies four criteria in the screening analysis to determine which technology options to eliminate from further consideration: (1) technological feasibility; (2) practicability to manufacture, install, and service; (3) adverse impacts on product or equipment utility or availability; and (4) adverse impacts on health or safety. DOE calls technologies that pass the screening analysis "design options," and considers them in the engineering analysis as methods of improving the efficiency of the covered products.

[3] In the past DOE, issued an ANOPR following publication of the framework document. The Energy Independence and Security Act of 2007 eliminated the requirement that DOE issue ANOPRs as part of the standards rulemaking process. See EISA, sec. 307. DOE is now using an alternative process to provide the same information and opportunity for public comment as the ANOPR, but without publication of the detailed analyses in the *Federal Register*.

Also in the pre-rulemaking stage of the analysis, DOE collects manufacturer cost data, historical shipment data, shipment-weighted average efficiency data, and preliminary manufacturer impact data (*e.g.*, capital conversion expenditures, marketing costs, and research and development costs). Given these data, and the efficiency levels achievable by the design options developed earlier, DOE estimates the impact of potential standards on individual consumers and the nation as a whole. These calculations are contained within the following analyses, explained in subsequent sections of this framework document:

- the engineering analysis (section 5);
- the consumer life-cycle cost (LCC) and payback period (PBP) analysis (section 8);
- the national impact analysis, which considers national energy savings (NES) and national consumer net present value (NPV) (section 10); and
- a preliminary manufacturer impact analysis (section 12).

DOE will present the results of these analyses in a technical support document (TSD) to be published prior to the NOPR stage of the rulemaking. The release of the preliminary TSD, which will be made available on the Department's website, will be followed by a public meeting. A meeting agenda, presentation slides, and an executive summary highlighting the issues on which DOE seeks comment will accompany the TSD on the website. DOE will publish a notice in the *Federal Register* announcing this meeting and the availability of these related materials.

Discussion of various CSLs in the preliminary TSD will facilitate review by interested parties of the spreadsheet models that underpin the analyses. DOE will use comments by these parties to refine the models for the NOPR stage of the rulemaking analyses, where DOE will propose specific efficiency levels for adoption. Based on the results, DOE selects CSLs from the energy-efficiency or energy-use levels considered in the preliminary analyses. In addition to the efficiency levels corresponding to the maximum technologically feasible ("max-tech")[4] design and the minimum LCC point, DOE generally selects levels or design options for consideration that span the full range of technologically achievable efficiencies. DOE typically analyzes the following CSLs:

- the baseline CSL (*i.e.*, the minimum level) is represented by the product with the lowest energy-efficiency level currently sold on the market for a given product class; for classes where minimum energy-efficiency standards already exist, the baseline efficiency level is typically defined by the existing energy conservation standard;

- the highest CSL or lowest energy consumption level that is technologically feasible (*i.e.*, the "max-tech" level);

- the level with the minimum LCC or greatest LCC savings; and

[4] The "max tech" represents the most efficient design that is commercialized or has been demonstrated in a prototype with materials or technologies available today. "Max tech" is not constrained by economic justification, and typically is the most expensive design option considered in the engineering analysis.

- levels that incorporate noteworthy technologies or fill in large gaps between other CSLs considered.

The preliminary analyses rely on analytical models and tools to assess the different product classes at each efficiency or energy use level analyzed. Many of these analytical models and tools are in the form of spreadsheets, some of which DOE uses to conduct the LCC and PBP analyses and to determine the NES and NPV of prospective standards. Preliminary results may facilitate discussions among interested parties on potential joint recommendations for standard levels.

In addition to the other materials mentioned above, DOE will make the spreadsheet tools used for the preliminary analyses available on its website for review and will consider comments after the public meeting.[5] DOE will provide a 60-day public comment period following the publication of the Pre-NOPR notice. At that point, DOE encourages interested parties to develop joint recommendations for standard levels to the extent possible.

1.4 Notice of Proposed Rulemaking

In developing the NOPR, DOE will first review and consider all the comments it received after the Pre-NOPR public meeting. This process may result in revisions or refinements to the preliminary analyses, including the engineering and LCC analyses. DOE will also conduct additional economic and environmental impact analyses at this stage of the rulemaking. These analyses generally include a consumer LCC subgroup analysis (section 11), a complete manufacturer impact analysis (section 12), a utility impact analysis (section 13), an employment impact analysis (section 14), an environmental assessment (section 15), and a regulatory impact analysis (section 16).

DOE will describe the methodology it used and post the results of all the analyses on its website for review and comment. Based on comments by interested parties, further revisions to the analysis may be undertaken. This analytical process ends with the selection of proposed standard levels (if any), which DOE will present in the NOPR. DOE selects these proposed standard levels from the trial standard levels (TSLs) analyzed during the NOPR phase of the rulemaking, equivalent to the CSLs analyzed during the preliminary analyses. The NOPR, published in the *Federal Register*, will document the evaluation and selection of any proposed standards levels, along with a discussion of other TSLs considered but not selected (and the reasons for not selecting them).

The selection process for proposed energy conservation standards generally runs as follows. For each product class, DOE will identify the maximum improvement in energy efficiency or maximum reduction in energy use that is technologically feasible. If DOE proposes a level that is below this max-tech level, it will explain the reasons for eliminating higher levels, beginning with the highest level considered. DOE will present the analysis results in the NOPR, with the details of the analysis provided in an accompanying TSD.

[5] All materials associated with the residential clothes washer rulemakings are available on DOE's website at http://www1.eere.energy.gov/buildings/appliance_standards/residential/clothes_washers.html.

DOE considers many factors in selecting proposed standards, as described in section 1.2.2. These factors are established by EPCA and consider the many benefits, costs, and impacts of energy conservation standards. Additionally, DOE encourages interested parties to develop joint recommendations for standard levels. DOE will consider such recommendations in its decision process.

When DOE publishes the NOPR, it will provide the U.S. Department of Justice (DOJ) with a copy of the NOPR and TSD to solicit feedback on the competitive impact of the proposed standard levels. DOJ will review these proposed standard levels in light of any lessening of competition that is likely to result from the imposition of standards. (42 U.S.C. 6295(o)(2)(B)(i)(V) and (B)(ii)) DOE will consider DOJ's determination on the impacts of the proposed standard on competition in preparing the final rule. The NOPR is followed by a 60-day public comment period that includes one public meeting.

1.5 Final Rule

After the publication of the NOPR, DOE will consider public comments it receives on the proposal (including TSLs) and accompanying analyses. On the basis of the public comments, DOE will review the engineering and economic impact analyses and proposed standards and make modifications as necessary. Before it issues the final rule, DOE will consider DOJ's comments on the NOPR relating to the impacts of the proposed standard levels on competition.

The standards rulemaking will conclude with publication of the final rule. DOE will select the final standard levels based on the complete record of the standards rulemaking. The final rule will promulgate the final standard levels and their effective date, and will explain the basis for their selection. The final rule will be accompanied by a final TSD.

2. OVERVIEW OF ANALYSES FOR RULEMAKING

The purpose of the analyses conducted in support of the standards rulemaking is to ensure that DOE selects energy conservation standards that achieve the maximum improvement in energy efficiency, that will result in significant energy savings, and that are technologically feasible and economically justified. The concept of economic justification within this context includes considering the economic impacts on domestic manufacturers and consumers, national benefits, including environmental impacts, and issues of consumer utility.

This section offers an overview of DOE's analytical methodology and discusses the major components of the analyses DOE will conduct. DOE will ensure a consistent approach to analysis throughout the rulemaking by considering each analysis as a part of the overall standards-setting process.

Figure 2.1 summarizes the analytical components of the standards-setting process. The analyses are presented in the center column. Each analysis has a set of key inputs. The identified approaches are the methods that DOE will use to obtain key inputs, which may vary depending on the information in question. DOE will collect some input from interested parties and other

experts; DOE will develop other information independently. The results of each analysis are key outputs, which feed directly into the rulemaking. Arrows indicate the flow of information between the various analyses.

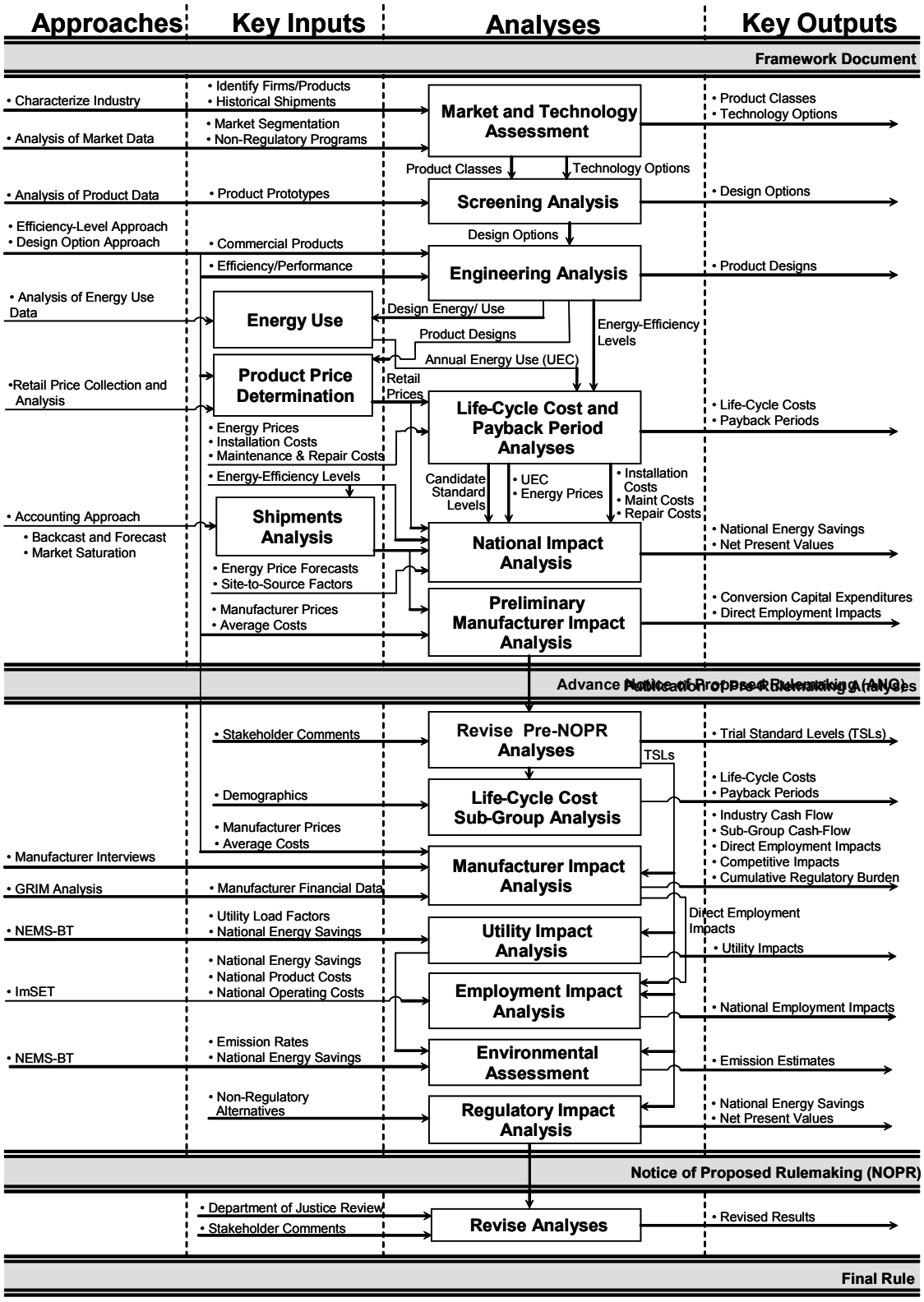

Figure 2.1 Analyses Conducted for the Residential Clothes Washer Energy Conservation Standards Rulemaking

3. MARKET AND TECHNOLOGY ASSESSMENT

The market and technology assessment will provide information about the residential clothes washer industry and specifics about the performance attributes of this product. DOE will use this assessment throughout the rulemaking. This assessment is particularly important at the outset of the rulemaking to determine product classes and to identify potential design options or efficiency levels for each product class.

3.1 Market Assessment

DOE will qualitatively and quantitatively characterize the structure of the residential clothes washer industry and market. In the market assessment, DOE will identify and characterize the manufacturers of this product, estimate market shares and trends, address regulatory and non-regulatory initiatives intended to improve the energy efficiency or reduce the energy consumption of products covered by this rulemaking, and explore the potential for technological improvements in the design and manufacturing of such products.

During the market assessment, DOE gathers data to identify important issues later in the rulemaking (*e.g.,* potential small business impacts, competitive disruptions, and other factors that may arise from enacting standards). For example, DOE will use historical product shipments and prices as an indicator of future shipments and prices. Market structure data will be particularly useful for assessing competitive impacts as part of the manufacturer impact analysis. This assessment also allows DOE to start updating design options by reviewing product literature, industry publications, and company websites.

Item 3-1 *DOE requests information that would contribute to the market assessment for the residential clothes washers covered in this rulemaking (e.g., current product features and efficiencies, product feature and efficiency trends, and historical product shipments and prices).*

3.2 Product Classes

DOE may develop separate product classes and formulate separate energy conservation standards for each class. The general criteria for separation into different classes include (1) type of energy used; (2) capacity; or (3) other performance-related features such as those that provide utility to the consumer, or others deemed appropriate by the Secretary that would justify the establishment of a separate energy conservation standard. (42 U.S.C. 6295(q))

DOE has previously divided residential clothes washers into five product classes based on location of access, capacity, and such features as suds saving. Existing energy conservation standards define residential clothes washers in the following classes:

- top-loading, compact (less than 1.6 cubic feet capacity);
- top-loading, standard (1.6 cubic feet or greater capacity);
- top-loading, semiautomatic;
- front-loading; and

- suds-saving.

In the November 1998 Supplemental ANOPR, DOE proposed to eliminate the top-loading semiautomatic and suds-saving product classes because they do not offer any added utility that would otherwise need to be preserved under the energy conservation standards. See 42 U.S.C. 6295(o)(4). DOE stated it believed that these products should be subject to the minimum energy conservation standards applicable to either compact or standard clothes washers. 63 FR 64348. Interested parties did not comment on this proposed elimination. Due to the absence of information available to analyze these product classes and ensure that they could meet the proposed standard levels, DOE maintained these classes in the January 2001 Final Rule, but did not subject them to energy conservation standards. 66 FR 3322. DOE is unaware of any top-loading semiautomatic or suds-saving clothes washers on the market. Also, the current DOE test procedure cannot measure the possible energy savings associated with suds savings. For these reasons, DOE is again considering, and soliciting comment on, the validity of retaining the top-loading semiautomatic and suds-saving product classes.

Additionally, DOE seeks comment as to whether the method of "loading" clothes washers, or any other characteristic commonly associated with traditional "top-loading" or "front-loading" clothes washers are "features" within the meaning of 42 U.S.C. 6295(o)(4) in EPCA and whether the availability of such feature(s) would likely be affected by eliminating the separate classes for these product types previously established by DOE. Previously, in the proposed rule for commercial clothes washers, DOE took the position that EPCA does not permit adoption of a standard that would eliminate top-loading commercial clothes washers because the method of loading is a "feature." 73 FR 62034, 62049–50. Furthermore, in DOE's denial of the California Energy Commission's (CEC) petition for waiver from Federal preemption (71 FR 78157 (December 28, 2006)) and the ensuing litigation, California Energy Commission v. DOE, Case. No. 07-71576 (9th Cir.), DOE took the position that it could not waive federal preemption, in part because the proposed California regulation of residential clothes washer water usage would result in the unavailability of top-loading residential clothes washers in the California market, based on DOE's evaluation of the clothes washer market in 2006. DOE is willing, however, to reconsider these previous conclusions as part of this rulemaking. More specifically, DOE is soliciting public comments on whether one or more of the characteristics commonly associated with different types of clothes washers, such as method of loading, presence or absence of agitators, ability to interrupt cycles and possibly others, provide consumer utility that should, under existing law, be recognized and protected by DOE through the maintenance or establishment of separate product classes.

Item 3-2 *DOE requests input from interested parties on the proposed product classes and the criteria used for creating these product classes. What other factors, if any, should DOE consider beyond those identified above as a basis for developing product classes? When answering, please explain in detail and cite specific examples to the extent possible.*

Item 3-3 *DOE seeks comment on the merits of retaining or eliminating the top- loading semiautomatic and suds-saving clothes washer product classes.*

Item 3-4 *DOE seeks comment as to whether the method of "loading" clothes washers or any other consumer utility generally associated with the method of loading are "features" within the meaning of 42 U.S.C. 6295(o)(4) in EPCA and whether the availability of such feature(s) would likely be affected by eliminating the separate classes for these product types previously established by DOE.*

3.3 Technology Assessment

The technology assessment will center on understanding how the product uses energy and potential changes that could reduce energy consumption. DOE typically uses information about "technology options"—existing technologies and prototype designs and concepts—to identify technologies product manufacturers could use to attain higher energy conservation levels. In consultation with interested parties, DOE will develop a list of technologies to consider in this analysis. Initially, this list will include all those technologies considered to be technologically feasible and will help DOE determine the max-tech design based on a review of efficiencies of available products and their features.

DOE will consider technologies identified in its most recent analysis of amended energy conservation standards as well as from information published in recent trade publications, technical reports, and manufacturer literature. Most of the technologies listed in Table 3.1—with exceptions noted below—are taken from a 1996 report prepared for DOE entitled *Design Options for Clothes Washers.*[6] Steam washing and improved front-loading washer drum design were identified in the September 2005 edition of *Appliance Magazine*. Plastic particle cleaning was identified in the September 2008 edition of *Appliance Magazine*. DOE has included spray rinse and advanced agitator technology options based on comments on the most recent standards rulemaking for commercial clothes washers. Residential and commercial clothes washer platform designs and technologies are largely similar, except that commercial clothes washers are built for more rugged and frequent use. DOE added the low-standby-power design option based on a review of the *International Standby Basket of Products Survey*,[7] which showed a wide range of standby power consumption for front-loading clothes washers surveyed in the United States, and on DOE's review of the controller and display options available for residential clothes washers currently on the market. DOE also added a hot water circulation loop based on a review of technical reports. Of the technologies listed below, the current DOE test procedure cannot measure the possible energy savings of adaptive control systems other than adaptive water-fill control systems.

[6] *Design Options for Clothes Washers*, Lawrence Berkeley National Laboratory, LBNL-47888, October 1996.
[7] *International Basket of Products Survey*, Asia-Pacific Partnership on Clean Development and Climate. Available at www.energyrating.gov.au/standbydata/app/Default.aspx.

Table 3.1 Technology Options for Residential Clothes Washers

1. Adaptive fill controls
2. Added insulation
3. Advanced agitation concepts for top-loading machines
4. Automatic fill control
5. Bubble action
6. Direct-drive motor
7. Electrolytic disassociation of water
8. Horizontal-axis design[8]
9. Hot water circulation loop
10. Front-loading design with recirculation
11. Improved fill control
12. Improved front-loading washer drum design
13. Improved water extraction to lower remaining moisture content
14. Increased motor efficiency
15. Low-standby-power design
16. Ozonated laundering
17. Plastic particle cleaning
18. Reduced thermal mass
19. Spray rinse or similar water-reducing rinse technology
20. Steam washing
21. Thermostatically controlled mixing valves
22. Tighter tub tolerance
23. Ultrasonic washing

4. SCREENING ANALYSIS

The purpose of the screening analysis is to screen out technology options that DOE will not consider in the rulemaking.

DOE will develop a list of technology options (developed through its own research and in consultation with interested parties) for consideration in the engineering analysis (section 5). DOE will develop this list based on the technologies shown in Table 3.1. The identified candidate technology options will encompass all those technologies that may be technologically feasible. Thereafter, DOE will review each technology option in light of the following four criteria, as provided in sections 4(a)(4) and 5(b) of *Procedures, Interpretations, and Policies for*

[8] Typically, vertical-axis clothes washers (also known as top-loaders) are accessed from the top, while horizontal-axis clothes washers (also known as front-loaders) are accessed from the front. However, a limited number of residential horizontal-axis clothes washers that are accessible from the top using a hatch in the wash basket are currently available. For the purposes of this analysis, such horizontal-axis top-loading clothes washers will be considered in the top-loading product classes.

Consideration of New or Revised Energy Conservation Standards for Consumer Products (the "Process Rule")[9] and tailored to the current rulemaking:

1. *Technological feasibility.* DOE will not further consider technologies that are not incorporated in commercially available products or in working prototypes.

2. *Practicability to manufacture, install, and service.* If DOE determines that mass production of a product's technology and reliable installation and servicing of the technology could not be achieved on the scale necessary to serve the relevant market by the time of the effective date of the standard, then it will not consider that technology further.

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

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

As described in the 1996 report on *Design Options for Clothes Washers*, DOE eliminated six technologies from further analysis: bubble action, electrolytic disassociation of water; ozonated laundering; reduced thermal mass; suds savings; and ultrasonic washing. DOE will re-examine whether the basis for eliminating these technologies from further analysis is still valid. DOE will fully document the reasons for eliminating any technology options during the screening analysis, and will provide this documentation for review and comment by interested parties as part of the preliminary TSD. DOE will call those technology options that are not screened out by the above four criteria "design options" and will consider these options in the development of cost-efficiency curves in the engineering analysis.

Item 4-1 *Are there any technologies listed in Table 3.1 that DOE should not consider because of their impacts on safety, performance, or consumer utility of the product? If so, why?*

Item 4-2 *Are there other technologies that DOE should consider as technology options and what, if any, impacts would the technology options be expected to have on safety, performance, and consumer utility? Why?*

[9] 10 CFR part 430, subpart C, appendix A.

5. ENGINEERING ANALYSIS

After conducting the screening analysis, DOE will analyze the remaining design options that would improve product efficiency. This engineering analysis consists of estimating the energy consumption and cost of products at various levels of increased efficiency. This section provides an overview of the engineering analysis (section 5.1), and discusses baseline units (section 5.2), DOE's proposed approach for determining the cost-efficiency relationship (section 5.3), efficiency levels (section 5.4), proprietary designs (section 5.5), and cumulative regulatory burdens that might affect the engineering analysis (section 5.6).

5.1 Engineering Analysis Overview

The purpose of the engineering analysis is to determine the relationship between manufacturer cost and energy efficiency for residential clothes washers. In determining the cost-efficiency relationship, DOE will estimate the increase in manufacturer cost associated with technological changes that increase the efficiency of these products relative to the baseline models.

DOE will derive cost estimates for the engineering analysis (which DOE also will use in the manufacturer impact analysis) from detailed incremental cost data disaggregated into the cost of incremental material, labor, and overhead. DOE will create an industry-wide analysis based primarily on the manufacturer-supplied data. DOE may supplement this analysis with cost estimates of specific design options. To this end, DOE will request design, efficiency, and cost information from manufacturers to determine the cost of improving the efficiency of the baseline models. In addition, DOE must identify the model with the highest efficiency that is technologically feasible within each product class (*i.e.,* the max-tech model).

DOE will supplement manufacturer-supplied data with a reverse-engineering process. Reverse engineering entails a detailed product disassembly process, whereby (1) representative units are torn down; (2) all components, processes, assembly, and manufacturing steps are noted in an activities-based cost model; and (3) all manufacturing costs are calculated. Representative units are chosen based on the range of efficiencies, design options, and capacities.

The result is a "green-field" model[10] of the subject unit and the factory in which it would be built. These unit-specific factory requirements can then be aggregated by market share, unit shipments, or any other method DOE wishes to use to derive industry-wide estimates.

The industry-wide estimates will consist of detailed incremental cost data, disaggregated into the incremental costs of material,[11] labor,[12] and overhead.[13] DOE will associate incremental

[10] A "green-field" model estimates the cost of a product as if it were built in a brand new facility that had just broken ground.

[11] Direct material costs are the costs of raw materials such as steel, copper, and insulation; they also include the costs of scrap metal that can be traced to final or end equipment. Direct material costs do not include indirect material costs that are attributed to supplies that may be used in the production process, but are not assigned to final pieces of equipment (*e.g.*, lubricating oil for production machinery).

[12] Labor costs are the earnings of workers who assemble parts into a finished good or operate machines in the production process. Direct labor includes the fringe benefits of direct laborers such as group health care, as well as

costs with efficiency levels or with specific design options or design option combinations required to achieve a given efficiency level.

5.2 Baseline Models

Once DOE establishes product classes, it will select a baseline model—a reference point for each product class subject to analysis against which it can measure changes resulting from energy conservation standards. The baseline model in each product class represents the characteristics of common or typical equipment in that class. Typically, a baseline model would be a model that just meets current energy conservation standards.

At a subsequent stage in its analysis, DOE will use the baseline models to conduct the engineering analysis and the LCC and PBP analyses. To determine energy savings and changes in manufacturer selling price, DOE will compare each higher efficiency product design against the baseline model.

Current energy conservation standards for residential clothes washers are based on MEF, expressed in cubic feet of washer capacity per kilowatt-hour (kWh), and WF, expressed in gallons per cubic foot of washer capacity. As mentioned earlier, the MEF considers not only the energy consumption of the washer, but also the amount of energy required to dry the load in a clothes dryer, which is a function of the RMC of the clothes. EPCA, as amended by EISA 2007, established energy conservation standards for top-loading and front-loading standard-size residential clothes washers manufactured on or after January 1, 2011, which must have an MEF no less than 1.26 and WF no more than 9.50. (42 U.S.C. 6295(g)(9)) DOE intends to use these energy conservation standards to characterize the baseline unit efficiency for top-loading standard-size clothes washers. However, a survey of front-loading clothes washers in the CEC appliance database shows that there are no front-loading washers with efficiencies at the existing Federal standards level, or, for that matter, any below the ENERGY STAR level (1.72 MEF/8.00 WF). Therefore, DOE is proposing to use the ENERGY STAR criteria to characterize the baseline unit efficiency for front-loading clothes washers.

The January 2001 Final Rule established that top-loading compact-size residential clothes washers shall have an MEF no less than 0.65. 66 FR 3333. DOE intends to use the existing energy conservation standard to characterize the baseline unit MEF for top-loading compact clothes washers. However, the energy conservation standard does not specify a maximum WF for this product class. To address this issue, DOE proposes to use the percentage decrease in baseline MEF that top-loading compact clothes washers exhibit compared to top-loading standard-sized clothes washers to estimate the baseline WF for top-loading compact clothes washers. DOE is choosing this approach because MEF and WF are generally inversely related. Given this relationship, DOE estimates that the WF for top-loading compact clothes washers will

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overtime pay. Direct labor does not include indirect labor, which is defined as the earnings of employees who do not work directly in assembling a piece of equipment—such as supervisors, janitors, stockroom personnel, inspectors, and forklift operators.

[13] Factory overhead excludes depreciation, but includes indirect labor, downtime, set-up costs, indirect material, expendable tools, maintenance, property taxes, insurance on assets, and utility costs. Factory overhead does not include selling, general, and administrative costs (SG&A); research and development costs (R&D); interest; or profit, which DOE accounts for separately.

increase by the same percentage over the WF for top-loading standard-sized clothes washers as MEF decreases. DOE plans to propose a scaled WF of 18.40 to characterize the baseline for this product class. DOE believes that this is a reasonable value when considering top-loading compact clothes washer survey data compiled by National Resources Canada (NRCan) in its appliance database.[14] DOE notes that these data cover models with a wider range of energy and water efficiencies than those in the CEC database.

DOE is unaware of any information on baseline performance of top-loading semiautomatic or suds-saving clothes washers, and seeks comment from interested parties on baseline efficiency levels for these product classes.

Item 5-1 *DOE seeks input from interested parties on whether the above energy efficiency levels are appropriate for characterizing the performance of baseline units.*

Item 5-2 *DOE seeks information on baseline efficiency levels appropriate for top-loading semiautomatic and suds-saving clothes washers.*

Item 5-3 *DOE seeks information on the specific technological characteristics of the baseline model for each product class, including the technologies described in section 3.3. Examples of the types of information DOE seeks include the type of wash basket drive motor and the typical input wattage, as well as the type of fill control system.*

5.3 Approach for Determining the Cost-Efficiency Relationship

In support of this rulemaking, DOE will seek to obtain incremental cost data for residential clothes washers. This data is intended to represent the average incremental production cost to improve a baseline model to a specified efficiency level. This methodology constitutes an efficiency-level approach to the engineering analysis because DOE will examine the aggregated incremental increases in manufacturer selling price at specified levels of energy efficiency. DOE plans to use an efficiency-level approach because data contained within the CEC product database, for example, demonstrate a significant range of efficiencies for most of the product classes. Drafts of the engineering analysis data-request sheets are contained in appendix A.

To be useful in the manufacturer impact analysis, manufacturer cost information should reflect the variability in the baseline models, design strategies, and cost structures that can exist among manufacturers. DOE will attempt to qualify the cost-efficiency data supplied by interested parties through engineering expertise and consultation with interested parties and/or technical experts. Specifically, DOE will supplement these cost data with information obtained through follow-up manufacturer interviews. These confidential interviews will provide a deeper understanding of the various combinations of technologies used to increase product efficiency and their associated manufacturing costs. Sample questions to be asked during the follow-up interviews are contained in appendix B.

[14] Available online at *http://oee.nrcan.gc.ca/residential/personal/appliances.cfm?attr=4*.

If DOE is unable to reconcile information collected during the manufacturer interviews with the collected cost data, or with information contained in the market and technology assessment, DOE will supplement the collected data through a design-option approach. This involves consulting with outside experts and/or further review of publicly available cost and performance information.

DOE will supplement the manufacturer-supplied data with a reverse-engineering analysis, as described above, to identify the incremental cost and efficiency improvement associated with each design option or design option combination—in effect, supplementing the efficiency-level approach with a design-option approach as needed. DOE will conduct reverse engineering through physical teardowns and testing on residential clothes washer models at key efficiency levels to determine baseline manufacturing cost as well as incremental manufacturing costs above the baseline. DOE proposes to perform reverse engineering on units rated at baseline and improved (for example, ENERGY STAR) energy consumption levels for each analyzed product class.

DOE may supplement the reverse-engineering data with information from catalogs, websites, and trade publications to create a wider set of units for its cost-efficiency analysis.

DOE will estimate the contribution of the depreciation of conversion capital expenditures to the incremental overhead. During the manufacturer interviews, DOE will gather information about the capital expenditures that would be necessitated by increasing the efficiency of the baseline models to various efficiency levels (*i.e.*, conversion capital expenditures by efficiency or energy-use level). DOE will also request information about the depreciation method used to expense the conversion capital.

The approach proposed above will allow DOE to represent residential clothes washers throughout the entire efficiency range without depending on time-consuming simulation modeling. DOE will maintain confidentiality of proprietary data while allowing the public to examine the cost and design assumptions that underlie the cost-efficiency estimates.

Item 5-4 *DOE requests feedback on the use of an efficiency-level approach to determine the relationship between manufacturer cost and energy efficiency for residential clothes washers, supplemented, as needed, by a design-option approach.*

For each of the proposed product classes presented in section 3.2 that are appropriate to analyze, DOE will suggest efficiency levels and attempt to obtain incremental cost data at each of these levels. DOE will select appropriate efficiency levels for data collection on the basis of (1) energy savings potential identified from engineering models; (2) observation of existing products on the market; and/or (3) information obtained for the technology assessment. DOE proposes to conduct the engineering analysis (and LCC and PBP analyses) on residential clothes washer product classes for which there are sufficient information and representative units on the market, and extend the results analytically to the remaining product classes as appropriate.

Item 5-5 *DOE requests input on the selection of appropriate product classes for reverse-engineering analysis, and any product classes for which it is appropriate to extend these results analytically.*

5.4 Efficiency Levels

For each of the product classes presented in section 3.2 that are appropriate to analyze, DOE will undertake analyses to determine potential efficiency levels and seek to develop incremental cost data at each of these levels. DOE plans to conduct an engineering analysis (and LCC and PBP analyses) on all product classes for which it suggests efficiency levels.

Table 5.1 through Table 5.3 present the efficiency levels DOE proposes to analyze for residential clothes washers. The "maximum available" efficiency levels in the tables correspond to models with the maximum efficiency currently available in the market, but may not necessarily correspond to the max-tech levels. Models with maximum available efficiency may not incorporate all possible design options for increasing efficiency and, therefore, may not achieve an efficiency level as high as the max-tech level. Also, some of the design options that have met the screening criteria (*i.e.*, passed the screening analysis) may not yet be commercially available (*e.g.*, are only in working prototypes or are available technologies that are not currently in production) and, therefore, would not be found in today's products with maximum available efficiency. Because of the potential dichotomy between max-tech and maximum available efficiencies, and because DOE is required to analyze max-tech, it will seek input from interested parties to determine appropriate max-tech efficiency levels. (42 U.S.C. 6295(p)(2))

To analyze the cost-efficiency relationship of this product, DOE proposes to use efficiency levels based on the MEF and WF specifications prescribed by ENERGY STAR and the Consortium for Energy Efficiency (CEE)'s Super-Efficient Home Appliances Initiative, along with the maximum levels that are currently available in the market. For top-loading clothes washers, DOE did not include CEE Tier 3 as an efficiency level because the difference between the Tier 3 criteria (2.20 MEF/4.50 WF) and the maximum available level (2.25 MEF/4.45 WF) was so small. For top-loading standard-size clothes washers, DOE proposes to add a level to fill the gap between the baseline and the ENERGY STAR criteria. For front-loading clothes washers, DOE proposes to add a level to fill the gap between the CEE Tier 3 criteria and the maximum available level. It will set these gap-fill levels at combinations of MEF and WF that are strongly represented in the CEC product listing.

For both top- and front-loading clothes washers, DOE recognizes that MEF and WF pairings may not simultaneously achieve max-tech levels. That is, a clothes washer with the highest possible MEF may not achieve the lowest possible WF. Similarly, a clothes washer with the lowest WF may not achieve the highest MEF. DOE considered several models in each product class to determine max-tech values that best represent optimal performance for clothes washers on the market. DOE did not suggest max-tech levels that represent a "hybrid" of the highest possible MEF and the lowest possible WF for each product class.

For top-loading compact-size clothes washers, DOE did not establish efficiency levels for analysis in previous rulemakings. Based on a review of the top-loading compact-size clothes

washers in the CEC database, which revealed little difference between the maximum available efficiency and the baseline DOE standard, DOE proposes to analyze one efficiency level above the baseline represented by the currently available maximum technology.

DOE seeks timely input from interested parties on clothes washer efficiencies to enable it to decide on the efficiency levels for analysis as quickly as possible.

Table 5.1 Efficiency Levels for Top-Loading Standard-Size Residential Clothes Washer Analysis

Level	Efficiency Level Source	Efficiency Level	
		MEF	WF
Baseline	DOE Standard	1.26	9.50
1	Gap Fill	1.40	9.50
2	ENERGY STAR	1.72	8.00
3	CEE Tier 1	1.80	7.50
4	CEE Tier 2	2.00	6.00
5	Max Available	2.26	4.48

Table 5.2 Efficiency Levels for Top-Loading Compact-Size Residential Clothes Washer Analysis

Level	Efficiency Level Source	Efficiency Level	
		MEF	WF
Baseline	DOE Standard	0.65	18.40
1	Max Available	0.78	13.90

Table 5.3 Efficiency Levels for Front-Loading Residential Clothes Washer Analysis

Level	Efficiency Level Source	Efficiency Level	
		MEF	WF
Baseline	ENERGY STAR	1.72	8.00
1	CEE Tier 1	1.80	7.50
2	CEE Tier 2	2.00	6.00
3	CEE Tier 3	2.20	4.50
4	Gap Fill	2.40	4.20
5	Max Available	2.89	3.36

Item 5-6 *DOE seeks input from interested parties about the adequacy of the proposed efficiency levels for requesting incremental cost data from manufacturers. DOE also seeks input from interested parties on appropriate maximum technologically feasible efficiency levels and the basis for why those levels should be selected.*

5.5 Proprietary Designs

DOE will consider in its engineering and economic analyses all design options that are commercially available or present in a working prototype, including proprietary designs and technologies. However, DOE will consider a proprietary design in the subsequent analyses only if the achieved efficiency level can also be reached using other non-proprietary design options. If the proprietary design is the only approach available to achieve a given efficiency level, then DOE will reject that efficiency level, as the analytical results would appear to favor one manufacturer over others.

DOE is sensitive to manufacturer concerns about proprietary designs and will attempt to maintain the confidentiality of any proprietary data submitted by manufacturers or discussed during manufacturer interviews. These data may be provided under a confidentiality agreement with DOE's contractor responsible for this part of the rulemaking analysis, Navigant Consulting, Inc. (NCI). As in other rulemakings, NCI regularly works with confidential data from manufacturers and other organizations, preparing aggregated results for DOE's analysis that do not divulge sensitive raw data, but that enable other interested parties to review and comment on the aggregated dataset. Alternatively, interested parties may submit confidential data to DOE, indicating in writing which data should remain confidential. To prevent public disclosure of the data due to actions taken by a third party, interested parties providing confidential information to DOE must submit that data according to 10 CFR 1004.11. This information will provide input to the manufacturer impact analysis and other economic analyses.

Item 5-7 *Are there proprietary designs or technologies for residential clothes washers of which DOE should be aware in this rulemaking? If so, what are these designs or technologies and how should DOE acquire the cost data necessary for evaluating them?*

5.6 Outside Regulatory Changes Affecting the Engineering Analysis

In conducting an engineering analysis, DOE considers the effects of regulatory changes outside DOE's statutory energy conservation standards rulemaking process that can affect the manufacturers of the covered equipment. Some of these changes can also affect the energy efficiency or energy consumption of the products covered under this rulemaking. In addition to the efficiency regulations on residential clothes washers, several other Federal regulations and pending regulations apply to other products these manufacturers make. For example, some manufacturers in the residential clothes washer industry are subsidiaries of larger parent companies that manufacture other products subject to Federal regulations, including the phaseout

of hydrochlorofluorocarbon (HCFC) refrigerants mandated by the U.S. Environmental Protection Agency (EPA).

DOE will attempt to identify all cumulative engineering issues that could affect the engineering analysis. Consideration of these issues is closely related to the cumulative regulatory burden assessment that DOE will conduct as part of the manufacturer impact analysis. DOE will consider the comments received on the engineering analysis described in the preliminary TSD and make any necessary changes. The updated analysis will be presented in the NOPR TSD.

Item 5-8 *Are there additional outside regulatory issues that DOE should consider in its analysis of residential clothes washers? If so, identify what they are and how DOE should consider them for purposes of its analysis.*

6. ENERGY AND WATER USE DETERMINATION

The energy and water use determination establishes the annual energy consumption of the appliance and assesses the energy-savings potential of different product efficiencies. As part of the energy and water use analysis, certain engineering assumptions may be required regarding product application, including how often the product is operated and under what conditions. DOE uses the annual energy consumption and energy- and water-savings potential in the LCC and PBP analyses to establish the consumer operating cost savings of product efficiency levels.

DOE will use data from the Energy Information Administration (EIA)'s Residential Energy Consumption Survey[15] (RECS) as a basis for estimating the annual energy and water consumption of clothes washers. From RECS, DOE will develop a household sample that uses only homes with clothes washers; *i.e.*, households without clothes washers will be excluded. RECS specifies the use cycles of the washer, thereby allowing DOE to determine the washer's annual energy and water consumption.

DOE will determine the annual energy and water consumption by multiplying the total per-cycle energy consumption developed from the engineering analysis by the number of use-cycles in a year for each washer in the household sample developed from RECS. Annual energy use includes both clothes washer and clothes dryer energy use, taking into account the RMC of the washed clothes. Clothes washer energy use includes the energy to heat water. When the RECS data are used to perform the energy and water use analysis, households with different fuel types for the water heater and clothes dryer will be selected. Some selected households will not have clothes dryers, so RMC changes will not influence the energy consumption in those cases.

As noted in section 1.2, DOE recently revised its clothes washer test procedure to more accurately reflect the average number of annual use cycles. 62 FR 45484. Assuming the average number of use cycles in the RECS household sample is not significantly different, DOE plans to rely on the assumptions in this test procedure to establish the typical clothes washer annual energy and water consumption. DOE will use the RECS household data to establish the high variability in clothes washer use, and, in turn, washer annual energy and water use.

[15] Available at www.eia.doe.gov/emeu/recs/contents.html.

DOE also plans to use the RECS household sample as a basis for conducting the LCC and PBP analyses (see section 8).

Item 6-1 *DOE seeks input from interested parties on the approaches presented for estimating both the typical values and variability in the annual energy and water consumption of residential clothes washers.*

DOE intends to account for the rebound effect in its determination of annual energy consumption. The rebound effect occurs when a piece of equipment, made more efficient and used more intensively, does not yield the expected energy savings from the efficiency improvement. In the case of more efficient domestic residential clothes washers, limited research has been conducted to show that there is no rebound effect for home appliances, although the consumer may choose to purchase larger models with more features that would result in higher energy use.[16]

Item 6-2 *DOE seeks comments on the rebound effect associated with more efficient residential clothes washers. In other words, DOE seeks input on what portion of the energy savings resulting from more efficient equipment may be lost due to increased usage or consumers purchasing larger or more feature-laden clothes washers. DOE is interested in receiving any data that may support these comments.*

7. MARKUPS FOR EQUIPMENT PRICE DETERMINATION

DOE requires retail (consumer) prices for the baseline efficiency level and all other efficiency levels under consideration for use in the LCC and PBP analyses and the national impact analysis. DOE uses manufacturer-to-consumer markups to convert the manufacturer selling price estimates from the engineering analysis to consumer prices. The manufacturer-to-consumer markups are in addition to the markups on production costs that DOE uses to estimate manufacturer selling price in the engineering analysis. To validate these markups, DOE will collect data on existing prices in the market by either purchasing large data sets or downloading data from retailer Internet sites.

However, before it can develop markup information, DOE must first identify distribution channels (*i.e.*, how the product is distributed from the manufacturer to the consumer). AHAM's *2005 Fact Book* (the latest available version) shows that over 93 percent of all appliances are distributed from the manufacturer directly to some type of retailer. Retailers identified in AHAM's *2005 Fact Book* include home improvement stores (such as Lowe's and Home Depot), membership warehouse clubs/stores (such as Sam's Club and Costco), department stores (such

[16] L.A. Greening, D.L. Greene, and C. Difiglio. Energy efficiency and consumption – the rebound effect – a survey. *Energy Policy* 28 (2000) 389–401. Available for purchase at www.elsevier.com/locate/enpol.

as Sears and Kohl's), discount stores (such as Wal-Mart and Kmart), and appliance and consumer electronics stores. Because an overwhelming majority of appliances are sold through retail stores, DOE plans to analyze residential clothes washer product sales based on the assumption that these appliances are sold in a manufacturer-to-consumer distribution channel consisting of three parties: (1) the manufacturers producing the products, (2) retailers purchasing the products from manufacturers and selling them to consumers, and (3) the consumers that purchase the products.

DOE plans to determine an average manufacturer markup by examining the annual Securities and Exchange Commission (SEC) 10-K reports filed by publicly traded manufacturers whose product range includes clothes washers. DOE will determine an average retailer markup by analyzing both economic Census data from the U.S. Census Bureau as well as the annual SEC 10-K reports filed by publicly traded retailers.

In addition to developing the manufacturer and retailer markups, DOE will develop and include sales taxes to calculate appliance retail prices. The Sales Tax Clearinghouse[17] is an Internet source that DOE intends to use to calculate applicable sales taxes.

To the extent possible, DOE also will use collected retail price data to validate the overall manufacturer-to-consumer markup. One source for retail price data is the NPD Group, Inc., which sells sales-weighted retail price data for clothes washers for specific years. As an alternative to purchasing retail price data, DOE may rely on retailers' Internet sites, although the representativeness of any given price data point is unknown.

This analysis will generate retail prices for each possible efficiency level, assuming that each level represents a new efficiency standard. DOE makes this assumption to capture the effect new standards have on retail price, *i.e.*, higher manufacturer production volumes of more efficient products. Because DOE expects to develop a range of price estimates, it may describe new retail prices within a range of uncertainty. If the range of retail prices for each product is large enough, DOE will develop retail price probability distributions to use as inputs to the LCC and PBP analyses to determine the impact of the uncertainty on the economic feasibility of amended energy conservation standards.

DOE welcomes comments on its proposed approach for developing estimates of future retail prices.

8. LIFE-CYCLE COST AND PAYBACK PERIOD ANALYSES

The effects of increased energy conservation standards on a consumer of clothes washers include changes in operating expenses (usually decreased) and changes in purchase prices (usually increased). DOE analyzes the net effect on consumers by calculating the LCC and PBP using engineering performance data (section 5), energy and water consumption data (section 6), and equipment retail prices (section 7). Inputs to the LCC and PBP calculation include the total installed cost to the consumer (purchase price plus installation cost) and operating cost (energy

[17] Sales Tax Clearinghouse, Inc., *State sales tax rates along with combined average city and county rates*. Available at http://thestc.com/STrates.stm.

expenses and, if applicable, water expenses, repair costs, and maintenance costs). Additional inputs to the LCC calculation include energy price forecasts, the lifetime of the appliance or other defined period of analysis, and discount rates.

8.1 Approach for Conducting the LCC and PBP Analyses

In the pre-rulemaking stage, DOE will conduct the LCC and PBP analyses by modeling both the uncertainty and variability in the inputs using Monte Carlo simulations and probability distributions. The Monte Carlo approach provides a significant advantage over less sophisticated approaches (*e.g.*, an approach using typical or average values to characterize inputs) by identifying the percent of consumers benefiting and being burdened by a prospective standard.

LCC and PBP models developed by DOE incorporate both Monte Carlo simulations and probability distributions by using Microsoft Excel spreadsheets combined with Crystal Ball (a commercially available add-in program). Each Monte Carlo simulation will consist of 10,000 LCC and PBP calculations. The models will perform each calculation using input values that are either sampled from probability distributions and household samples or characterized with single point values. The analysis results will be a distribution of 10,000 data points showing the range of LCC savings and PBPs for a given efficiency level relative to the baseline level.

Except for repair and maintenance costs, DOE will use probability distributions to characterize the operating cost inputs to the LCC and PBP analyses, including product lifetimes and consumer discount rates. As described in section 6, DOE will use RECS to establish a sample of individual households for the LCC and PBP analyses. DOE will perform the LCC and PBP calculations on each household to account for the variability in energy and water consumption, and energy, water, and wastewater pricing associated with the household sample. Therefore, the household sample for each product becomes, in effect, a probability distribution for annual energy and water consumption, and energy, water, and wastewater prices. DOE may describe maintenance and repair costs with single point values. The methodology for developing maintenance and repair costs is described in more detail below.

After gathering the necessary data DOE will decide whether to use point values to characterize most of the total installed cost inputs, including the manufacturer markup, the retailer markup, and the installation costs. If the manufacturer cost estimates developed in the engineering analysis are uncertain or variable, DOE will use probability distributions to capture this uncertainty and variability; otherwise, DOE will use single point values for this input . DOE intends to characterize sales taxes with probability distributions to capture their regional variability.

Another factor in identifying which consumers benefit from or are burdened by a prospective standard is the distribution of product efficiencies in the marketplace, referred to as base case efficiency distributions or market-share efficiency data. Assuming these data are available, DOE can characterize the current product mix with probability distributions. DOE will then assign specific appliance efficiencies to each household in its household sample based on the efficiency's sales weight. Because DOE intends to perform the LCC and PBP calculations on a household-by-household basis, DOE expects to determine the LCC and PBP for a particular standard level based on the appliance efficiency in a given household. For example, if a

household is assigned a product efficiency that is greater than or equal to the efficiency of the standard level under consideration, the LCC and PBP calculation would reveal that the household would not be affected by a new standard level. By accounting for the households that already purchase more efficient products, DOE will not overstate the potential benefits from increasing product efficiency. To enable DOE to use this methodology, DOE expects to ask interested parties—presumably either AHAM or individual manufacturers—to provide data on the current mix of product efficiencies to account for those households already purchasing high-efficiency products.

As discussed in section 6, DOE intends to consider the rebound effect associated with more efficient clothes washers. The net impact on consumers is the sum of the change in the cost of owning the clothes washer (*i.e.,* life-cycle cost) and the increased value for the enhanced product features or usage patterns. DOE estimates that if it were able to monetize the increased value to consumers added by the rebound effect, this value would be similar to the monetary value of added energy use. Therefore, the economic impacts on consumers with or without the rebound effect, as measured in the LCC analysis, are the same.

DOE intends to conduct the LCC and PBP analyses for the following residential clothes washer product classes: (1) top-loading compact, (2) top-loading standard, and (3) front-loading. To identify the consumers that benefit from, or are burdened by, a prospective standard, DOE requests base case efficiency distributions or market-share efficiency data from the industry. Table A-3 in appendix A identifies the market-share efficiency data that DOE is seeking.

During the NOPR-stage consumer analysis, DOE may evaluate additional parameters not included in the preliminary analysis pertaining to information provided by interested parties or that otherwise becomes available to the Department.

Based on the results of the LCC analysis, DOE will select CSLs for the preliminary analysis. The range of CSLs typically will include the efficiency level with the minimum LCC, the highest efficiency level that is technologically feasible, and other intermediate levels DOE has not yet determined.

The following sections discuss the methodologies DOE plans to use to develop several of the inputs to the LCC and PBP analyses, including (1) energy, water, and wastewater prices; (2) maintenance, repair, and installation costs; (3) product lifetimes; and (4) discount rates. The other inputs to the LCC and PBP analyses—namely, manufacturer costs (section 5), annual energy consumption (section 6), and markups for the determination of consumer retail prices (section 7)—have been discussed previously.

DOE is also required to perform a PBP analysis to determine whether the 3-year rebuttable presumption of economic justification applies (in essence, whether the purchaser will recover the higher installed cost of more energy efficient equipment through lowered operating costs within 3 years.) (42 U.S.C. 6295(o)(2)(B)(iii)) To determine the rebuttable-presumption PBP, DOE will determine the value of the first year's energy savings by calculating the quantity of those savings in accordance with DOE's test procedure, rather than the field-based energy consumption data from RECS. Although DOE will examine the rebuttable-presumption criteria,

it will determine economic justification of selected CSLs through a more detailed analysis of the economic impacts of increased efficiency pursuant to section 325(o)(2)(B)(i) of EPCA. (42 U.S.C. 6295(o)(2)(B)(i))

For the NOPR, DOE will review all of the comments it receives on the preliminary LCC analysis, make any necessary revisions to the analysis, and evaluate additional parameters not included in the preliminary analysis, if necessary.

Item 8-1 *DOE seeks input from interested parties on the planned approach of using Monte Carlo simulation and probability distributions to conduct the LCC and PBP analyses.*

Item 8-2 *DOE requests data from interested parties to characterize the current mix of residential clothes washer efficiencies in the market.*

8.2 Energy, Water, and Wastewater Prices

For consumers of residential clothes washers, DOE plans to review residential energy price data from the EIA to establish electricity, natural gas, and oil prices. All fuel types must be considered in the LCC and PBP analyses, as U.S. households use electric, gas-fired, and oil-fired water heaters to provide heated water for clothes washer operation. DOE will review the water and wastewater rates survey data from the American Water Works Association (AWWA) and Raftelis Financial Consultants, Inc. (a water and wastewater financial consulting firm) as a potential means for establishing residential water and wastewater prices.

DOE plans on developing average energy prices from EIA data for 13 geographic areas—the nine U.S. Census divisions, four large States (New York, Florida, Texas, and California) treated separately. DOE is separating out these four large States to analyze the impact of standards on 32 percent of the U.S. general population and to develop energy prices at the smallest geographic area as the data permit. Looking at smaller geographic areas enables DOE to examine additional regional differences in the variability of energy prices. For those Census divisions containing one of these large States, DOE intends to leave out the data for these States to avoid double-counting when calculating the regional average values. For example, the Pacific region average will not include California, and the West South Central region average will not include Texas. As described in section 8.1 above, DOE plans to use RECS to develop a sample of individual households that use residential clothes washers. Depending on the household's geographic location, DOE will assign the appropriate energy price from one of the 13 geographic areas. Therefore, DOE will be able to assess the variability of energy prices at the regional level for residential clothes washers.

To calculate electricity prices for residential consumers in each of the above geographic areas, DOE intends to use information provided by electric utilities as summarized in the most recent EIA Form 861 data.[18] These data are published annually and include annual electricity sales in kWh; revenues from electricity sales; and number of consumers, for the residential,

[18] Available at www.eia.doe.gov/cneaf/electricity/page/eia861.html.

commercial, and industrial sectors for every utility serving final consumers. The calculation of an average residential electricity price will proceed in two steps: (1) for each utility, estimate an average residential price by dividing the residential revenues by residential sales; and (2) calculate a regional average price, weighting each utility with customers in a region by the number of residential consumers served in that region.

To calculate natural gas and oil prices for residential consumers in each of the above geographic areas, DOE intends to use data from the EIA publications *Natural Gas Monthly*[19] and *Petroleum Navigator*.[20] These publications include a compilation of monthly fuel delivery volumes and average consumer prices by State for residential, commercial, and industrial customers. DOE plans to use the complete annual data for the most recent year available to calculate an average price for each area. The calculation of natural gas and oil average prices will proceed in two steps: (1) calculate the annual prices for each State using a simple average over the appropriate months; and (2) calculate a regional price, weighting each State in a region by its population. This method differs from the method used to calculate electricity prices because EIA does not provide consumer- or utility-level data on gas and oil consumption and prices.

To calculate water and wastewater prices for residential consumers, DOE intends to use data from the most recent *Water and Wastewater Survey*[21] conducted by Raftelis and AWWA. The survey covers approximately 300 water utilities and 200 wastewater utilities, with each industry analyzed separately. For each utility, the water and wastewater survey includes the cost to consumers of purchasing a given volume of water and producing a given volume of wastewater. Because a sample of 200–300 utilities is not large enough to calculate regional prices for all U.S. Census divisions and large States,[22] DOE intends to calculate regional values at the Census region level (Northeast, South, Midwest, and West). The calculation of average per-unit-volume residential prices will proceed in three steps: (1) calculate the per-unit-volume price for each utility by dividing the total volumetric cost by the volume delivered or produced (as in the case of wastewater); (2) calculate a State-level average price by weighting each utility in a given State by the number of residential consumers it serves; and (3) calculate a regional average by combining the State-level averages, weighting each by the population of that State.

If the EIA and AWWA/Raftelis data demonstrate a large variability in energy, water and wastewater prices, DOE will conduct a sensitivity analysis to determine how high and low energy, water, and wastewater price estimates affect the economic feasibility of amended energy conservation standards.

DOE will use projections of national average energy prices to residential consumers to estimate future energy prices in its LCC analysis. DOE will use the most recent available edition of EIA's *Annual Energy Outlook* (*AEO*) as the default source of projections for future energy prices. DOE will base projections of future water and wastewater prices on an examination of trends in historical prices.

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[19] Available at *www.eia.doe.gov/oil_gas/natural_gas/data_publications/natural_gas_monthly/ngm.htm*.
[20] Available at *http://tonto.eia.doe.gov/dnav/pet/pet_pri_dist_dcu_nus_a.htm*.
[21] Available for purchase at *www.raftelis.com/ratessurvey.html*.
[22] By comparison, the EIA Form 861 data include more than 3,000 utilities.

Item 8-3 *DOE seeks input from interested parties on the planned approach for estimating current and forecasted energy, water, and wastewater prices.*

8.3 Maintenance, Repair, and Installation Costs

DOE will consider any expected changes to maintenance, repair, and installation costs for the residential clothes washers covered in this rulemaking. Typically, small incremental changes in product efficiency incur little or no changes in repair and maintenance costs over baseline products. There is a greater probability that products with efficiencies that are significantly higher than the baseline will incur increased repair and maintenance costs, since such products are more likely to incorporate technologies that are not widely available. DOE will rely on input from manufacturers and other interested parties in developing appropriate repair and maintenance cost estimates, as necessary.

Regarding installation costs, unless the efficiency increases considered for this rulemaking result in significantly larger or heavier products, DOE expects that more efficient clothes washers will not incur increased installation costs.

Item 8-4 *DOE seeks input from interested parties on whether it is correct to assume that changes in maintenance, repair, and installation costs will be negligible for more efficient residential clothes washers. If it is incorrect, DOE is interested in the reasons why this is so and specific ways to correct this assumption.*

8.4 Product Lifetimes

DOE's previous energy conservation standards rulemakings have established the product lifetimes of residential clothes washers. In the December 2000 TSD for clothes washers, DOE estimated an average product lifetime of 14.1 years.

DOE will use information from various literature sources (*e.g.*, *Appliance Magazine*, handbooks published by AHAM) as well as input from manufacturers and other interested parties to establish whether the above product lifetimes are still representative.

Item 8-5 *DOE seeks input from interested parties on appropriate lifetimes for the residential clothes washer product classes covered in this rulemaking.*

8.5 Discount Rates

The calculation of consumer LCC requires the use of an appropriate discount rate. DOE uses the discount rate to determine the present value of lifetime operating expenses. The discount rate used in the LCC analysis represents the rate from an individual consumer's perspective.[23]

[23] The consumer discount rate is in contrast to the discount rates used in the national impact analysis, which are intended to represent the rate of return of capital in the U.S. economy as well as the societal rate of return on private consumption. See section 10.3 for additional information.

For consumers of residential clothes washers, DOE plans to use the same approach that it relied on to develop discount rates for residential furnaces and boilers—*i.e.*, deriving the discount rates from estimates of the interest or "finance cost" to purchase residential products. Following financial theory, the finance cost of raising funds to purchase these products can be interpreted as (1) the financial cost of any debt incurred to purchase products (principally interest charges on debt), or (2) the opportunity cost of any equity used to purchase products (principally interest earnings on household equity). Household equity is represented by holdings in assets such as stocks and bonds, as well as the return on homeowner equity. Much of the data required to determine the cost of debt and equity come from the Federal Reserve Board's triennial *Survey of Consumer Finances*.[24]

Item 8-6 *DOE seeks input from interested parties on the planned approach for estimating discount rates for residential consumers.*

Based on consideration of the comments received on the LCC and PBP analyses documented for the preliminary TSD, DOE will make changes as needed to the analysis. It will reflect those changes in the documentation of the NOPR.

9. SHIPMENTS ANALYSIS

Shipments forecasts are required to calculate the national impacts of standards (NES and NPV) and to calculate the future cash flows of manufacturers. DOE plans to develop shipments forecasts based on an analysis of key market drivers for the particular products.

9.1 Base Case Forecast

To evaluate the various impacts of standards, DOE develops a base case forecast against which to compare forecasts for higher efficiency levels. (Higher efficiency level forecasts are also referred to as standards case forecasts.) DOE designs the base case to depict what would likely happen to energy and water consumption and costs over time if DOE does not adopt energy conservation standards. In determining the base case for each set of products, DOE plans to calibrate its forecasts against historical shipments. DOE will also consider the mix of efficiencies sold in the absence of new standards and how that mix might change over time. As a result, DOE will need to collect data on historical product shipments and the market shares of the different efficiency levels offered in each product class. Based on detectable trends in the collected efficiency data, DOE will forecast base case shipment-weighted efficiencies (SWEF) by product class. Forecasts of SWEFs are discussed in greater detail in section 10.1.

DOE plans to determine annual shipments in the base case by primarily accounting for sales to two market segments: new construction and replacements. DOE intends to determine shipments to new construction by accounting for new housing construction and historical rates of product ownership (saturation rates). DOE plans to rely on the latest available edition of EIA's *AEO* to forecast new residential construction. Regarding historical product saturation rates, both

[24] Available at www.federalreserve.gov/pubs/oss/oss2/scfindex.html.

AHAM's *2005 Fact Book* and EIA's RECS provide relevant data. DOE plans to use both sources to establish product saturation rates. DOE will also consider other input interested parties provide. To determine replacement shipments, DOE will use the same product lifetimes and retirement functions that it generates for the LCC and PBP analyses. In addition, DOE will consider other market segments as appropriate, such as households that may retire their appliances early, and existing households that do not already own the appliance.

Item 9-1 *DOE seeks data on representative saturation rates for residential clothes washers.*

For residential clothes washers, DOE intends to develop a base case shipments forecast for three product classes: (1) top-loading compact, (2) top-loading standard, and (3) front-loading. Therefore, for purposes of developing calibrated base case forecasts, DOE is seeking historical product shipments data for each product class. The AHAM *2005 Fact Book* and *Appliance Magazine* offer historical shipments, but the data are not disaggregated by product class. DOE hopes to collect from the industry disaggregated shipments data dating back at least 5 years. Table A-1 in appendix A identifies the specific years for which DOE seeks historical shipments data.

Item 9-2 *DOE seeks historical shipments data broken down by product class.*

9.2 Standards Impacts on Product Shipments

For each product, DOE will develop a set of shipments forecasts for the covered products for each set of efficiency levels analyzed. It will use these standards case forecasts to evaluate the impacts of standards on product shipments. DOE will derive standards case forecasts using the same data sets as it used for the base case forecasts. However, because the standards case forecasts consider the increase in purchase price and the decrease in operating costs caused by standards, forecasted shipments typically deviate from the base case. Household income also factors into consumer purchase decisions. Therefore, the magnitude of the difference between the standards case and base case shipments forecasts depends on the estimated purchase price increase and the operating cost savings caused by the standard, relative to household income. Because the purchase price tends to have a larger impact than operating cost on appliance purchase decisions, standards case forecasts typically show a drop in product shipments relative to the base case.

DOE's past standards analyses have attempted to quantify the sensitivity of shipments to increased purchase prices and operating cost savings as well as to changes in household income. For example, DOE has conducted literature reviews and analyses of historical appliance price and efficiency data to develop sensitivities. DOE will attempt to develop purchase price and operating cost sensitivities for residential clothes washers. However, because the data required to develop these sensitivities are limited and often difficult to obtain, DOE will also consider modeling standards case shipments forecasts with scenarios (*i.e.*, specified impacts to product shipments) if necessary.

Market-pull programs, such as consumer rebate programs that encourage the purchase of more-efficient products and manufacturer tax credits that encourage the production of more efficient products, also affect standards case shipments forecasts. To the extent that such programs exist, DOE considers their impact on the forecast of both base case and standards case shipments.

Item 9-3 *As part of its preliminary manufacturer impact analysis, DOE seeks input from manufacturers and other interested parties on the potential impact of new energy conservation standards on product shipments.*

Item 9-4 *DOE also requests input on any market-pull programs that promote the adoption of more efficient residential clothes washer products.*

10. NATIONAL IMPACT ANALYSIS

This section discusses DOE's assessment of the aggregate impacts of potential energy conservation standards at the national level. Measures of impact that DOE will report include the future NES from candidate standards and the NPV of total consumer life-cycle costs.

10.1 Inputs to NES and NPV Forecasts

Analyzing impacts of Federal energy conservation standards for residential clothes washers requires a comparison of projected U.S. energy consumption with and without new or amended energy conservation standards. The forecasts contain projections of annual appliance shipments (section 9), the annual energy and water consumption of new appliances (section 6), and the purchase price of new appliances (section 7).

A key component of DOE's estimates of NES and NPV are the product energy efficiencies forecasted over time for the base case (without new standards) and each standards case. For residential clothes washers, the forecasted efficiencies represent the annual shipment-weighted annual energy and water consumption, and wastewater production of the products under consideration over the forecast period (*i.e.*, from the assumed effective date of a new standard to 30 years after the standard becomes effective). Because key inputs to the calculation of the NES and NPV (annual energy consumption for the NES, and retail prices and annual operating costs for the NPV) depend on the estimated efficiencies, these efficiencies are important to the analysis.

DOE intends to rely on input from interested parties, in particular AHAM and appliance manufacturers, to develop base case historical shipment-weighted average efficiencies. For past home appliance standards rulemakings, AHAM was able to provide SWEF data. DOE hopes that AHAM and manufacturers will provide similar historical shipment-weighted average efficiency data (EF or MEF and WF) for as many of the clothes washer product classes as possible.

If AHAM is unable to provide historical SWEF data by product class, DOE will make its own estimates based on the aggregated historical SWEF data, past and current energy conservation standards, and historical shipments data disaggregated by product class. To forecast

base case efficiencies, in addition to determining detectable trends in any historical SWEF data provided, DOE intends to review data from the ENERGY STAR program to determine the effect that the program has had on increasing product efficiency. Based on the trends in the historical SWEF data and the ENERGY STAR program's success at transforming the clothes washer market, as well its potential for future impacts on product efficiency, DOE will forecast base case efficiency trends for each product class.

To develop shipment-weighted efficiencies for the various standards cases, DOE expects to collect market-share efficiency data (*i.e.*, data on the distribution of product shipments by efficiency) for the various product classes of each appliance. These are the same market-share efficiency data (otherwise known as base case efficiency distributions) that DOE is requesting for the LCC and PBP analyses. These data would allow DOE to accurately quantify the percent of consumers that benefit from an increase in the energy conservation standard. Realizing that this information may be difficult to collect, DOE hopes to obtain market-share efficiency data for at least the most predominant product classes from a recent year (*i.e.*, 2005 or 2006).

The market-share efficiency data will allow DOE to estimate the efficiency impact that standards may have in the year they become effective. For example, DOE has assumed a "roll-up" scenario for past standards rulemakings.[25] Under this scenario, DOE assumes (1) product efficiencies in the base case that do not meet the standard level under consideration would "roll up" to meet the new standard level, and (2) product efficiencies above the standard level under consideration would not be affected. Once DOE establishes the shipment-weighted efficiency for the assumed effective date of the standard, it will estimate future shipment-weighted efficiencies using the same rate of forecasted efficiency growth as in the base case efficiency trend.

Appendix A identifies the efficiency data DOE is requesting from the industry. As identified in Table A-2, DOE is seeking historical SWEF (EF or MEF and WF) data for as many of the five product classes identified in section 3.2 as interested parties can provide. For the market-share efficiency data that DOE seeks, the efficiency bins encompass the efficiency levels listed in Table A-3. In the cases where market-share efficiency data are not available, DOE will use efficiency distributions based on available models as a proxy.

Item 10-1 *DOE seeks historical SWEF (EF or MEF and WF) data by product class. DOE also seeks historical market share data showing the percentage of product shipments by efficiency level for as many product classes as possible.*

10.2 National Energy Savings

DOE intends to calculate national energy consumption for each year beginning with the expected effective date of the standards. It will calculate national energy consumption for the base case and each standard level analyzed. DOE plans to perform this calculation using a

[25] For example, the residential central air conditioner standards rulemaking considered a roll-up scenario when estimating the impact of standards. See chapter 7 of the central air conditioner TSD for more details, which is available at www.eere.energy.gov/buildings/appliance_standards/residential/ac_central_1000_r.html.

spreadsheet model that effectively multiplies annual shipments forecasts by unit energy savings, accounting for the stock of appliances affected by standards.

In response to comments by interested parties who asked for a simple, transparent model, DOE has developed NES spreadsheet models for its standards rulemakings since 1996, to forecast energy savings and to demonstrate how to account for the growth in efficiency over time.[26] Although these models are specific to each product, DOE can apply their general structure to the entire residential clothes washer market. DOE expects the NES spreadsheet model it develops for this rulemaking to provide a credible, stand-alone forecast of NES and NPV for residential clothes washers.

As discussed in section 6, DOE intends to consider the rebound effect associated with more efficient clothes washers. DOE will incorporate the rebound effect used in the energy use analysis into its calculation of national energy savings by diminishing the SWEFs in the standards case forecasted efficiency trends.

Based on comments DOE receives on the preliminary phase of this rulemaking, DOE may make changes to the analysis. It will reflect those changes in the documentation for the NOPR.

Item 10-2 *DOE seeks input on its plan to develop NES spreadsheet models for estimating national impacts of amended energy conservation standards for residential clothes washers. For example, are spreadsheet models still the preferred approach for estimating national impacts?*

10.3 Net Present Value

DOE calculates the national NPV of energy conservation standards in conjunction with the NES. DOE calculates annual energy expenditures from annual energy consumption by incorporating forecasted energy prices, using the shipment and average energy efficiency forecasts described in section 9. DOE calculates annual product expenditures by multiplying the price per unit by the number of forecasted shipments. The difference between a base case and a standards case scenario gives the national energy bill savings and increased product expenditures in dollars. The difference each year between energy bill savings and increased product expenditures is the net savings (if positive) or net costs (if negative). DOE discounts these annual values to the present time and sums them to give a net present value. According to U.S. Office of Management and Budget (OMB) requirements, DOE will conduct two NPV calculations, one using a real discount rate of 3 percent and another using a real discount rate of 7 percent (OMB, Circular A-4: Regulatory Analysis. (Sept. 17, 2003)). The discount rates for the determination of NPV are in contrast to the discount rates used in the LCC analysis, which are developed from a consumer's perspective. The 7-percent real value is an estimate of the average before-tax rate of return to private capital in the U.S. economy. The 3-percent real value represents the "societal rate of time preference," which is the rate at which society discounts future consumption flows to

[26] Several NES spreadsheet models from previous rulemakings, including the rulemaking for residential clothes washers, can be found on DOE's website at www.eere.energy.gov/buildings/appliance_standards.

their present value. Based on consideration of the comments received in response to the preliminary phase of this rulemaking, DOE will make any necessary changes to the analysis and the CSLs.

As noted in section 10.2, DOE intends to consider the rebound effect associated with more efficient clothes washers in its determination of national energy savings. As discussed in section 8, DOE believes that if it were able to monetize the increased value to consumers added by the rebound effect, this value would be similar in value to foregone energy savings. For this standards rulemaking, DOE estimates that this increased value to the consumer is equivalent to the monetary value of the energy savings that would have occurred without the rebound effect. Therefore, the economic impacts on consumers with or without the rebound effect, as measured in the NPV, are the same.

11. LIFE-CYCLE COST SUBGROUP ANALYSIS

This section describes how DOE analyzes consumer impact of any new standards by dividing consumers into subgroups and accounting for variations in key inputs to the LCC analysis. A consumer subgroup comprises a subset of the population that is likely to be affected disproportionately by new or revised energy conservation standards. The purpose of a subgroup analysis is to determine the extent of this disproportional impact. DOE will work with interested parties early in the rulemaking process to identify any subgroups for consideration. In the case of residential clothes washers, some possible subgroups DOE may consider are low-income households and senior citizens. However, DOE will not analyze the consumer subgroups until the NOPR stage of the analysis.

In comparing potential impacts on the different consumer subgroups, DOE will evaluate variations in regional energy prices, energy use profiles, and installation costs that might affect the LCC of an energy conservation standard to certain consumer subgroups. To the extent possible, DOE will obtain estimates of the variability in each input and consider these ranges in its calculation of consumer impacts. It will discuss with interested parties the variability ranges in each input and likely sources of information.

Item 11-1 *DOE requests input as to which consumer subgroups, if any, it should consider when devising standards for residential clothes washers.*

12. MANUFACTURER IMPACT ANALYSIS

DOE announced changes to the manufacturer impact analysis format in a report issued to Congress, *Energy Conservation Standards Activities*[27] ("Standards Activities"), on January 31, 2006 (as required by section 141 of the Energy Policy Act of 2005 (EPACT 2005)).

Under this new format, DOE will collect, evaluate, and report preliminary information and data on manufacturer impacts in the preliminary TSD. (See Standards Activities, p. 48.) Such preliminary information includes the anticipated conversion capital expenditures by efficiency level and the corresponding anticipated impacts on employment. DOE will solicit further information during the preliminary engineering analysis manufacturer interviews. Preliminary manufacturer impact analysis data needs are contained in appendix B.

DOE intends the manufacturer impact analysis to provide an assessment of the potential impacts of energy conservation standards on manufacturers of residential clothes washers. In addition to financial impacts, a wide range of quantitative and qualitative effects may occur following adoption of a standard that may require changes to the manufacturing practices for these products. DOE will identify these effects through interviews with manufacturers, as well as other interested parties and experts.

For the NOPR, DOE will supplement the results of the preliminary MIA conducted as part of the preliminary analyses with more detailed analyses, described in sections 12.1 through 12.5. Specifically, DOE will carry out an industry-wide cash-flow analysis using the Government Regulatory Impact Model (GRIM), identify and analyze subgroups of manufacturers whose business varies significantly from the industry as a whole, perform a competitive impacts assessment, and review the cumulative regulatory burden for the industry.

12.1 Sources of Information for the Manufacturer Impact Analysis

Many of the analyses described earlier provide important information that DOE uses as inputs for the manufacturer impact analysis. Such information includes financial parameters developed in the market assessment (section 3.1), manufacturing costs from the engineering analysis (section 5.3), retail price forecasts (section 7), and shipments forecasts (section 9). DOE supplements this information with information gathered during manufacturer interviews.

DOE will conduct detailed interviews with manufacturers to gain insight into the range of potential impacts of standards. The interview process plays a key role in the manufacturer impact analysis, since it provides an opportunity for directly affected parties to express their views on important issues. During the interviews, DOE will solicit information on the possible impacts of standards on manufacturing costs, equipment prices, sales, direct employment, capital assets, and industry competitiveness. Both qualitative and quantitative information are valuable in terms of this analysis. DOE will schedule interviews well in advance to provide every opportunity for key individuals to be available to participate. In addition, DOE will provide manufacturers with the questionnaire before the interviews to facilitate the gathering of the appropriate information.

[27] A copy of this report is available at: www.eere.energy.gov/buildings/appliance_standards/2006_schedule_setting.html.

Although a written response to its questionnaire is acceptable, DOE prefers an interactive interview process, because it helps clarify responses and provides the opportunity to identify additional issues.

DOE will ask interview participants to identify all confidential information provided in writing or orally, and DOE will determine whether the information submitted is entitled to confidential treatment. It will consider information gathered, as appropriate, in the energy conservation standards decision-making process. However, DOE will not make confidential information available in the public record. DOE also will ask participants to identify all information that they wish to have included in the public record but that they do not want to have associated with their interview that would identify that particular manufacturer; DOE will incorporate this information into the public record, but will report it without attribution.

DOE will collate the completed interview questionnaires and prepare a summary of the major issues and outcomes. This summary will become part of the TSD produced for this rulemaking.

12.2 Industry Cash-Flow Analysis

The industry cash-flow analysis relies primarily on the GRIM. DOE uses the GRIM to analyze the financial impacts of new or more stringent energy conservation standards on the industries that produce the products covered by the standard.

The GRIM analysis uses a number of inputs—annual expected revenues; manufacturer costs such as costs of goods sold; selling, general, and administrative costs; taxes; and capital expenditures (both ordinary capital expenditures and those related to standards)—to determine a series of annual cash flows beginning from the announcement of the new standard and continuing for several years after its implementation. DOE compares the results against base case projections that involve no new standards. The financial impact of new standards is the difference between the two sets of discounted annual cash flows. Other performance metrics, such as return on invested capital, also are available from the GRIM.

DOE will gather the inputs needed for the GRIM from two primary sources: the analyses conducted to this point and interviews with manufacturers and other interested parties. Information gathered from previous analyses will include financial parameters, manufacturing costs, price forecasts, and shipments forecasts. Interviews with manufacturers and other interested parties will be essential in supplementing this information.

12.3 Manufacturer Subgroup Analysis

Average industry cost values may not adequately assess differential impacts among subgroups of manufacturers. DOE recognizes that smaller manufacturers, niche players, and manufacturers exhibiting a cost structure that differs significantly from the industry average may be affected differently by the imposition of standards. Ideally, DOE would consider the impact on every firm individually. In highly concentrated industries, this may be possible. In industries having numerous participants, however, DOE uses the results of the market and technology assessment to group manufacturers into subgroups, as appropriate.

Small businesses, as defined by the U.S. Small Business Administration (SBA) for household laundry equipment manufacturers, which includes residential clothes washers, are enterprises with 1,000 employees or fewer. Small business size standards are listed by North American Industry Classification System (NAICS) code and industry description. Household laundry equipment manufacturing is classified under NAICS 335224. A search of small businesses of this NAICS code listed in the SBA website indicates that there is at least one small business that manufactures residential clothes washers that would be covered by this rulemaking. As part of its subgroup analysis, DOE will identify small businesses that manufacture these products and interview small businesses affected by the rulemaking to determine if there are differential impacts on these companies that may result from new energy conservation standards. DOE will examine publicly available data and contact manufacturers, when needed, to determine if they meet the SBA's definition of a small manufacturing facility and if their manufacturing facilities are located within the United States.

The detailed manufacturer subgroup impact analysis will entail calculating cash flows separately for each defined class of manufacturer.

Item 12-1 *DOE seeks comment on appropriate manufacturer subgroups, if any, that DOE should consider in a manufacturer subgroup analysis for residential clothes washers.*

12.4 Competitive Impacts Assessment

EPCA directs DOE to consider any lessening of competition likely to result from an imposition of standards. (42 U.S.C. 6295(o)(2)(B)(i)(V)) It further directs the Attorney General to determine in writing the impacts, if any, of any lessening of competition. (42 U.S.C. 6295(o)(2)(B)(ii))

DOE will make a determined effort to gather and report firm-specific financial information and impacts, and it will then report the aggregated impact of the standard on manufacturers. The competitive impacts analysis will focus on assessing the impacts to smaller, yet significant, manufacturers. DOE will base the assessment on manufacturing cost data and on information collected from interviews with manufacturers. The manufacturer interviews will focus on gathering information that will help in assessing asymmetrical cost increases to some manufacturers, increased proportion of fixed costs potentially increasing business risks, and potential barriers to market entry (*e.g.*, proprietary technologies). DOE will provide the Attorney General with a copy of the NOPR for consideration in his/her evaluation of the impact of standards on the lessening of competition.

12.5 Cumulative Regulatory Burden

DOE is aware that other regulations may apply to equipment covered under this rulemaking, as well as to other equipment produced by the same manufacturers of equipment covered under this rulemaking. Multiple regulations may result in a significant, cumulative regulatory burden on these manufacturers. Accordingly, DOE will analyze and seek to mitigate the overlapping effects of amended DOE standards and other regulatory actions on

manufacturers of residential clothes washers. DOE is aware that home appliance manufacturers and trade groups have issued public comments concerning the excessive regulation of the home appliance industry in comparison to other industries. DOE will consider these issues during the manufacturer impact analysis.

Regulations that could affect the industries impacted by this rulemaking include:

- *DOE standards for residential clothes washers.* Manufacturers have gone through redesign cycles mandated by standards since 1990. Most recently, EISA 2007 prescribed standards for residential clothes washers that will take effect in 2011.
- *EPA-mandated phase-out of HCFCs.* Some manufacturers in the residential clothes washer industry are subsidiaries to large parent companies that manufacture products subject to the EPA-mandated phase-out of HCFC refrigerants (*i.e.*, refrigerators, room air-conditioners, dehumidifiers), requiring manufacturers to switch to non-ozone-depleting refrigerants.
- *Reduction of Hazardous Substances (RoHS) directive.* The *Directive on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment* was adopted in February 2003 by the European Union (EU) and became effective July 1, 2006.[28] RoHS identifies specific categories of products that can contain no more than threshold amounts of mercury, lead, cadmium, hexavalent chromium, and two fire retardants. While this legislation does not extend to products in the United States, domestic manufacturers selling to the EU market must produce RoHS-compliant appliances. These manufacturers may choose to promulgate the associated design changes across their entire product line.

Item 12-2 *What other regulations or pending regulations should DOE consider in its examination of cumulative regulatory burden?*

13. UTILITY IMPACT ANALYSIS

To estimate the effects of energy conservation standards for residential clothes washers on electric utility industries, DOE plans to use a variant of the EIA's National Energy Modeling System (NEMS) called NEMS-BT. BT refers to DOE's Building Technologies Program. NEMS is a large, multisectoral, partial-equilibrium model of the U.S. energy sector that EIA has developed over several years, primarily for the purpose of preparing the *AEO*. NEMS produces a widely recognized reference case forecast for the United States through 2030 and is available in the public domain.[29]

[28] Available at http://ec.europa.eu/environment/waste/weee/index_en.htm.

[29] For more information on NEMS, please refer to the U.S. Department of Energy, Energy Information Administration documentation. A useful summary is *National Energy Modeling System: An Overview 2000,* DOE/EIA-0581(March 2000), available at http://tonto.eia.doe.gov/ftproot/forecasting/05812000.pdf. EIA approves use of the name NEMS to describe only an official version of the model without any modification to code or

The utility impact analysis is a comparison between the NEMS-BT model results for the base case and standards cases. Outputs of the utility impact analysis usually parallel results that appear in the latest *AEO*, with some additions. Typical outputs of the utility impact analysis include forecasts of electricity and gas sales, price, and avoided capacity. DOE plans to conduct the utility impact analysis as a scenario departing from the latest *AEO* reference case. In other words, DOE will model the energy savings impacts from amended energy conservation standards using NEMS-BT to generate forecasts that deviate from the *AEO* reference case.[30]

Item 13-1 *DOE seeks input from interested parties on its plans to use NEMS-BT to conduct the utility impact analysis. Is the NEMS-BT model appropriate for assessment of utility impacts of energy conservation standards? If not, why? What would be a more appropriate model for DOE to use?*

14. EMPLOYMENT IMPACT ANALYSIS

DOE estimates the impacts of standards on employment for equipment manufacturers, relevant service industries, energy suppliers, and the economy in general. This analysis covers both direct and indirect employment impacts. Direct employment impacts would result if standards led to a change in the number of employees at manufacturing plants and related supply and service firms. DOE will evaluate direct employment impacts in the manufacturer impact analysis, as described in section 12.

Indirect employment impacts are impacts on the national economy other than in the manufacturing sector being regulated. Indirect impacts may result both from expenditures shifting among goods (the substitution effect) and changes in income that lead to a change in overall expenditure levels (the income effect). DOE defines indirect employment impacts from standards as net jobs eliminated or created in the general economy as a result of increased spending driven by the increased product prices and reduced spending on energy.

DOE will investigate the combined direct and indirect employment impacts in the employment impact analysis using the Pacific Northwest National Laboratory (PNNL)'s Impact of Sector Energy Technologies (ImSET) model. PNNL developed ImSET for DOE's Office of Planning, Budget, and Analysis. The model estimates the employment and income effects of energy-saving technologies in buildings, industry, and transportation. Compared to simple economic multiplier approaches, ImSET allows for more complete and automated analysis of the economic impacts of energy efficiency investments. Although DOE intends to use ImSET for its analysis of employment impacts, it welcomes input on other tools and factors it might consider.

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data. Because this analysis entails some minor code modifications and the model is run under various policy scenarios that are variations on EIA assumptions, DOE refers to the model by the name NEMS-BT.

[30] Several NEMS-BT models from previous rulemakings, including residential clothes washers, can be found on DOE's website at www.eere.energy.gov/buildings/appliance_standards.

Item 14-1 *DOE welcomes feedback on its planned approach for assessing national employment impacts, both direct and indirect, and is interested in whether other tools or factors should be considered as part of its analysis. If other tools or factors should be considered, please identify them and explain why, and how, they should be integrated into DOE's analysis.*

15. ENVIRONMENTAL ASSESSMENT

DOE will prepare its draft environmental assessment (EA) pursuant to the National Environmental Policy Act and the requirements under 42 U.S.C. 6295(o)(2)(B)(i)(VI) and 6316(a), to determine the environmental impacts of the amended standards. The intent of the environmental assessment is to provide emissions results estimates and to fulfill requirements to properly quantify and consider the environmental effects of the proposed amended standards.

The environmental assessment will focus on the impact of possible energy conservation standards on the pollutants and emissions from electricity-generating power plants. Specifically, the environmental assessment for this rulemaking will consider three types of energy-related emissions — oxides of nitrogen (NO_x), mercury (Hg), and carbon dioxide (CO_2). An additional emission, sulfur dioxide (SO_2), was previously considered. However, DOE has determined that due to the presence of national caps on SO_2 emissions as addressed below, any such reduction resulting from an energy conservation standard would not affect the overall level of SO_2 emissions in the United States.

DOE will estimate the reduction in total emissions of CO_2, NO_x, and Hg using the NEMS-BT computer model. As noted earlier in the discussion of the Utility Impact Analysis, NEMS-BT is a variant of NEMS which is used to produce EIA's AEO. In the Environmental Assessment, DOE will consider the incremental impact on emissions from several energy conservation standards for clothes washers. In considering the environmental impacts of each possible standard, DOE will rely on the data and assumptions in the most current version of the AEO.

The NEMS-BT is run similarly to the latest AEO version of NEMS, except the energy use is reduced by the amount of energy saved due to the CSLs. DOE obtains the inputs of national energy savings from the NIA spreadsheet model. For the Environmental Assessment, the output is the forecasted physical emissions. The net benefit of the standard is the difference between emissions estimated by NEMS-BT and the Reference Case. The NEMS-BT tracks CO_2 emissions using a detailed module that provides results with a broad coverage of all sectors and inclusion of interactive effects.

Item 15-1 *DOE invites comments on how to estimate monetary values associated with CO_2 emissions reductions or on any widely accepted values that might be used in DOE's analyses.*

The Clean Air Act Amendments of 1990 set an emissions cap on SO_2 for power generation that would be affected by the amended standards.[31] The attainment of this target, however, is flexible among generators and is enforced through the use of emissions allowances and tradable permits. In other words, with or without a standard, total cumulative SO_2 emissions will always be at or near the ceiling, while there may be some timing differences among yearly forecasts. Thus, it is unlikely that there will be an SO_2 environmental benefit from standards as long as there is enforcement of the emissions ceilings. Although there may not be an actual reduction in SO_2 emissions from electricity savings, there still may be an economic benefit from reduced demand for SO_2 emission allowances. Electricity savings decrease the generation of SO_2 emissions from power production, which can decrease the need to purchase or generate SO_2 emissions allowance credits, and decrease the costs of complying with regulatory caps on emissions.

NO_x emissions from 28 eastern States and the District of Columbia (D.C.) are limited under the Clean Air Interstate Rule, published in the Federal Register on May 12, 2005. Although the rule has been remanded to EPA by the D.C. Circuit, it will remain in effect until it is replaced by a rule consistent with the Court's opinion in North Carolina v. EPA. Because all States covered by CAIR opted to reduce NO_x emissions through participation in cap-and-trade programs for electric generating units, emissions from these sources are capped across the CAIR region. As with the SO_2 emissions cap, energy conservation standards are not likely to have a physical effect on NO_x emissions in those States. However, the standards created by a final rule that may result from this framework document might produce an environmentally related economic impact in the form of lower prices for emissions allowance credits if they were large enough. DOE believes that such standards would not produce such an impact because the estimated reduction in NO_x emissions or the corresponding increase in available allowance credits in States covered by the CAIR cap would be too small to affect allowance prices for NO_x.

In contrast, new or amended energy conservation standards would reduce NO_x emissions in those 22 States that are not affected by the CAIR, and these emissions could be estimated from NEMS-BT. As a result, DOE will use NEMS-BT to forecast emission reductions from any standards that DOE ultimately proposes in a NOPR for the products covered by this framework document.

Item 15-2 *DOE seeks input from interested parties on how it should address NO_x emissions in this rulemaking consistent with the current CAIR requirements.*

Future emissions of Hg would have been subject to emission caps under the Clean Air Mercury Rule (CAMR).[32] The CAMR would have permanently capped emissions of Hg for new and existing coal-fired plants in all States by 2010, but was vacated by the D.C. Circuit in its February 8, 2008, decision in *New Jersey v. Environmental Protection Agency*.[33] As a result, DOE plans to use NEMS-BT to forecast Hg emission reductions from any standards that DOE

[31] Information available at www.epa.gov/air/caa.
[32] The EPA's Clean Air Mercury Rule was published on May 18, 2005. 70 FR 28606.
[33] *New Jersey v. EPA*, 517 F.3d 574 (D.C. Cir. 2008).

ultimately proposes in a NOPR for the products covered by this framework document.

Regarding mercury emissions from electric power generation, as it has done in the past, DOE will estimate the physical quantity of mercury emissions reductions associated with an energy conservation standard. For past rulemakings issued by DOE in 2008, it had assumed that these emissions would be subject to EPA's Clean Air Mercury Rule (CAMR),[34] which would have capped Hg emissions for new and existing coal-fired power plants in all States by 2010. As with SO_2 and NO_x emissions, a cap on Hg emissions would have been interpreted by DOE as having no physical effect on these emissions, but would instead be expected to result in an environmental-related economic benefit in the form of a lower price for emission allowance credits. However, as described above, on February 8, 2008, the D.C. Circuit court vacated the CAMR. Although DOE plans to use NEMS-BT to forecast Hg emission reductions, DOE will consider other approaches for addressing Hg emissions.

Item 15-3 *Because court actions have vacated the CAMR, DOE seeks input from interested parties on how it should address Hg emissions in this rulemaking.*

While NEMS-BT contains provisions for estimating emissions of NO_x and SO_2 from power generation, it does not estimate household emissions from gas and oil appliances (e.g., emissions directly from gas and oil water heaters used to heat water for clothes washers). Therefore, DOE plans to conduct an analysis that includes separate estimates of the effect of energy conservation standards on household NO_x and SO_2 emissions, based on simple emissions factors derived from the literature. Although small, household-SO_2 and NO_x emissions savings will be reported because the SO_2 and emissions caps and NO_x emission caps (in the States where CAIR is in effect) do not apply to the residential sector.

DOE will calculate the possible monetary benefit of CO_2, NO_x, and Hg reductions. Cumulative monetary benefits will be determined using discount rates of 3 and 7 percent. DOE will monetize reductions in CO_2 emissions due to the potential standards based on a range of monetary values drawn from studies that attempt to estimate the present value of the marginal economic benefits (based on the avoided marginal social costs of carbon) likely to result from reducing greenhouse gas emissions. The marginal social cost of carbon is an estimate of the monetary value to society of the environmental damages of CO_2 emissions.

There are markets for allowances that represent SO2 emissions from certain sources. The market clearing price of SO_2 emissions is roughly the marginal cost of meeting the regulatory cap, not the marginal value of the cap itself. Further, because SO_2 (for the nation) is regulated by a cap and trade system, the effect of the need to meet these caps is already included in the price of energy or energy savings. With a cap on SO_2, the value of energy savings already includes the value of SO_2 control for those consumers experiencing energy savings. The economic cost savings associated with SO_2 emissions caps is approximately equal to the change in the price of traded allowances resulting from energy savings multiplied by the number of allowances that

[34] The EPA's Clean Air Mercury Rule was published on May 18, 2005. 70 FR 28606.

would be issued each year. That calculation is uncertain because the energy savings for clothes washers would most likely be so small relative to the entire electricity generation market that the resulting emissions savings would have almost no impact on price formation in the allowances market and likely would be outweighed by uncertainties in the marginal costs of compliance with the SO_2 emissions caps.

In sum, the methodology for the environmental impact analysis will be similar to the methodology DOE used to estimate the environmental impacts published in EIA's *AEO*. These results include power sector emissions for SO_2, NO_x, Hg, and CO_2 in 5-year forecasted increments extrapolated to 2046. The outcome of the analysis for each trial standard level will be reported as a deviation from the *AEO* reference (base) case, with the analysis being conducted at the NOPR stage of the rulemaking. DOE will also estimate SO2 and NO_x emission impacts at the site where gas and oil water heaters are used to heat water for clothes washing.

Item 15-4 *DOE seeks input from interested parties on its plans to use NEMS-BT to conduct the environmental impact analysis on the equipment covered by this rulemaking. DOE is particularly interested in whether there are any other approaches to the environmental assessment that it should consider and the advantages and disadvantages of each of those approaches.*

Item 15-5 *Are there any other environmental factors DOE should consider in this rulemaking? If so, what are they and why should they be considered?*

16. REGULATORY IMPACT ANALYSIS

In the NOPR stage of this rulemaking, DOE will prepare a regulatory impact analysis that will address the potential for non-regulatory approaches to supplant or augment energy conservation standards to improve the efficiency of residential clothes washers on the market. DOE recognizes that voluntary or other non-regulatory efforts by manufacturers, utilities, and other interested parties can result in substantial efficiency improvements. DOE intends to analyze the likely effects of non-regulatory initiatives on product energy use, consumer utility, and LCCs. DOE will attempt to base its assessment on the actual impacts of any such initiatives to date, but also will consider information on the impacts that an existing initiative might have in the future.

If DOE proposes energy conservation standards for residential clothes washers and the NOPR constitutes a significant regulatory action, DOE would submit to OMB the assessment of costs and benefits required under section 6(a)(3) of Executive Order 12866, Regulatory Planning and Review, 58 FR 51735 (October 4, 1993).

APPENDIX A – DRAFT ENGINEERING ANALYSIS DATA REQUEST SHEETS

DOE seeks average **incremental production cost** to take basic models in the categories shown from the current DOE minimum efficiency level (or proposed baseline level) to the specified efficiency level. For those product classes where more than one basic model may exist, please indicate the minimum and maximum incremental costs that would be incurred across the array of basic models.

The data sheets are divided by product and contain tables requesting shipment and manufacturer cost data.

The shipment-weighted energy use data of Table A-2 should be based on the DOE clothes washer test procedure (10 CFR 430, subpart B, appendix J, J1).

Shipments

For residential clothes washers, the AHAM *2005 Fact Book* offers historical shipments data, but the information is not disaggregated by product class. As shown in the "shipment request" tables below, DOE hopes to collect both shipments data and shipment-weighted average efficiency data dating back to 1993. In addition, DOE hopes to collect market share efficiency (*i.e.*, data on the distribution of product shipments by efficiency) for each product class.

Manufacturer Costs

Incremental cost data (in U.S. dollars) include the materials, labor, and overhead needed to take basic models from the current minimum DOE baseline efficiency standard to each higher efficiency level. The depreciation of the conversion capital expenditures is an important component of the overhead for DOE to understand. Therefore, DOE is requesting information about conversion capital expenditures by efficiency level.

DOE requests notification from those interested parties planning to submit data by the close of the framework comment period, specifically October 16, 2009. DOE will not accept any data submitted after this date.

APPENDIX A - ENGINEERING ANALYSIS DATA REQUEST SHEETS

Aggregated industry data is requested for Table A-1 through Table A-5.

Table A-1 Residential Clothes Washer Shipments

Year	Shipments, Domestic + Imports (Thousands of Units)				
	Top Loading			Front Loading	Suds Saving
	Compact	Standard	Semi automatic		
1993					
1994					
1995					
1996					
1997					
1998					
1999					
2000					
2001					
2002					
2003					
2004					
2005					
2006					
2007					

Table A-2 Shipment-Weighted Average Efficiency Data

Year	Shipment Weighted Average Efficiency									
	Top Loading						Front Loading		Suds Saving	
	Compact		Standard		Semiautomatic					
	(MEF or EF)	(WF)	(MEF or EF)	(WF)	(MEF or EF)	(WF)	(MEF or EF)	(WF)	(MEF or EF)	(WF)
1993										
1994										
1995										
1996										
1997										
1998										
1999										
2000										
2001										
2002										
2003										
2004										
2005										
2006										
2007										

Table A-3 Market Share Efficiency Data: Top-Loading – Compact and Standard, and Front-Loading

Top Loading Compact			Top Loading Standard			Front Loading		
Efficiency Bins		Market Share for 2005 or 2006*	Efficiency Bins		Market Share for 2005 or 2006*	Efficiency Bins		Market Share for 2005 or 2006*
(MEF)	(WF)	(Percent)	(MEF)	(WF)	(Percent)	(MEF)	(WF)	(Percent)
0.65	18.40		1.26	9.50		1.72	8.00	
0.78	13.90		1.40	9.50		1.80	7.50	
			1.72	8.00		2.00	6.00	
			1.80	7.50		2.20	4.50	
			2.00	6.00		2.40	4.20	
			2.25	4.45		2.89	3.36	

* Total market share percentages should equal 100%.

Table A-4 Manufacturer Cost Data: Top-Loading – Compact and Standard

Product Class ➔	Top Loading Compact	Top Loading Standard				
Efficiency Level	1	1	2	3	4	5
MEF	0.78	1.40	1.72	1.80	2.00	2.25
WF	13.90	9.50	8.00	7.50	6.00	4.45
Average Incremental Costs ($ Per Unit)*						
Material						
Labor						
Overhead#						
Minimum Incremental Costs ($ Per Unit)*						
Material						
Labor						
Overhead#						
Maximum Incremental Costs ($ Per Unit)*						
Material						
Labor						
Overhead#						
Conversion Capital Expenditures ($, Millions)						
Building CAPX						
Tooling/ Equipment CAPX						
One Time Product Conversion Expenses ($, Millions)						
R&D						
Marketing						

Depreciation on the conversion capital expenditure should NOT be included in the incremental overhead.

***** Incremental costs per unit should be reported relative to the baseline unit's cost. The baseline unit complies with the federal standard for residential clothes washers and is equal to an MEF of 1.26 and WF of 9.50 for Top-Loading – Standard and an MEF of 0.65 for Top-Loading - Compact. The baseline WF of 18.40 for Top-Loading – Compact was selected based on a survey of clothes washers listed in the NRCan product database.

Other Information:

1. What depreciation method would your company use to depreciate the conversion capital expenditures? _____.

Direct material – Costs of raw materials including scrap that can be traced to final or end products. Direct material costs do not include indirect material costs which are attributed to supplies that may be used in the production process but are not assigned to final products (*e.g.*, lubricating oil for production machinery).
Direct labor – The earnings of workers who assemble parts into a finished good for operate machines in the production process. Direct labor includes the fringe benefits of direct laborers such as group health care, as well as overtime pay. Direct labor does not include indirect labor which is defined as the earnings of employees who do not work directly in assembling a product, such as supervisors, janitors, stockroom personnel, inspectors, and forklift operators.
Overhead – Factory overhead excluding depreciation. Factory overhead includes indirect labor, downtime, set-up costs, indirect material, expendable tools, maintenance, property taxes, insurance on assets, and utility costs. Factory overhead does not include selling, general, and administrative costs (SG&A); R&D; interest; or profit (accounted for by DOE separately).
Full Production Cost = Direct Material + Direct Labor + Overhead (factory) + Depreciation
Full Cost of Product = Full Production Cost + Non-production Costs (SG&A, R&D, interest, and profit)

Table A-5 Manufacturer Cost Data: Front-Loading

Product Class ➔	Front Loading				
Efficiency Level	1	2	3	4	5
MEF	1.80	2.00	2.20	2.40	2.89
WF	7.50	6.00	4.50	4.20	3.36
Average Incremental Costs ($ Per Unit)*					
Material					
Labor					
Overhead#					
Minimum Incremental Costs ($ Per Unit)*					
Material					
Labor					
Overhead#					
Maximum Incremental Costs ($ Per Unit)*					
Material					
Labor					
Overhead#					
Conversion Capital Expenditures ($, Millions)					
Building CAPX					
Tooling/ Equipment CAPX					
One Time Product Conversion Expenses ($, Millions)					
R&D					
Marketing					

Depreciation on the conversion capital expenditure should NOT be included in the incremental overhead.
***** Incremental costs per unit should be reported relative to the baseline unit's cost. The baseline unit complies with the current ENERGY STAR level for residential clothes washers and is equal to an MEF of 1.72 and WF of 8.00.

Other Information:

2. What depreciation method would your company use to depreciate the conversion capital expenditures?
   _____.

Direct material – Costs of raw materials including scrap that can be traced to final or end products. Direct material costs do not include indirect material costs which are attributed to supplies that may be used in the production process but are not assigned to final products (*e.g.*, lubricating oil for production machinery).
Direct labor – The earnings of workers who assemble parts into a finished good for operate machines in the production process. Direct labor includes the fringe benefits of direct laborers such as group health care, as well as overtime pay. Direct labor does not include indirect labor which is defined as the earnings of employees who do not work directly in assembling a product, such as supervisors, janitors, stockroom personnel, inspectors, and forklift operators.
Overhead – Factory overhead excluding depreciation. Factory overhead includes indirect labor, downtime, set-up costs, indirect material, expendable tools, maintenance, property taxes, insurance on assets, and utility costs. Factory overhead does not include selling, general, and administrative costs (SG&A); research and development (R&D); interest; or profit (accounted for by DOE separately).
Full Production Cost = Direct Material + Direct Labor + Overhead (factory) + Depreciation
Full Cost of Product = Full Production Cost + Non-production Costs (SG&A, R&D, interest, and profit)

APPENDIX B – SAMPLE QUESTIONS FOR ENGINEERING ANALYSIS FOLLOW-UP AND PRELIMINARY MANUFACTURER IMPACT ANALYSIS INTERVIEWS

DESIGN FOR ENERGY IMPROVEMENT INFORMATION REQUEST

DOE would like to confirm information on the incremental costs of increasing product efficiency by understanding the design options involved in the efficiency improvement.

1. Which design features impacting energy use are generally incorporated into a "baseline" clothes washer in the following product classes:

    a. Top-Loading, Compact-size?
    b. Top-Loading, Standard-size?
    c. Front-Loading?

2. Are you aware of any top-loading semiautomatic or suds-saving units on the market?

3. Which design changes are associated with converting a baseline top-loading standard-sized clothes washer (1.26 MEF, 9.50 WF) to the maximum available level (2.25 MEF, 4.45 WF)? Are these design changes comparable for top-loading compact-sized clothes washers? What are the costs of the individual design options selected? Are the aggregated industry costs representative of your firm's costs?

4. Which design changes are associated with converting a baseline front-loading standard-sized clothes washer (1.72 MEF, 8.00 WF) to the maximum available level (2.89 MEF, 3.36 WF)? Are these design changes comparable for other product classes? What are the costs of the individual design options selected? Are the aggregated industry costs representative of your firm's costs?

5. Do you believe that the gap-fill efficiency levels defined by DOE for top-loading compact-sized, top-loading standard-sized, and front-loading clothes washers are representative? If not, can you suggest appropriate gap-fill values? If you believe the top-loading semiautomatic and suds-saving clothes washer product classes should be analyzed, can you suggest baseline, gap-fill, and max-tech efficiency levels for those product classes?

6. Are there fundamental differences between required design changes that make the cost increment much higher for some product classes than others?

7. Would you help DOE understand and estimate the conversion capital investments that would be necessary at each candidate standard level? What is the nature of the capital investments?

PRELIMINARY MANUFACTURER IMPACT ANALYSIS TOPICS

1 Issues

1.1 What are the key issues for your company regarding a possible future product rulemaking?

2 Shipment Projections

2.1 What is your company's approximate market share in each of the product classes?
2.2 Would you expect your market share to change once standards become effective? Does your outlook change with higher efficiency levels?
2.3 How would you expect shipments to change for the industry as a whole as a function of standards and why?
2.4 Looking at price/cost effects only, how would you expect shipments to change for a 25%, 50%, 100%, or 200% manufacturer price/cost increase?

3 Conversion Costs

3.1 What level of capital expenditure and product conversion costs would you anticipate to make at higher standard levels? Please describe what they are and provide your best estimate of their respective magnitudes.
3.2 How would the imposition of new energy conservation standards affect capacity utilization and manufacturing assets at your domestic production facilities? Would a new standard result in stranded capital assets? Would any facilities be closed or downsized? Added or upgraded?
3.3 How might a new standard impact product innovation?

4 Product Mix and Profitability

4.1 How would your company's product mix and marketing strategy change with changes in the efficiency standard?
4.2 Would the current percentage of shipments at the ENERGY STAR level for residential clothes washers be the same under a new standard?
4.3 What distribution channels are used from the manufacturer to the retail outlet? What is the share of product going through each distribution channel?
4.4 Generally how would new product standards impact your customer mix, distribution channels, and corresponding profit margins?
4.5 For residential clothes washers, how might a new standard impact the ENERGY STAR program, and consequently your firm?
4.6 What is the approximate percentage of shipments (*i.e.*, market share) for each product, or more specifically, for each product class?

5 Market Shares and Industry Consolidation

5.1 In the absence of new standards, do you expect any industry consolidation?

5.2 How would new standards affect your ability to compete?
5.3 Could new standards disproportionately advance or harm the competitive positions of some firms?
5.4 Are there concerns over intellectual property?
5.5 Could new standards result in disproportionate economic or performance penalties for particular consumer/user subgroups?
5.6 Beyond price and energy efficiency, could new standards result in products that will be more or less desirable to consumers due to changes in product functionality, utility, or other features?

6 Cumulative Regulatory Burden

6.1 Are there recent or impending regulations on your specific product or other products that impose a cumulative burden on the industry?
6.2 If so, what is the total expected impact of those other regulations?

APPENDIX C – SUMMARY OF ITEMS FOR COMMENT FROM INTERESTED PARTIES

DOE requests comments from interested parties on the following issues: