# Rulemaking Framework for Commercial Clothes Washers and Residential Dishwashers, Dehumidifiers, and Cooking Products

**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 |
| ANSI | American National Standards Institute |
| AWWA | American Water Works Association |
| BT | Building Technologies Program |
| CBECS | Commercial Building Energy Consumption Survey |
| CEC | California Energy Commission |
| CEE | Consortium for Energy Efficiency |
| CFC | chlorofluorocarbon |
| CFR | Code of Federal Regulations |
| CLA | Coin Laundry Association |
| $CO_2$ | carbon dioxide |
| CSA | Canadian Standards Association |
| CSL | candidate standard level |
| cu. ft. | cubic foot |
| 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 |
| E.O. | Executive Order |
| EPACT | Energy Policy Act of 2005 |
| EPA | U.S. Environmental Protection Agency |
| EPCA | Energy Policy and Conservation Act |
| FEMP | Federal Energy Management Program |
| FR | final rule |
| GRIM | Government Regulatory Impact Model |
| HCFC | hydrochlorofluorocarbon |
| HFC | hydrofluorocarbon |
| IEC | International Electrotechnical Commission |
| ImSET | Impact of Sector Energy Technologies |
| kWh | kilowatt-hour |
| LCC | life-cycle cost |
| MEF | modified energy factor |
| MIA | manufacturer impact analysis |
| MLA | Multi-Housing Laundry Association |
| NAECA | National Appliance Energy Conservation Act of 1987 |
| NECPA | National Energy Conservation Policy Act of 1978 |
| NEMS | National Energy Modeling System |
| NES | national energy savings |
| NOPR | notice of proposed rulemaking |
| $NO_x$ | oxides of nitrogen |
| NPV | net present value |

| | |
|---|---|
| OIRA | Office of Information and Regulatory Affairs |
| R&D | research and development |
| RECS | Residential Energy Consumption Survey |
| RIA | regulatory impact analysis |
| SG&A | selling, general, and administrative costs |
| $SO_2$ | sulfur dioxide |
| TSD | technical support document |
| TSL | trial standard level |
| U.S. | United States |
| WACC | weighted-average cost of capital |
| WF | water factor |

# Rulemaking Framework for Commercial Clothes Washers and Residential Dishwashers, Dehumidifiers, and Cooking Products

## 1. INTRODUCTION

The purpose of this document is to describe the procedural and analytical approaches the U.S. Department of Energy (the Department or DOE) anticipates using to evaluate energy conservation standards for commercial clothes washers and residential dishwashers, dehumidifiers, and cooking products. The rulemaking also will consider amendments to the water factor requirements for commercial clothes washers. Cooking products include cooktops and ovens (electric and gas) and microwave ovens.

The DOE Appliances and Commercial Equipment Standards Program, of the Office of Energy Efficiency and Renewable Energy's (EERE's) 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, collectively referred to as stakeholders, include manufacturers, consumers, energy conservation and environmental advocates, State and Federal agencies, and any other groups or individuals with an interest in the standards and test procedures.

This document is intended to inform stakeholders of the process of the standards rulemaking for commercial clothes washers and residential dishwashers, dehumidifiers, and cooking products and to encourage and facilitate stakeholder input during the rulemaking. This document is the starting point for developing standards and is not a definitive statement with respect to any issue to be determined in the rulemaking.

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. Although DOE is bundling the above four products into a single rulemaking, it will conduct separate analyses for each product to determine whether amended energy conservation standards are technologically feasible and economically justified. In other words, for each of the four products examined in this rulemaking, the Department will perform a set of separate analyses, including an engineering analysis, a life-cycle cost and payback period analysis, a national impact analysis, and a manufacturer impact analysis.

Information regarding this rulemaking will be maintained on the DOE website at:

http://www.eere.energy.gov/buildings/appliance_standards/

*This document contains comment boxes that highlight issues on which DOE seeks comment and requests feedback from interested parties. In addition, these comment boxes are used to ask specific questions on the approaches the Department is proposing to follow to conduct the analyses required for the standards rulemaking. Such requests for stakeholder feedback are numbered according to the section in which they appear.*

## 1.1 The 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. The National Energy Conservation Policy Act of 1978 (NECPA) amended EPCA to add Part C of Title III (42 U.S.C. 6311-6317), which established an energy conservation program for certain industrial equipment. Additional amendments to EPCA have given DOE the authority to regulate the energy efficiency of several products, including commercial clothes washers and residential dishwashers, dehumidifiers, and cooking products—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 dishwashers and cooking products, as well as requirements for determining whether these standards should be amended. (42 U.S.C. 6291-6309) The amendments to EPCA in the Energy Policy Act of 2005 (EPACT 2005), P.L. 109-58, included amendments that expanded DOE's energy conservation program to include certain commercial equipment and residential products, including dehumidifiers and commercial clothes washers.

The Department published draft data sheets containing energy savings potentials in 2005 as part of the 2006 schedule-setting process. However, the calculations for commercial clothes washers and residential dishwashers, dehumidifiers, and cooking products were completed in previous years. Therefore, the following sections cite the appropriate fiscal year's priority-setting activities from which the Department completed the energy savings calculations for each product.

NAECA established prescriptive standards for **dishwashers**, requiring that they be equipped with an option to dry without heat and further required that DOE conduct two cycles of rulemakings to determine if more stringent standards are justified.[1] (42 U.S.C. 6295 (g)(1), (4) and (5)) On May 14, 1991, DOE issued a final rule establishing the first set of performance standards for dishwashers; the new standards became effective on May 14, 1994. 56 FR 22250. The Department initiated a second standards rulemaking for dishwashers by issuing an advance notice of proposed rulemaking (ANOPR) on November 14, 1994. 59 FR 56423. As a result of the priority-setting process outlined in the July 15, 1996, *Procedures for Consideration of New or Revised Energy Conservation Standards for Consumer Products* (the "Process Rule"), 61 FR 36974, 10 CFR Part 430, Subpart C, Appendix A, DOE suspended the standards rulemaking for dishwashers. The Department's priority-setting activities for fiscal year 2005 included an updated analysis of amended standards for dishwashers that established an energy savings

[1] The Department defines "dishwasher" under EPCA as "a cabinet-like appliance which with the aid of water and detergent, washes, rinses, and dries (when a drying process is included) dishware, glassware, eating utensils, and most cooking utensils by chemical, mechanical and/or electrical means and discharges to the plumbing drainage system." 10 CFR 430.2.

potential ranging from 0.5 to 2.2 quadrillion British thermal units (quads). However, the high potential estimate of 2.2 quads is based on dishwasher technology that may not reflect field-representative testing requirements that recently have been added to the updated version of the DOE test procedure.

As with dishwashers, NAECA established prescriptive standards for gas **cooking products**, requiring gas ranges and ovens with an electrical supply cord not to be equipped with constant burning pilots and directed DOE to conduct two cycles of rulemakings to determine if more stringent standards are justified.[2,3] (42 U.S.C. 6295 (h)(1)-(2)) The Department initially analyzed standards for cooking products as part of an eight-product standards rulemaking. It issued a notice of proposed rulemaking (NOPR) on March 4, 1994, proposing performance standards for gas and electric residential cooking products, including microwave ovens. 59 FR 10464. In accordance with its 1996 Process Rule, DOE refined its standards analysis of cooking products. With regard to gas cooking products, DOE focused on the economic justification for eliminating standing pilots. Partially due to the difficulty of conclusively demonstrating that elimination of standing pilots was economically justified, DOE issued a final rule on September 8, 1998, that covered only electric cooking products, including microwave ovens. 63 FR 48038. The final rule found that no standards were justified for electric cooking products. (Id.) The Department never completed its standards rulemaking for gas cooking products. Its priority-setting activities for fiscal year 2005 included an updated analysis of amended standards for cooking products that established an energy savings potential of 0.4 to 0.7 quad for gas cooking products, 1.7 quads for electric cooking products (excluding microwave ovens), and 0.3 quad for microwave ovens.

**Commercial clothes washers** and **dehumidifiers** are new products covered by EPACT 2005. **Commercial clothes washers** are defined in EPACT 2005 as soft-mount, front-loading or soft-mount, top-loading washers that have a clothes container compartment that is not more than 3.5 cubic feet for horizontal-axis clothes washers and not more than 4.0 cubic feet for vertical-axis clothes washers. EPACT 2005 also defines commercial clothes washers as products designed for applications in which the occupants of more than one household will be using the clothes washer, such as multi-family housing common areas, coin laundries, or other commercial applications. (EPACT 2005, section 136(a)(4)) EPACT 2005 established standards for commercial clothes washers that will become effective on January 1, 2007. (Section 136(e)) EPACT 2005 also requires that DOE issue a final rule by January 1, 2010 to determine whether these standards should be amended. (Id.) As part of its priority-setting activities for fiscal year 2003, DOE conducted analyses for commercial clothes washers to estimate the energy savings potential of amended standards. The Department determined an energy savings potential for commercial clothes washers ranging from 0.3 to 0.5 quad; however, the savings were based on an assumed baseline efficiency that is lower than that legislated by EPACT 2005. Thus, the maximum energy savings potential is likely closer to 0.2 quad.

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[2] The Department defines "cooking products" under EPCA as "consumer products that are used as the major household cooking appliances. They are designed to cook or heat different types of food by one or more of the following sources of heat: gas, electricity, or microwave energy. Each product may consist of a horizontal cooking top containing one or more surface units and/or one or more heating compartments. They must be one of the following classes: conventional ranges, conventional cooking tops, conventional ovens, microwave ovens, microwave/conventional ranges and other cooking products." 10 CFR 430.2.

[3] DOE is required to conduct two cycles of rulemakings for both gas and electric cooking products.

In EPACT 2005, **dehumidifiers** are defined as self-contained, electrically operated, and mechanically encased assemblies consisting of: (1) a refrigerated surface (evaporator) that condenses moisture from the atmosphere; (2) a refrigerating system, including an electric motor; (3) an air-circulating fan; and (4) a means for collecting or disposing of the condensate. (EPACT 2005, section 135(a)) EPACT 2005 established standards for dehumidifiers that will become effective on October 1, 2007. (Section 135(c)(4)) EPACT 2005 also requires that DOE issue a final rule by October 1, 2009, to determine whether these standards should be amended. (Id.) If amended standards are justified, EPACT 2005 requires them to become effective by October 1, 2012. (Id.) In the event that DOE fails to publish a final rule, EPACT 2005 specifies a new set of amended standards with an effective date of October 1, 2012. (Id.) As part of its priority-setting activities for fiscal year 2003, DOE conducted analyses for dehumidifiers to estimate the energy savings potential of amended standards. The Department estimated an energy savings potential range of 0.2 to 0.5 quad; however, the savings were based on an assumed baseline efficiency that is lower than that legislated by EPACT 2005.

## 1.2 Overview of the Rulemaking Process

### 1.2.1 Test Procedures

The Department has established test procedures for dishwashers, cooking products, and commercial clothes washers. In 2003, DOE revised its test procedures for **dishwashers** and **cooking products** to more accurately establish their efficiency and energy use (and water use for dishwashers). The 2003 test procedure amendments included the following revisions to the DOE test procedure for dishwashers: (1) addition of a method to rate the efficiency of soil-sensing products; (2) addition of a method to measure standby power; and (3) a reduction in the average-use cycles per year. (68 FR 51887, August 29, 2003). For DOE's cooking products test procedure, the Department published the revisions as a final rule in 1997; these included: (1) a reduction in the annual useful cooking energy; (2) a reduction in the number of self-cleaning oven cycles per year; and (3) incorporation of portions of the International Electrotechnical Commission (IEC) Standard 705 for the testing of microwave ovens. (62 FR 51976, October 3, 1997). The Department does not expect to make further changes to them.

Based on language in EPACT 2005, DOE is required to rate **commercial clothes washers** with the same test procedure established for residential clothes washers. (EPACT 2005, section 136(f)) DOE adopted test procedures for commercial clothes washers in a final rule published on October 18, 2005. 70 FR 60407, 60416. EPACT 2005 also specifies that the U.S. Environmental Protection Agency (EPA)'s test criteria used under the ENERGY STAR Program must serve as the basis for the test procedure for **dehumidifiers**. (Section 135(b)) The ENERGY STAR test criteria require that American National Standards Institute (ANSI)/Association of Home Appliance Manufacturers (AHAM) Standard DH-1 be used to measure energy use while Canada's CAN/Canadian Standards Association (CSA)-C749-94 be used to calculate the energy factor. The Department is currently working to codify the test procedure requirements from EPACT 2005 for dehumidifiers in the Code of Federal Regulations (CFR).

### 1.2.2 Rulemaking Process and Stakeholder Participation

Under EPCA, when DOE is studying new or amended standards, it must consider, to the greatest extent practicable: (1) the economic impact of the standard on the manufacturers and consumers of the affected products; (2) the savings in operating costs throughout the estimated average life of the product compared to any increases in the initial cost, or maintenance expense; (3) the total projected amount of energy savings likely to result directly from the imposition of the standard; (4) any lessening of the utility or the performance of the 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 conservation; and (7) other factors the Secretary considers relevant. (42 U.S.C. 6295 (o)(2)(B)(i) and 42 U.S.C. 6316(a)) Other statutory requirements are set forth in 42 U.S.C. 6295 (o)(1)-(2)(A), (2)(B)(ii)-(iii), and (3)-(4); 42 U.S.C. 6316(a).

The Department considers stakeholder participation to be a very important part of the process for setting energy conservation standards. The Department actively encourages the participation and interaction of all stakeholders during the comment period of each rulemaking stage. Beginning with the Framework Document and during subsequent comment periods, interactions among stakeholders provide a balanced discussion of critical information required to conduct the standards rulemaking.

In conducting the test procedure rulemakings and the energy conservation standards rulemakings, DOE involves stakeholders through formal public notifications (i.e., Federal Register notices). For this commercial clothes washer and residential dishwasher, dehumidifier, and cooking product energy conservation standards rulemaking, the Department will employ the procedures set forth in the Process Rule, to the extent they are appropriate for the development of energy conservation standards for these products.

The standards rulemaking process involves three formal, major public notices, which are published in the Federal Register. The first of the rulemaking notices is an advance notice of proposed rulemaking (ANOPR, see section 1.3). The ANOPR is designed to publicly vet the models and tools used in the rulemaking, and to facilitate public participation before the proposed rule stage. The second notice is a notice of proposed rulemaking (NOPR, see section 1.4), which presents a discussion of comments received in response to the ANOPR; the analysis of the impacts of standards on consumers, manufacturers and the nation; the Department's weighting of the impacts; and the proposed standards. The third notice is the final rule (see section 1.5), which presents a discussion of comments received in response to the NOPR; the revised analysis of the impacts of standards; the Department's weighting of the impacts; the standards adopted by DOE; and the effective dates of the standards.

## 1.3 Advance Notice of Proposed Rulemaking

As part of its initial rulemaking activities, the Department typically identifies the product design options or efficiency levels that it will analyze in detail and those it should eliminate from further consideration. This process includes a market and technology assessment (see section 3) and a screening analysis (see section 4). These activities include consultations with stakeholders and

independent technical experts who can assist with identifying the key issues and design options or efficiency levels to be considered by the Department in the rulemaking.

At the start of the ANOPR analysis, the Department considers efficiency levels for each product class. The Department uses these efficiency levels to collect manufacturer cost data, historical shipment data, shipment-weighted average efficiency data, and preliminary manufacturer impact data (e.g., capital conversion expenditures, marketing costs, research and development costs). During the ANOPR stage, DOE presents consumer life-cycle cost (LCC) impact and payback period results (see section 8); national energy savings (NES) and consumer net present value (NPV) results (see section 10) for a range of efficiency or energy use levels; and will also present a preliminary manufacturer impact analysis (see section 12).

The Department's selection of efficiency or energy use levels to analyze is based on the costs and benefits of efficiency levels or design options. In addition to the efficiency corresponding to the maximum technologically feasible ("max tech") design and the efficiency corresponding to the minimum life-cycle-cost point, DOE generally selects levels or design options for consideration that span the full range of technologically achievable efficiencies.

The range of levels analyzed typically includes:

- The highest energy efficiency level or lowest energy consumption level that is technologically feasible (the "max-tech" level);
- The level with the lowest LCC; and
- Levels that incorporate noteworthy technologies or fill in large gaps between efficiency levels of other levels considered.

The efficiency or energy use levels analyzed serve to demonstrate the models' and tools' functions and outputs. During the ANOPR, models and tools are tested for the different product classes at each efficiency or energy use level analyzed. In addition, preliminary ANOPR results may facilitate negotiations among interested parties.

The Department will make the results of the analyses available on its website for review and will consider comments on them after publication of the ANOPR. When the Department publishes the ANOPR, the Department will also make available a technical support document (TSD) containing the details of all the analyses performed to date.

### 1.4 Notice of Proposed Rulemaking

After the publication of the ANOPR, there is a 75-day public comment period and one public meeting. At this point the Department encourages stakeholders to develop joint recommendations for standard levels.

After the ANOPR, DOE will conduct further economic impact analyses. These analyses may include refinements of previous analyses, and will include a consumer LCC sub-group analysis (see section 11), a complete manufacturer impact analysis (see section 12), a utility impact analysis (see section 13), an employment impact analysis (see section 14), an environmental assessment (see section 15), and a regulatory impact analysis (see section 16).

The Department will make the results of all the analyses available on its website for review and will consider comments after the publication of the NOPR. This review and comment process may result in revisions to the analyses. This analytical process ends with the selection of proposed standard levels that will be presented in the NOPR. The Department selects the proposed standard levels from the trial standard levels (TSLs) analyzed. The NOPR, published in the Federal Register, will document the evaluation and selection of any proposed standards.

For each product class, the Department will identify the maximum improvement in energy efficiency or maximum reduction in energy use that is technologically feasible. If the Department proposes a level that is below the maximum technology, it will sequentially explain the reasons for eliminating higher levels beginning with the highest level considered. The Department will present the analysis results in the NOPR and the analysis details in an accompanying TSD.

The Department considers many factors in selecting proposed standards. These factors or criteria are established by statute and capture the many benefits, costs, and impacts of the standards. Additionally, the Department encourages stakeholders to develop joint recommendations for standard levels. The Department will carefully consider such recommendations in its decision process.

When the Department publishes the NOPR, it will provide the Department of Justice (DOJ) with a copy of the NOPR and TSD and will solicit feedback on the impact of the proposed standard level on competition. DOJ will review these standard levels in light of any lessening of competition that is likely to result from the imposition of standards. The Department 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 75-day public comment period that includes one public meeting.

### 1.5 Final Rule

Revisions to the analyses may result from the public comments on the NOPR. On the basis of the public comments, DOE will review the engineering and economic impact analyses and proposed standards and make modifications as necessary.

After the publication of the NOPR, the Department will conduct a thorough review of all analyses performed, and of the TSLs. Final revisions to the analyses and trial standard levels will be made as appropriate.

Before the final rule is issued, the Department will consider DOJ comments on the NOPR relating to the impacts of the proposed standard levels on competition to determine whether changes to these standard levels are needed.

The standards rulemaking will conclude with the publication of the final rule. The Department 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 explain the basis for their selection. The final rule will be accompanied by a final TSD.

## 2. ANALYSES FOR RULEMAKING

Ultimately, the Department intends to select energy conservation standards that achieve the maximum improvement in energy efficiency that is technologically feasible and economically justified. The selection of such standards is expected to achieve the maximum energy savings that are economically justified without putting an unjust financial burden on any particular party. Economic justification includes consideration of the economic impacts on domestic manufacturers and consumers, national benefits including environmental impacts, issues of consumer utility, and impacts from any lessening of competition. The purpose of the analyses conducted in support of the standards rulemaking will be to insure that the final standards meet these criteria of technological feasibility and economic justification.

This section offers an overview of DOE's analytical methodology and discusses the major components of the analyses DOE will conduct. A consistent approach to analysis throughout the rulemaking will be ensured through the consideration of each analysis as a part of the overall standards-setting framework.

Figure 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, which are data and information required for the analysis. "Approaches" are the methods that will be used to obtain key inputs. For example, some key inputs exist in public databases, some will be collected from stakeholders or others with special knowledge, and some will be developed by the project team in support of the rulemaking. The results of each analysis are key outputs, which feed directly into the rulemaking. Dotted lines connecting one analysis to another indicate the flow of information.

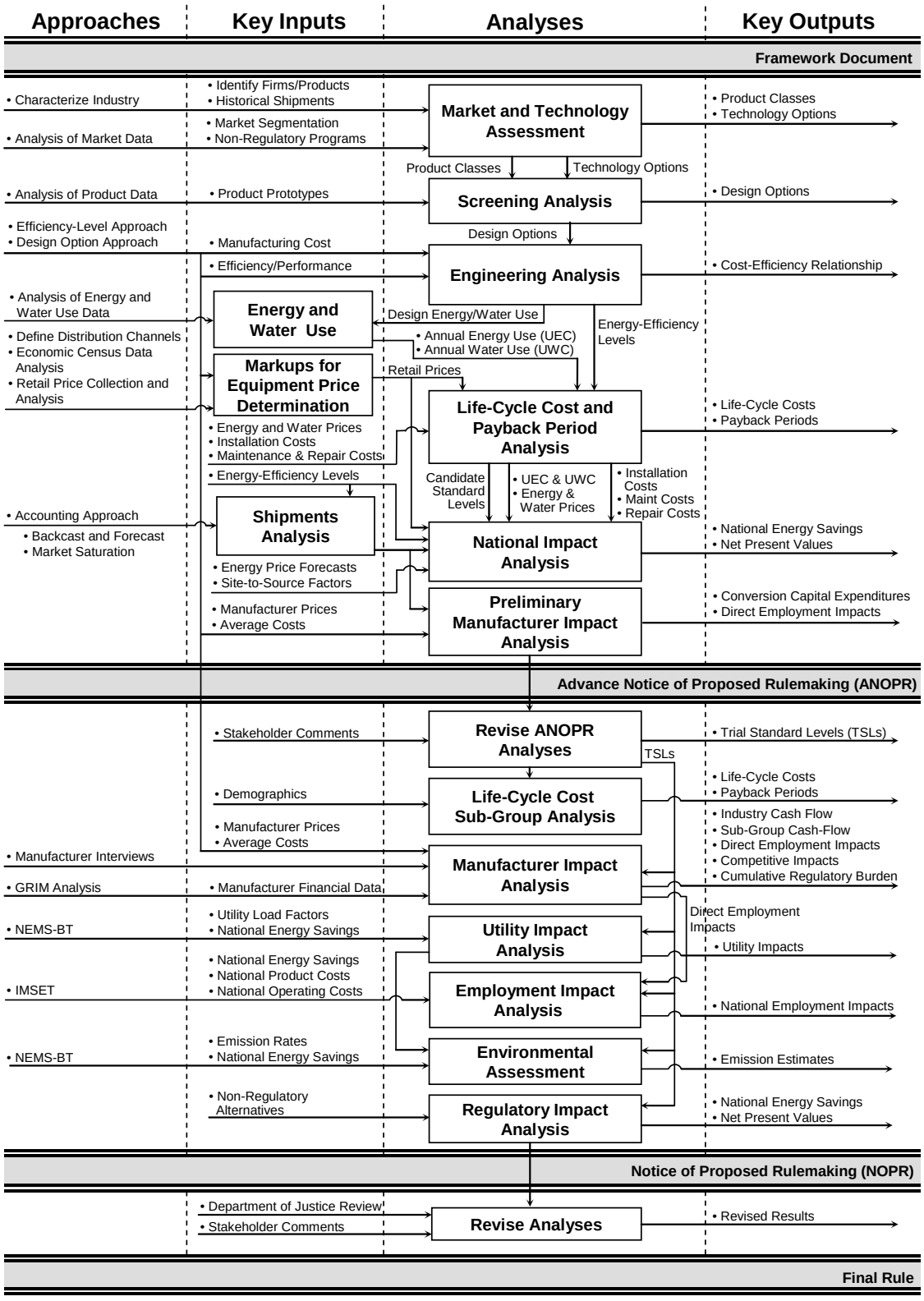


**Figure 1. Flow Diagram of Analyses for the Commercial Clothes Washer and Residential Dishwasher, Dehumidifier, and Cooking Energy Conservation Standards Rulemaking Process**

## 3. MARKET AND TECHNOLOGY ASSESSMENT

The market and technology assessment will provide information about the commercial clothes washer, residential dishwasher, dehumidifier, and cooking product industries that DOE will use 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

The Department will qualitatively and quantitatively characterize the structure of the commercial clothes washer, residential dishwasher, dehumidifier, and cooking product industries and markets. In the market assessment, the Department will identify and characterize the manufacturers of this equipment; estimate market shares and trends in the market; 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 equipment.

As stated above, the collected information will serve as a resource for use throughout the rulemaking. For example, the Department will use historical equipment shipments and prices as an aid in creating shipment scenarios and predicting future prices. Market structure data will be particularly useful for assessing competitive impacts as part of the manufacturer impact analysis.

***Item 3-1*** *The Department requests information that would contribute to the market assessment (e.g., current product features and efficiencies, product-feature and efficiency trends, historical product shipments and prices).*

### 3.2 Product Classes

The Department intends to separate each product (commercial clothes washers, residential dishwashers, dehumidifiers, and cooking products) into product classes. Because the Department will formulate a separate energy conservation standard for each product class, the criteria for separation into different classes are: type of energy used, capacity or 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) and 6316(a))

For **commercial clothes washers**, DOE is proposing one product class, in accordance with EPACT 2005, that encompasses both top- and front-loading units.

For **dishwashers**, the size of the unit significantly impacts the energy consumed. In other words, standard-sized dishwashers have significantly higher energy use than compact units. Because standard dishwashers offer enhanced consumer utility over compact units (i.e., the ability to wash more dishes), the Department is proposing to establish the following product classes, which are based on the size of the dishwasher (as specified in ANSI/AHAM Standard DW-1):

- Compact, capacity less than eight place settings plus six serving pieces; and
- Standard, capacity equal to or greater than eight place settings plus six serving pieces.

For **dehumidifiers**, EPACT 2005 establishes product classes based on the capacity of the unit as measured in pints of water extracted per day. (EPACT 2005, section 135(c)) The Department presumes that there are unique design constraints associated with a unit's capacity that warrant the creation of these separate classes. As part of the standards rulemaking analysis, the Department will conduct an investigation as to whether all the product classes established by EPACT 2005 are warranted. Until then, the Department is proposing the following product classes as they are established by EPACT 2005:[4]

- 25.00 pints/day or less;
- 25.01–35.00 pints/day;
- 35.01–45.00 pints/day;
- 45.01–54.00 pints/day;
- 54.01–74.99 pints/day; and
- 75.00 pints/day or more.

For **cooking products**, the proposed product classes are based on energy source (i.e., gas or electric) and the type of cooking (i.e., cooktops, ovens, and microwave ovens). There are five cooking product classes: gas cooktops, electric cooktops, gas ovens, electric ovens, and microwave ovens. The Department's proposed product classes are based on the list of classes defined by DOE in its 1996 TSD for residential cooking products. (http://www.eere.energy.gov/buildings/appliance_standards/residential/cooking_products.html) Gas and electric ranges[5] are not listed below as product classes. Because ranges consist of both a cooktop and oven, any potential cooktop and oven standards would apply to the individual components of the range. As a result, product classes for ranges are not necessary.

For **gas cooktops**, DOE's proposed product class is:

- Conventional burners.

For **electric cooktops**, DOE's 1996 TSD determined that the ease of cleaning smooth elements provides enhanced consumer utility over coil elements. Because smooth elements typically use more energy than coil elements, DOE is proposing the following product classes for electric cooktops:

[4] For standards effective October 1, 2007, EPACT 2005, in section 135(c), names five product classes for dehumidifiers: 25.00 pints/day or less, 25.01-35.00 pints/day, 35.01-54.00 pints/day, 54.01-74.99 pints/day, and 75.00 pints/day or more. EPACT 2005 also prescribes a new set of amended standards for dehumidifiers in the event that DOE fails to publish a final rule requiring new standards to take effect by October 1, 2012. In providing a new set of standards, EPACT 2005, in section 135(c), subdivides the 35.01-54.00 pints/day product class into two product classes: 35.01-45.00 pints/day and 45.01-54.00 pints/day.

[5] The Department defines a "conventional range" under EPCA as "a class of kitchen ranges and ovens which is a household cooking appliance consisting of a conventional cooking top and one or more conventional ovens." 10 CFR 430.2.

- Low or high wattage open (coil) elements; and
- Smooth elements.

For **electric ovens**, DOE's 1996 TSD determined that the type of oven-cleaning system is a utility feature that affects performance. The Department found that standard ovens and ovens using a catalytic continuous-cleaning process use roughly the same amount of energy. On the other hand, self-cleaning ovens use a pyrolytic process that provides enhanced consumer utility with lower overall energy consumption as compared to either standard or catalytically lined ovens. Thus, DOE is proposing the following product classes for electric ovens:

- Standard oven with or without a catalytic line; and
- Self-clean oven.

For **gas ovens**, for the same reasons as for electric ovens, DOE is proposing the following product classes:

- Standard oven with or without a catalytic line; and
- Self-clean oven.

For **microwave ovens**, DOE proposes no further class breakdown.

***Item 3-2*** *The Department requests input from stakeholders on the proposed classes and criteria used for creating these product classes. Specifically, should additional or fewer criteria beyond those identified above be used as a basis for developing product classes?*

### 3.3 Technology Assessment

The Department typically uses information about existing and past technology options and prototype designs as input in identifying technologies manufacturers could use to attain higher energy efficiency levels. In consultation with interested parties, the Department intends to develop a list of technologies that can and should be considered in the analysis. Initially, this list will include all those technologies considered to be technologically feasible and will serve to establish the maximum technologically feasible design. In the screening analysis, DOE will eliminate from consideration technologies that are not incorporated in commercial products or in working prototypes, or that fail to meet certain criteria as to practicability to manufacture, install and service, as to impacts on product utility or availability, or as to health or safety. Process Rule, section 4(a)(4) and 5(b).

For **commercial clothes washers**, DOE will consider technologies taken from its most recent analysis of amended energy conservation standards for residential clothes washers as well as from information provided in recent trade publications. With the exception of steam washing and improved horizontal-axis-washer drum design, the following technologies are taken from a 1996 report prepared for DOE entitled *Design Options for Clothes Washers*. (LBNL-47888, October 1996, Lawrence Berkeley National Laboratory) Steam washing and improved horizontal-axis-washer drum design were identified in the September 2005 edition of *Appliance Magazine*. 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) and suds savings.

- Added insulation
- Adaptive control systems
- Automatic fill control
- Direct-drive motor
- Horizontal-axis design
- Horizontal-axis design with recirculation
- Improved-fill control
- Improved water extraction to lower remaining moisture content
- Increased motor efficiency
- Thermostatically controlled mixing valves
- Tighter tub tolerance
- Bubble action
- Electric disassociation of water
- Ozonated laundering
- Reduced thermal mass
- Suds savings
- Ultrasonic washing
- Steam washing
- Improved horizontal-axis-washer drum design

As described in the 1996 report on *Design Options for Clothes Washers*, DOE at that time eliminated the following technologies from further analysis: bubble action; electric disassociation of water; ozonated laundering; reduced thermal mass; suds savings; and ultrasonic washing. The Department will re-examine whether the basis for eliminating these technologies from further consideration is still valid.

For **dishwashers**, DOE will consider technologies identified in the following three sources: the Department's ANOPR published on November 14, 1994, 59 FR 56423; recent information provided by trade publications; and design data identified in manufacturer product offerings. With the exception of the last four technologies (variable washing pressures and flow rates, variable-speed drive system, condenser drying and fan/jet drying), the following technologies are taken from the ANOPR. The variable washing pressure and variable-speed drive technologies are identified in the February 2006 edition of *Appliance Magazine*. Condenser and fan/jet drying are technologies listed in one manufacturer's product offerings. The current DOE test procedure can measure the possible energy savings of all of the design options below, although the ability to use reduced inlet water temperature is likely not practical. Reducing the inlet water temperature requires a separate cold water line to be connected to the dishwasher. Because dishwashers in the U.S. are connected only to a hot water line, the institutional barrier to bringing both hot and cold water lines to dishwashing units is probably too high to make this option a practical technology.

- Improved food filter
- Improved spray-arm geometry

- Improved fill control
- Modified sump geometry, with and without dual pumps
- Microprocessor controls and fuzzy logic, including adaptive or soil-sensing controls
- Reduced inlet-water temperature
- Improved motor efficiency
- Increased insulation
- Flow-through heating
- Ultrasonic washing
- Variable washing pressures and flow rates
- Variable-speed drive system
- Condenser drying
- Fan/jet drying

The Department has not conducted a comprehensive analysis of energy conservation standards for **dehumidifiers**. Thus, reports or analyses identifying technologies for improving product efficiency are not readily available to the Department. Although DOE does not have a list of technologies to refer to, the following designs are commonly used to improve dehumidifier performance.

- Improved compressor efficiency
- Improved fan-motor efficiency
- Improved fan efficiency
- Improved evaporator performance
- Improved condenser performance
- Improved flow-control devices
- Improved demand-defrost controls
- Heat-pipe technology

The Department most recently analyzed energy conservation standards for **cooking products** in 1996 and 1997. In the 1997 analysis, DOE analyzed only gas cooking products to determine the technical and economic feasibility of eliminating standing pilots. The Department's prior analysis in 1996, entitled *Technical Support Document for Residential Cooking Products,* identified several technologies for improving gas and electric cooking efficiency.

For **gas cooktops**, DOE considered the technologies listed below. The 1996 TSD found that reduced excess air, reflective surfaces, and insulation yield very low energy savings. With regard to thermostatically controlled burners, the current DOE test procedure cannot measure their possible energy savings.

- Reduce excess air at burner
- Electronic ignition
- Sealed burners
- Reflective surfaces
- Insulation
- Thermostatically controlled burners
- Catalytic burners

- Radiant gas burners

For **open (coil) element electric cooktops**, DOE considered the technologies listed below. The 1996 TSD found that reflective surfaces and insulation yield very low energy savings. With regard to electronic controls, the current DOE test procedure cannot measure their possible energy savings.

- Improved contact conductance
- Reflective surfaces
- Insulation
- Electronic controls

For **smooth element electric cooktops**, DOE considered the technologies listed below. The current DOE test procedure cannot measure the possible energy savings from either induction elements or electronic controls.

- Induction elements
- Halogen elements
- Radiant elements
- Electronic controls

For **gas and electric ovens**, DOE considered the technologies listed below. The current DOE test procedure can measure the possible energy savings of all of the design options below, although the 1996 TSD did not consider the use of reflective surfaces or halogen lamps, since neither provided appreciable energy savings. In addition, the 1996 TSD dropped from consideration the elimination of the oven-door window due to the potential impact on consumer utility.

- No oven-door window
- Improved insulation
- Added insulation
- Reduced vent rate
- Reduced conduction losses
- Reflective surfaces
- Forced convection
- Oven separator
- Improved door seals
- Steam cooking
- Bi-Radiant oven (electric only)
- Halogen lamp oven (electric only)
- Pilotless ignition (gas only)
- Radiant burner (gas only)

For **microwave ovens**, in the 1996 TSD DOE considered all of the following technologies, with the exception of dual magnetrons. Dual magnetrons were identified in the February 2006 edition of *Appliance Design* as a means to decrease cooking times. The current DOE test procedure can

measure the possible energy savings of all of the design options below, although the 1996 TSD did not consider, for a variety of reasons, added insulation, the elimination/improvement of ceramic stirrer covers, and the modification of wave guides.

- Add insulation
- Reflective surfaces
- More efficient fan
- Improve efficiency of magnetron
- Improve efficiency of the power supply
- Eliminate or improve ceramic stirrer cover
- Modify wave guide
- Dual magnetrons

***Item 3-3*** *Of the technologies listed above, are there any that DOE should not consider because of their impacts on safety, performance, or consumer utility of the product?*

***Item 3-4*** *Are there other unlisted technologies that DOE should consider as design options and what, if any, impacts do the design options have on safety, performance, and consumer utility?*

### 3.4 Baseline Units

Once the Department establishes product classes, it will select a baseline model as a reference point for each product class, against which it can measure changes resulting from energy conservation standards. For commercial clothes washers, the Department will use the baseline model to evaluate new water factor standards in addition to energy conservation standards. The baseline model in each product class represents the characteristics of equipment in that class. Typically, a baseline model would be a model that just meets current required energy conservation standards. If there are no existing standards, as is the case with cooking products, the Department will select baseline models identified in the 1996 TSD for residential cooking products.

The Department will use the baseline models in the engineering analysis and the life-cycle-cost and payback-period analysis. To determine energy savings and changes in price, the Department will compare each higher-energy-efficiency or lower-energy-consumption design option with the baseline model.

Without consideration for product classes, EPACT 2005 establishes the following uniform **commercial clothes washer** energy and water conservation standards: a minimum modified energy factor (MEF) of 1.26 and a maximum water factor (WF) of 9.5. (EPACT 2005, section 136(e)) The MEF, measured in cubic feet per kilowatt-hour (kWh), takes into consideration not only the energy consumption of the washer but also the amount of energy required to dry clothes based on the remaining moisture content of the clothes.

The minimum energy conservation standards for **dishwashers**, as measured by the energy factor (EF) in cycles per kWh, became effective on May 14, 1994. The Department developed the following standards for compact and standard capacity dishwashers (10 CFR Part 430.32(f), Subpart C):

- Compact = 0.62 EF; and
- Standard = 0.46 EF.

As identified in section 3.2, the Department proposes six product classes for **dehumidifiers**. An initial review of dehumidifier models in AHAM's *May 2005 Directory of Certified Dehumidifiers* shows a correlation between efficiency and capacity. Because efficiency seems to be a function of capacity, the Department plans to complete the engineering and LCC analyses on the product class with the greatest percentage of shipments and then extrapolate to the other five product classes. Based on an analysis of preliminary shipment data and a comment from Whirlpool regarding ENERGY STAR levels for dehumidifiers,[6] the Department believes that the 35.01-45.00 pints/day product class should be the representative product class. EPACT 2005 sets minimum energy conservation standards for dehumidifiers based on the unit's capacity (in pints/day). (EPACT 2005, section 135(c)(4)) The Department will use the EPACT 2005 standard of 1.30 liters/kWh, which becomes effective October 1, 2007, as the baseline efficiency for this representative unit.

As noted earlier, **cooking products** currently do not have minimum energy conservation standards. The current DOE test procedure uses an EF to rate the efficiency of cooking products. The EF is the ratio of the annual useful cooking energy output of the cooking appliance (energy conveyed to the item being heated) to its total annual energy consumption. The 1996 TSD on residential cooking products established the following baseline EFs for the largest-selling product classes:

- Electric cooktops, open (coil) elements = 0.737 EF;
- Electric cooktops, smooth elements = 0.742 EF;
- Gas cooktops, conventional burners = 0.156 EF;
- Electric ovens, standard with or without a catalytic line = 0.107 EF;
- Electric ovens, self-clean = 0.096 EF;
- Gas ovens, standard with or without a catalytic line = 0.030 EF;
- Gas ovens, self-clean = 0.054 EF; and
- Microwave ovens = 0.557 EF.

The Department plans to use the above energy and water conservation standards to describe the energy and water efficiency of baseline units for commercial clothes washers and residential dishwashers, dehumidifiers, and cooking products.

[6] Hoyt, J.B. Letter to Andrew Fanara and Mehernaz Polad. May 12, 2005. Located online at: http://www.energystar.gov/index.cfm?c=revisions.dehumid_spec.

***Item 3-5*** *The Department seeks input from stakeholders on possible methods of extrapolating the engineering and LCC analyses from the representative dehumidifier product class to the other five product classes (e.g., maintaining relative incremental energy use specified in EPACT 2005 across product classes).*

***Item 3-6*** *The Department seeks input from stakeholders on whether the above energy and water efficiency/conservation levels are appropriate for characterizing the performance of baseline units.*

***Item 3-7*** *The Department seeks information regarding the specific technological characteristics of the baseline model for each product class, including the technologies described in section 3.4.*

## 4. SCREENING ANALYSIS

The purpose of the screening analysis is to screen out design options that will not be considered in the rulemakings for commercial clothes washers and residential dishwashers, dehumidifiers, and cooking products.

In consultation with interested parties, the Department will develop a list of design options for consideration. Initially, the candidate design options will encompass all those technologies considered to be technologically feasible. Following development of this initial list of design options, the Department will review each design option based on the following four criteria, as addressed in sections 4(a)(4) and 5(b) of the Process Rule:

1. *Technological feasibility.* Technologies that are not incorporated in commercial products or in working prototypes will not be considered further.

2. *Practicability to manufacture, install, and service.* If it is determined that mass production of a technology in commercial products and reliable installation and servicing of the technology could not be achieved on the scale necessary to serve the relevant market at the time of the effective date of the standard, then that technology will not be considered further.

3. *Impacts on product utility to consumers.* If a technology is determined to 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 be considered further.

4. *Safety of technologies.* If it is determined that a technology will have significant adverse impacts on health or safety, it will not be considered further.

The reasons for eliminating any design options during the screening analysis will be fully documented and published as part of the ANOPR.

## 5. ENGINEERING ANALYSIS

After conducting the screening analysis, the Department performs an engineering analysis based on the remaining design options. Potentially, as a result of screening out some design options which may enable the achievement of the highest efficiencies, the Department may, in effect, be limiting the efficiency levels considered in the engineering analysis. The engineering analysis consists of estimating the energy and water consumption and costs of products at various levels of increased efficiency. This section provides an overview of the engineering analysis (section 5.1), and discusses the approach for determining the cost-efficiency relationship (section 5.2), manufacturer prices (section 5.3), proprietary designs (section 5.4), and outside regulatory changes, or regulatory changes outside the realm of the Department's energy conservation standards process, that affect the engineering analysis (section 5.5). The Department will complete a separate engineering analysis for each of the four products.

### 5.1 Engineering Analysis Overview

The purpose of the engineering analysis is to determine the relationship between manufacturer selling price and energy efficiency for commercial clothes washers and residential dishwashers, dehumidifiers, and cooking products. In determining this relationship, the Department will estimate the increase in manufacturer selling price associated with technological changes that increase the efficiency of the baseline models.

The Department will obtain cost estimates for the engineering analysis (which it also will use in the manufacturer impact analysis) from detailed incremental cost data disaggregated into the cost of incremental material, labor, and overhead. The Department will create an industry-wide analysis based primarily on the manufacturer-supplied data. The Department may supplement this analysis with cost estimates of specific design options.

Therefore, the Department seeks design, efficiency, and cost information to determine the cost of improving the efficiency of the baseline model. In addition, the Department must identify the model with the highest efficiency that is technologically feasible within each product class (i.e., the "max tech" model).

### 5.2 Proposed Approach for Determining the Cost-Efficiency Relationship

In support of this rulemaking effort, the Department will seek to obtain incremental cost data for each of the four products. The data are 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 the Department will examine aggregated incremental increases in manufacturer selling price at specified levels of energy efficiency. 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 baseline models, design strategies, and cost structures that can exist among manufacturers. The Department will attempt to qualify the cost-efficiency data supplied by stakeholders through engineering expertise and consultation with stakeholders or technical experts. Specifically, the Department 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.

If the Department 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, the Department will supplement the collected data through a design-options approach involving consultation with outside experts and/or further review of publicly available cost and performance information.

The Department will estimate the contribution of the depreciation of conversion capital expenditures to the incremental overhead. During the interviews, the Department 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). The Department will also request information about the depreciation method used to expense the conversion capital.

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

***Item 5-1*** *The Department requests feedback on the use of an efficiency-level approach to determining the relationship between manufacturer selling price and energy efficiency for each of the four products, supported, as needed, by a design-options approach.*

For each of the product classes presented in section 3.2, the Department will suggest efficiency levels and seek to obtain incremental cost data at each of these levels. The Department proposes to conduct the engineering analysis (and LCC and payback period analyses) on all product classes for all of the products except dehumidifiers. For **dehumidifiers**, the Department will evaluate only the 35.01–45.00 pints/day product class, which has the greatest percentage of shipments and then will extrapolate to the other product classes. The Department believes that it can streamline the overall dehumidifier analysis using extrapolation from a single product class because the product classes differ by capacity rather than by fundamental design differences. (See the discussion in section 3.4 of this document.) Tables 1–8 provide both the efficiency level and the reference source of each level for each of the products under consideration. Many of the tabulated efficiency levels correspond to those set by energy efficiency programs or

organizations, including the DOE and EPA ENERGY STAR Program and the Consortium for Energy Efficiency (CEE), while other levels are calculated from existing levels to fill in gaps. Note that the maximum available efficiency levels in the following tables do not necessarily correspond to the "max tech" levels. Because the Department is required to analyze "max tech," it will seek stakeholder input to determine appropriate "max tech" efficiency levels. (42 U.S.C. 6295 (p)(2))

For **commercial clothes washers**, the Department is mandated by EPACT 2005 to determine both a minimum MEF and a maximum WF. (EPACT 2005, section 136(e)) For the purposes of analyzing the cost-efficiency relationship of this product, DOE will use efficiency levels based on the MEF and WF specifications prescribed by ENERGY STAR and the CEE Commercial Clothes Washer Initiative, and the maximum levels that are currently commercially available.

**Table 5-1 Efficiency Levels for Commercial Clothes Washer Analysis**

| Level | Efficiency Level Source | Efficiency Level | |
|---|---|---|---|
| | | MEF | Water Factor |
| baseline | DOE Standard (effective 2007) | 1.26 | 9.5 |
| 1 | CEE Tier 1 | 1.42 | 9.5 |
| 2 | CEE Tier 2 | 1.60 | 8.5 |
| 3 | 2007 ENERGY STAR | 1.72 | 8.0 |
| 4 | CEE Tier 3A | 1.80 | 7.5 |
| 5 | CEE Tier 3B | 1.80 | 5.5 |
| 6 | Max Available | 2.79 | 3.5* |

* The MEF and WF are not from the same clothes washer. The clothes washer with an MEF of 2.79 has a water factor of 6.0 and the clothes washer with a water factor of 3.5 has an MEF of 2.48. Source: ENERGY STAR qualified clothes washers as of February 7, 2006.

***Item 5-2*** *The Department will consider water factors that are equal to or less than 9.5. The Department is aware that pairings between MEF and WF have been established by organizations including ENERGY STAR and CEE (for voluntary standards). These pairings are shown in Table 1. The Department has the flexibility to consider other pairings of MEF and WF besides those in Table 1 and invites comment on suggested pairings.*

For the purposes of analyzing the cost-efficiency relationship of **dishwashers**, the Department intends to use the ENERGY STAR criteria, CEE Tier 1 and 2 levels, and the current maximum technology that is commercially available. The Department also intends to add two levels to fill the gap between CEE Tier 2 and the current maximum technology that is commercially available. Because current ENERGY STAR and CEE criteria exist only for standard size

dishwashers, DOE used the percent increase that standard size dishwashers achieve above the baseline efficiency to estimate the efficiency levels for compact dishwashers.

**Table 5-2 Efficiency Levels for Residential Dishwasher Analysis**

| Level | Efficiency Level Source | Efficiency Level (cycles/kWh) | |
|---|---|---|---|
| | | Compact | Standard |
| baseline | DOE Standard | 0.62 | 0.46 |
| 1 | ENERGY STAR (scaled for compact) | 0.78 | 0.58 |
| 2 | CEE Tier 1 (scaled for compact) | 0.84 | 0.62 |
| 3 | 2007 ENERGY STAR | 0.88 | 0.65 |
| 4 | CEE Tier 2 (scaled for compact) | 0.92 | 0.68 |
| 5 | Gap Fill | 1.01 | 0.75 |
| 6 | Gap Fill | 1.08 | 0.80 |
| 7 | Max Available | 1.74* | 1.11** |

* Source: Oregon Department of Energy, Tax Credit Qualifying Dishwashers Feb. 2006.
** Source: ENERGY STAR qualified dishwashers as of February 8, 2006.

As identified in section 3.4, the Department plans to complete the engineering and LCC analyses on the **dehumidifier** product class with the greatest percentage of shipments and then extrapolate to the other five product classes. The Department believes that the 35.01–45.00 pints/day product class should be the representative product class. Efficiency levels for the purposes of analyzing the cost-efficiency relationship of this product range from a point between the baseline and the default 2012 EPACT-prescribed standard to the maximum technology currently commercially available. The Department will consider the default 2012 level that is specified in EPACT 2005 as an intermediate efficiency level. The Department will not include the current ENERGY STAR level, since this is close to the baseline efficiency level.

**Table 5-3 Efficiency Levels for Residential Dehumidifier (Representative) Analysis**

| Level | Efficiency Level Source | Efficiency Levels (liters/kWh) |
|---|---|---|
| | | 35.01–45.00 pints/day |
| baseline | DOE Standard (effective 2007) | 1.30 |
| 1 | Between DOE and Default 2012 Standard | 1.35 |
| 2 | Default 2012 Standard (EPACT 2005) | 1.40 |
| 3 | Between Default 2012 Standard and Max Available | 1.50 |
| 4 | Max Available* | 1.74 |

* Source: ENERGY STAR qualified dehumidifiers as of November 28, 2005.

For the purposes of analyzing the cost-efficiency relationships of **cooking products**, DOE based the efficiency levels on the type of product. There are five cooking product types: gas cooktops, electric cooktops, gas ovens, electric ovens, and microwave ovens.

For **gas cooktops**, DOE plans to use the efficiency levels presented in its 1996 TSD for residential cooking products. Note that the baseline efficiency level assumes that the product is equipped with standing pilots and that the first efficiency level corresponds to the elimination of standing pilots.

**Table 5-4 Efficiency Levels for Residential Gas Cooktop Analysis**

| Level | Efficiency Level Source | Efficiency Level (EF) |
|---|---|---|
| | | Conventional burners |
| baseline | 1996 TSD (with standing pilots) | 0.156 |
| 1 | 1996 TSD (without standing pilots) | 0.399 |
| 2 | Max Tech (1996 TSD) | 0.420 |

For **electric cooktops**, DOE plans to use the efficiency levels presented in its 1996 TSD for residential cooking products.

**Table 5-5 Efficiency Levels for Residential Electric Cooktop Analysis**

| Level | Efficiency Level Source | Efficiency Level (EF) | |
|---|---|---|---|
| | | Low or high wattage open (coil) elements | Smooth elements |
| baseline | 1996 TSD | 0.737 | 0.742 |
| 1 | 1996 TSD/ Calculated | 0.753 | 0.753 |
| 2 | 1996 TSD/ Calculated | 0.769 | 0.797 |
| 3 | Max Tech (1996 TSD) | 0.777 | 0.840 |

For **gas ovens**, DOE plans to use the efficiency levels presented in its 1996 TSD for residential cooking products. For standard ovens with or without a catalytic line, the baseline efficiency level assumes that the product is equipped with a standing pilot and that the first efficiency level corresponds to the elimination of the standing pilot. Because the cleaning cycle requires electrical energy use, self-clean ovens are equipped with a non-standing pilot ignition system.

**Table 5-6 Efficiency Levels for Residential Gas Oven Analysis**

| Level | Efficiency Level Source | Efficiency Level (EF) | |
|---|---|---|---|
| | | Standard oven with or without catalytic line | Self-clean oven |
| baseline | 1996 TSD* | 0.030 | 0.054 |
| 1 | 1996 TSD# | 0.058 | 0.062 |
| 2 | 1996 TSD | 0.062 | 0.063 |
| 3 | Max Tech (1996 TSD) | 0.065 | 0.065 |

* For standard oven product class, baseline efficiency level assumes the inclusion of a standing pilot ignition system.
# For standard oven product class, first efficiency level assumes the elimination of the standing pilot ignition system.

For **electric ovens**, DOE plans to use the efficiency levels presented in its 1996 TSD for residential cooking products.

**Table 5-7 Efficiency Levels for Residential Electric Oven Analysis**

| Level | Efficiency Level Source | Efficiency Level (EF) | |
|---|---|---|---|
| | | Standard oven with or without catalytic line | Self-clean oven |
| baseline | 1996 TSD | 0.107 | 0.096 |
| 1 | 1996 TSD | 0.111 | 0.133 |
| 2 | 1996 TSD | 0.118 | 0.136 |
| 3 | Max Tech (1996 TSD) | 0.180 | 0.137 |

For **microwave ovens**, DOE does not propose multiple product classes. It based the analytical efficiency levels on its 1996 TSD for residential cooking products.

**Table 5-8 Efficiency Levels for Residential Microwave Oven Analysis**

| Level | Efficiency Level Source | Efficiency Level (EF) |
|---|---|---|
| baseline | 1996 TSD | 0.557 |
| 1 | 1996 TSD | 0.586 |
| 2 | 1996 TSD | 0.588 |
| 3 | 1996 TSD | 0.597 |
| 4 | Max Tech (1996 TSD) | 0.602 |

***Item 5-3*** *The Department seeks input from stakeholders concerning the efficiency levels to be used for collecting incremental cost data from manufacturers of commercial clothes washers and residential dishwashers, dehumidifiers, and cooking products. The Department also seeks input from stakeholders on appropriate maximum technologically feasible efficiency levels.*

## 5.3 Manufacturer Prices

The Department plans to apply markups to convert manufacturer production costs to manufacturer selling prices. The Department will estimate manufacturer markups from publicly available financial information (e.g., Securities and Exchange Commission 10-K reports).

***Item 5-4*** *The Department seeks comment on the markup approach proposed for developing estimates of manufacturer selling prices.*

## 5.4 Proprietary Designs

The Department will consider in its engineering and economic analyses all design options that are commercially available or present in a working prototype, including proprietary designs. The Department will consider a proprietary design in the subsequent analyses only if it is not a unique path to a given efficiency level. If the proprietary design is the only approach available to achieve a given efficiency level, then DOE will reject the efficiency level (that can only be achieved by a proprietary design) from further analysis. Furthermore, the Department is sensitive to manufacturer concerns regarding proprietary designs and will make provisions to maintain the confidentiality of any proprietary data submitted by manufacturers. This information will provide input to the competitive impacts assessment and other economic analyses.

***Item 5-5*** *Are there proprietary designs that the Department should consider for any of the products under consideration by this rulemaking? If so, how should the Department acquire the cost data necessary for evaluating these designs?*

## 5.5 Outside Regulatory Changes Affecting the Engineering Analysis

In conducting an engineering analysis, the Department must consider the effects of regulatory changes outside the Department's statutory energy conservation standards rulemaking process that can impact the manufacturers of the covered equipment. Some of these changes can also affect the energy efficiency or energy consumption of the covered equipment. For example, due to the phaseout of chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs), the dehumidifier industry must transition to non-ozone-depleting refrigerants. As a result, the industry will likely use hydrofluorocarbon (HFC)-based refrigerants in their products.

The Department will attempt to identify all such outside engineering issues that could impact the engineering analysis. The consideration of these issues is closely related to the cumulative regulatory burden assessment that the Department will carry out as part of the manufacturer impact analysis.

Based on consideration of the comments received for the ANOPR, DOE will make the necessary changes to the analysis. Changes will be reflected in the documentation of the NOPR.

***Item 5-6*** *Are there additional outside issues that the Department should consider in its analysis of commercial clothes washers and residential dishwashers, dehumidifiers, and cooking products?*

# 6. ENERGY AND WATER USE

The purpose of the energy and water-use analysis is to assess the energy-savings potential of different product efficiencies. For commercial clothes washers and residential dishwashers, DOE also will evaluate the water-savings potential of more-efficient products. As part of the energy and water-use analysis, certain engineering assumptions may be required regarding product application, including how the product is operated and under what conditions.

For **dishwashers**, as noted in section 1.2, DOE has recently revised its test procedure to more accurately reflect their annual energy and water consumption. 68 FR 51887. The Department plans to rely on the assumptions in this test procedure to establish the typical annual energy and water consumption of this product.

The Department needs disaggregated data to calculate energy (and water) consumption. Specifically, because dishwasher energy consumption consists of several components, the Department needs disaggregated energy-use data for the following: (1) hot water energy consumed at the water heater, (2) booster energy needed to elevate the hot water temperature,

and (3) machine energy, including both motor and drying energy. The Department will seek to obtain detailed energy-use and water-use data for the energy efficiency levels for dishwashers that it will analyze in the engineering analysis. Drafts of the data-request sheets are contained in Appendix A.

For **cooking products**, DOE also has relatively recently revised its test procedures to more accurately reflect the annual energy consumption of these products. 62 FR 51976. As with dishwashers, the Department plans to rely on the assumptions in this test procedure to establish the typical annual energy consumption of cooking products.

With the exception of electric cooktops, the Department needs disaggregated data to calculate the total energy consumption of cooking products. Because cooking product energy consumption consists of several components (e.g., self-cleaning energy consumption in addition to cooking energy consumption in the case of self-clean ovens), the Department needs disaggregated energy-use data. The Department will seek to obtain detailed energy-use data for the energy efficiency levels for cooking products that it will analyze in the engineering analysis. Drafts of the data-request sheets are contained in Appendix A.

For **commercial clothes washers** and **dehumidifiers**, the test procedures that are being codified in the CFR provide good methods for establishing each product's rated efficiency—e.g., liters/day for dehumidifiers and cubic feet/kWh for commercial clothes washers, but neither provides an accurate means for establishing annual energy consumption. In the case of commercial clothes washers, because the test procedure is based on rating the performance of residential clothes washers, the cycles-per-year values do not reflect commercial clothes washer usage. In the case of dehumidifiers, the test procedure does not offer a method for establishing annual energy consumption. Thus, the Department will need to conduct further research to establish the energy and water consumption of these two products.

For **commercial clothes washers**, DOE will rely on research sponsored by the Multi-Housing Laundry Association (MLA) and the Coin Laundry Association (CLA), trade associations representing the commercial laundry industry, to establish typical use cycles. The Department also will review other information, such as research sponsored by the American Water Works Association (AWWA) and the California Energy Commission (CEC), for its relevance. Although the cycles-per-year values in the test procedure do not reflect actual commercial-clothes-washer energy consumption, the test procedure is able to determine the energy and water use on a per-cycle basis. As a result, as with dishwashers, the Department needs disaggregated energy-use and water-use data to calculate the per-cycle energy and water consumption for the efficiency levels specified in Table 1.

The Department will seek to obtain detailed energy-use and water-use data for the energy efficiency levels for commercial clothes washers that it will analyze in the engineering analysis. Drafts of the data request sheets are contained in Appendix A.

For **dehumidifiers**, DOE's fiscal year 2003 priority-setting activities identified research estimating an annual energy consumption of approximately 1000 kWh per year (kWh/yr). As

with commercial clothes washers, DOE will review any other research pertinent to dehumidifiers to determine its usefulness for establishing the product's annual energy consumption.

Because energy use by commercial clothes washers and residential dishwashers, dehumidifiers, and cooking products (and water use for commercial clothes washers and residential dishwashers) is highly variable due to consumer usage patterns, the Department will conduct further research to establish a range of energy (and water) use for these products. The Energy Information Administration (EIA)'s Residential Energy Consumption Survey (RECS) is one source for defining the range of energy use for dishwashers, cooking products, and possibly dehumidifiers. EIA's Commercial Building Energy Consumption Survey (CBECS) does not seem to be a useful source for establishing the variability of commercial clothes washer energy and water consumption, since neither energy nor water consumption is specified for buildings identified with laundry facilities. Thus, the Department will rely on other sources (e.g., reports from the MLA and CLA) to characterize the variability in commercial clothes washer energy and water usage.

If the range of energy and water use determined for each product is large enough, DOE will conduct a sensitivity analysis to determine how high and low estimates of energy and water use impact the economic feasibility of amended energy conservation standards.

***Item 6-1*** *The Department seeks stakeholder input on the approaches proposed for specifying the typical annual energy and water consumption. Most importantly, the Department is interested in sources of data that can assist in characterizing the cycles per year for commercial clothes washers and the annual energy consumption of dehumidifiers.*

***Item 6-2*** *The Department seeks stakeholder input on data sources that it can use to characterize the variability in annual energy and water consumption for each of the four products.*

## 7. MARKUPS FOR EQUIPMENT PRICE DETERMINATION

The Department uses manufacturer-to-consumer markups to convert the manufacturer selling price estimates from the engineering analysis to consumer prices; it then uses these markups in the LCC analysis, consumer payback analysis, and national impact analysis. Retail prices are needed for the baseline efficiency level and all other efficiency levels under consideration. The Department will obtain these retail prices by applying manufacturer-to-consumer markups to manufacturer-selling-price estimates. To validate these markups, the Department will attempt to collect data on existing prices in the market either by purchasing large data sets or by downloading data from distributor Internet sites.

Before it can develop markups, DOE must identify distribution channels (i.e., how the product is distributed from the manufacturer to the consumer). AHAM's *2003 Fact Book* shows that over 93 percent of appliances are distributed from the manufacturer directly to a retailer. Thus, the

Department plans to analyze residential dishwasher, dehumidifier, and cooking product sales, assuming that these appliances are sold based on a manufacturer-to-retailer distribution channel. For commercial clothes washers, because the consumer is a commercial establishment, other parties (e.g., wholesalers) may be involved in the distribution of the product. Therefore, DOE plans to rely on industry input to determine the most representative distribution channels for the sale of commercial clothes washers. Once it establishes proper distribution channels for each of the products, DOE will rely on economic census data from the U.S. Census Bureau as well as input from the industry to define how products are marked up from the manufacturer to the consumer. To the extent possible, the Department also will use collected retail price data to help determine overall manufacturer-to-consumer markups.

This analysis will generate retail prices for each possible efficiency level, assuming that each level represents a new minimum efficiency standard. Because it expects to generate a range of price estimates, DOE plans to describe new retail prices within a range of uncertainty. If the range of retail prices for each product is large enough, DOE will conduct a sensitivity analysis to determine how high and low estimates of retail price impact the economic feasibility of amended energy conservation standards.

***Item 7-1*** *The Department welcomes suggestions and comments concerning its proposed approach for developing estimates of future retail prices.*

## 8. LIFE-CYCLE COST AND PAYBACK PERIOD ANALYSIS

The effects of increased energy conservation standards on a consumer of a product include a change in operating expense (usually decreased) and a change in purchase price (usually increased). In carrying out rulemakings for other products, the Department has analyzed the net effect on consumers by calculating the LCC and payback period using the engineering performance data (as described in section 5), the energy (and water) consumption data (as described in section 6), and equipment retail prices (as described in section 7). Inputs to the LCC calculation include the installed cost to the consumer (purchase price plus installation cost), operating expenses (energy expenses, and, if applicable, water expenses, repair costs, and maintenance costs), the lifetime of the appliance, and a discount rate.

In the ANOPR stage, DOE will conduct the LCC analysis using typical values to reflect conditions in the field for product retail price and life, energy and water costs, energy and water usage, and discount rates. If the Department determines that there is significant variability in any of the above inputs, it will conduct sensitivity analyses to determine how the LCC and payback period are impacted by high and low estimates for each of the inputs. For any sensitivity analyses that it conducts, the Department will account for correlations that may exist between inputs (e.g., energy usage may be correlated to energy prices). The detailed impact calculation, which DOE will conduct after the ANOPR, will include a comprehensive assessment of impacts on subgroups of consumers, as described in section 11.

During the post-ANOPR (or NOPR stage) consumer analysis, the Department may evaluate additional parameters not included in the ANOPR analysis.

Based on the results of the LCC analysis, DOE will select candidate standard levels (CSLs) for the ANOPR analysis. The range of CSLs typically will include the efficiency level with the lowest life-cycle cost, the highest efficiency level that is technologically feasible, and other levels DOE has not yet determined.

For commercial clothes washers and residential dishwashers, dehumidifiers, and cooking products, DOE will need to determine input values for several variables. The following sections discuss the methodologies DOE plans to use to develop energy and water prices; discount rates; maintenance, repair, and installation costs; and product lifetimes.

## 8.1 Energy and Water Prices

For consumers of residential **dishwashers**, **dehumidifiers**, and **cooking products**, DOE plans to review residential energy price data from the EIA as a potential means for establishing electricity and natural gas prices. The Department will review the water and wastewater rates survey data from AWWA/Raftelis Financial Consultants, Inc. as a potential means for establishing residential water and wastewater prices.

For consumers of **commercial clothes washers**, DOE will review EIA's commercial energy price data as a potential means for establishing electricity and natural gas prices. The Department will review the water and wastewater rate survey data from AWWA/Raftelis Financial Consultants, Inc. as a potential means for establishing commercial water and wastewater prices.

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

The Department will use projections of national average energy prices to residential consumers (for dishwashers, dehumidifiers, and cooking products) and to commercial consumers (for commercial clothes washers) to estimate future energy prices in its LCC analysis. The Department will use EIA's *Annual Energy Outlook* (*AEO*) as the default source of projections for future energy prices. It will base projections of future water and wastewater prices on an examination of trends in historical prices.

***Item 8-1*** *The Department seeks stakeholder input on the proposed approaches for estimating current and forecasted energy and water prices.*

## 8.2 Discount Rates

The calculation of consumer life-cycle costs requires the use of an appropriate discount rate. For consumers of residential **dishwashers**, **dehumidifiers**, and **cooking products**, the Department 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 comes from the Federal Reserve Board's triennial *Survey of Consumer Finances*.

For consumers of **commercial clothes washers**, the Department plans to use the same approach it relied on for developing discount rates for commercial unitary air conditioners and commercial consumers of distribution transformers. This approach involves deriving the discount rates for commercial consumers by estimating the cost of capital of companies that purchase commercial clothes washers. The cost of capital is commonly used to estimate the present value of cash flows to be derived from a typical company project or investment. Most companies use both debt and equity capital to fund investments, so the cost of capital is the weighted-average cost to the firm of equity and debt financing. This corporate finance approach is referred to as the weighted-average cost of capital (WACC). The set of companies purchasing commercial clothes washers may differ from those who purchase commercial unitary air conditioners or distribution transformers, which may result in different discount rates.

The Department will make public the discount rates and associated calculations at the time of ANOPR publication. Stakeholders may comment on this issue during the ANOPR comment period.

***Item 8-2*** *The Department seeks stakeholder input on the proposed approaches for estimating discount rates for residential and commercial consumers.*

### 8.3 Maintenance, Repair, and Installation Costs

The Department will consider expected changes to maintenance, repair, and installation costs for the products covered in this rulemaking. Typically, small incremental changes in product efficiency incur no, or only very small, changes in repair and maintenance costs over baseline products. There is a greater probability that equipment with efficiencies that are significantly greater than the baseline will incur increased repair and maintenance costs since such equipment is more likely to incorporate technologies that are not widely available. The Department will rely on input from manufacturers and other stakeholders in developing appropriate repair and maintenance costs if stakeholders feel such estimates are necessary.

With regard to installation costs, unless the efficiency increases considered for this rulemaking result in significantly larger or heavier products, the Department expects that more-efficient commercial clothes washers and residential dishwashers, dehumidifiers, and electric cooking products will not incur increased installation costs. Gas cooking products are an exception: In its 1996 TSD, DOE estimated that some consumers who purchase gas cooking products without an electrical supply cord could incur installation costs for bringing an electric outlet to the kitchen if they were required to purchase a product that requires electricity to operate. The

Department will once again consider this issue when analyzing increased product efficiencies for gas cooking products.

***Item 8-3*** *The Department seeks stakeholder input on whether it is correct to assume that, with the exception of gas cooking products, changes in maintenance, repair, and installation costs will be negligible for more-efficient products.*

### 8.4 Product Lifetimes

The Department's previous analyses have established the product lifetimes of commercial clothes washers and residential dishwashers, dehumidifiers, and cooking products. For **commercial clothes washers**, the Department's priority-setting activities for fiscal year 2003 estimated an average product lifetime of ten years, based on information from CEE. For **dishwashers**, the Department's priority-setting activities for fiscal year 2005 estimated an average product lifetime of 13 years, based on information from DOE's Federal Energy Management Program (FEMP). For **dehumidifiers**, the Department's priority-setting activities for fiscal year 2003 estimated an average product lifetime of 11 years, based on information from *Appliance Magazine*. Finally, for **cooking products**, the Department's priority-setting activities for fiscal year 2005 estimated an average product lifetime of 19 years for conventional gas and electric cooking products and 10 years for microwave ovens. The cooking product lifetime data were based on DOE's 1996 TSD.

The Department will use information from various literature sources (e.g., *Appliance Magazine*, Handbooks published by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers) as well as input from manufacturers and other stakeholders to establish whether the above product lifetimes are still representative.

Based on consideration of the comments received for the ANOPR, DOE will make the necessary changes to the analysis. Changes will be reflected in the documentation of the NOPR.

***Item 8-4*** *The Department seeks stakeholder input on appropriate product lifetimes for the products covered in this rulemaking.*

## 9. SHIPMENTS ANALYSIS

Shipment forecasts are required in order to calculate the national impacts of standards (energy and water savings and NPV) and to calculate the future cashflows of manufacturers. The Department 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 impacts of standards, the Department must develop a base case forecast against which to compare forecasts for higher efficiency levels. The base case is designed to depict what will happen to energy and water consumption and costs over time if DOE does not adopt energy conservation standards. In determining the base case, the Department will consider historical shipments, the mix of efficiencies sold in the absence of standards, and how that mix might change over time. In order to determine the base case, the Department needs data on historical product shipments and the market shares of the different efficiency levels offered for each product class. For some products, the AHAM *2003 Fact Book* offers historical shipments and efficiency data, but these data are not disaggregated by product class. The Department hopes to collect both shipments data and shipment-weighted average efficiency data dating back to 1990. In addition, the Department hopes to collect market-share efficiency data (i.e., data on the distribution of product shipments by efficiency) for each of the product classes. Realizing that this information may be difficult to collect, the Department plans only to ask for market-share efficiency data from recent years (i.e., 2002–2004). In the cases where market-share efficiency data are not available, the Department will use efficiency distributions based on available models as a proxy.

For **commercial clothes washers**, the Department will be seeking historical product shipments and shipment-weighted efficiency data (EF or MEF and water factor). The efficiency bins, where each bin is a range of product efficiencies, encompass the efficiency levels in Table 1 for which the Department is requesting manufacturing cost data.

For **dishwashers**, the Department is seeking historical product shipments and shipment-weighted efficiency data for both standard and compact dishwashers. The efficiency bins encompass the efficiency levels in Table 2 for which the Department is requesting manufacturing cost data.

For **dehumidifiers**, the Department is seeking historical product shipments and shipment-weighted efficiency data for the six product classes identified in section 3.2. The efficiency bins encompass the efficiency levels in Table 3 for which the Department is requesting manufacturing cost data.

For **cooking products**, the Department is requesting only historical product shipments. Because it seems that neither trade associations nor government agencies in the U.S. have been tracking the historical efficiencies of cooking products, the Department presumes that energy efficiency data for products sold in the U.S. are not readily available. With regard to historical product shipments, DOE is seeking shipments data for free-standing ranges, in addition to the product classes identified in section 3.2, to account for all cooking product shipments. The Department requests separate shipments information for standing-pilot and non-standing-pilot gas products. Note that the Department is seeking data for free-standing ranges for all of the possible cooktop and oven product class combinations.

The Department seeks to obtain historical shipments, shipment-weighted average efficiency data, and market-share efficiency data. An example of the data required for the analysis is contained in Appendix A.

## 9.2 Accounting Methodology

The Department proposes to determine annual shipments in the base case based by accounting for new building construction and historical rates of product ownership (saturation rates). For product retirements, DOE will use the same product lifetimes and retirement functions that it generates for the LCC and payback period analysis. This method has the distinct advantage of separately accounting for units installed in new construction and existing buildings. More importantly, DOE can express product saturation rates as a function of consumer price and operating cost to capture their impact on future shipments. The Department plans to rely on EIA's *AEO* to forecast new residential and commercial construction. With regard to historical product saturation rates, both AHAM's *2003 Fact Book* and EIA's RECS provide data for residential dishwashers, dehumidifiers, and cooking products. The Department plans to use both sources to establish product saturation rates. It also will take into consideration any other input provided by stakeholders. The Department especially seeks saturation data for commercial clothes washers, and it hopes that the industry will be helpful in providing such data.

***Item 9-1*** *The Department seeks data on representative saturation rates for each of the four products covered in this rulemaking.*

## 9.3 Standards Impacts on Product Shipments

For each product, the Department will develop a set of shipment forecasts for the covered equipment for each set of standards analyzed. These standards-case forecasts will be used to evaluate the impacts of standards on product shipments. Standards-case forecasts are derived using the same data sets as base-case forecasts; however, because the standards-case forecasts take into account the increase in purchase price and the decrease in operating costs caused by standards, forecasted shipments typically deviate from the base case. The magnitude of the difference between the standards-case and base-case shipment forecasts depend on the estimated purchase-price-increase as well as the operating-cost-savings caused by the standard. Because the purchase price tends to have a larger impact than operating cost on equipment purchase decisions, standards-case forecasts typically show a drop in product shipments relative to the base case.

The Department's past standards analyses have attempted to quantify the sensitivity of shipments to purchase price and operating-cost-savings. Because the data required to develop these sensitivities are limited and often difficult to obtain, the Department will consider modeling standards-case shipments forecasts with scenarios (i.e., specified impacts to product shipments) rather than developing sensitivities to purchase price or operating-cost-savings.

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 forecasts. When such programs exist, the Department considers their impact on the forecast of both standards-case and base-case shipments.

***Item 9-2*** *As part of its preliminary manufacturer impact analysis, the Department will seek input from manufacturers on the potential impact of new energy conservation standards on product shipments. Other stakeholders are also welcome to provide input. The Department also requests input on any market-pull programs that currently exist to promote the adoption of more-efficient products.*

## 10. NATIONAL IMPACT ANALYSIS

Section 8 discusses methods for estimating the LCC savings and payback period for individual consumers. This section discusses DOE's assessment of the aggregate impacts at the national level. Measures of impact to be reported include the NPV of total consumer life-cycle costs and national energy savings.

### 10.1 Inputs to Forecasts

Analyzing impacts of Federal energy conservation standards requires a comparison of projected United States energy consumption with, and without, new or amended energy conservation standards. The forecasts contain projections of unit energy consumption of new equipment, annual equipment shipments, and the price of purchased equipment. The derivations of the base case shipments forecasts are discussed in section 9. Approaches to determining retail prices are described in section 7, while approaches to determining unit energy (and water) consumption are described in section 6.

### 10.2 Calculation of Energy Savings

The Department intends to calculate national energy consumption for each year beginning with the expected effective date of the standards. It will calculate national energy consumption by fuel type for the base case and each standard level analyzed. The Department plans to perform this calculation through the use of a spreadsheet model that effectively multiplies annual shipment forecasts by unit energy savings, accounting for the stock of appliances affected by standards.

In response to comments by stakeholders who asked for a simple, transparent model, the Department has developed NES spreadsheet models for its standards rulemakings since 1996. The Department expects the NES spreadsheet model to provide a credible, stand-alone forecast of national energy savings and NPV for commercial clothes washers and residential dishwashers, dehumidifiers, and cooking products.

The Department has prepared NES spreadsheet models for other products to forecast energy savings and to demonstrate how the growth in efficiency can be accounted for over time.[7] Although these models are specific to each product, their general structure can be applied to commercial clothes washers and residential dishwashers, dehumidifiers, and cooking products.

[7] Several NES spreadsheet models from previous rulemakings, including residential clothes washers, can be found on the Department of Energy's website at www.eere.energy.gov/buildings/appliance_standards/.

Based on consideration of the comments DOE may receive on the ANOPR, DOE will make any necessary changes to the analysis. Those changes will be reflected in the documentation for the NOPR.

***Item 10-1*** *The Department seeks input on its plan to develop NES spreadsheet models for estimating national impacts of amended energy conservation standards.*

### 10.3 Net Present Value

The Department calculates the national NPV of the standards in conjunction with the NES. It 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. The Department calculates annual equipment expenditures by multiplying the price per unit times the forecasted shipments. The difference between a base-case and a standards-case scenario gives the national energy bill savings and increased equipment expenditures in dollars. The difference each year between energy bill savings and increased equipment expenditures is the net savings (if positive) or net costs (if negative). The Department discounts these annual values to the present time and sums them to give a net present value.

## 11. LIFE-CYCLE COST SUBGROUP ANALYSIS

This section describes how DOE analyzes consumer impacts 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, for one reason or another, to be impacted disproportionately by new standards. The purpose of a subgroup analysis is to determine the extent of this disproportional impact. The Department will work with stakeholders early in the rulemaking process to identify any subgroups for this consideration. However, it will not analyze the consumer subgroups until the NOPR stage of the analysis.

In comparing potential impacts on the different consumer subgroups, the Department will evaluate variations in regional energy prices, variations in energy use, and variations in installation costs that might affect the NPV of a standard to consumer subgroups. To the extent possible, DOE may obtain estimates of the variability in each input variable and consider this variability in its calculation of consumer impacts. It will discuss with stakeholders the variability in each input variable and likely sources of information.

The Department intends to consider the impact of any new standards on consumer subgroups. In the case of dishwashers, dehumidifiers, and cooking products, some possible subgroups DOE may choose to consider are: (1) low-income households, and (2) senior citizens. In the case of commercial clothes washers, small businesses are a subgroup that DOE may choose to consider. If it analyzes small businesses, DOE will likely focus on the following small business subgroups: (1) laundromats, (2) landlord-owned apartment buildings, and (3) other small businesses, such as lodging establishments, which have on-site laundry facilities.

***Item 11-1*** *The Department requests input as to what consumer subgroups are appropriate for commercial clothes washers and residential dishwashers, dehumidifiers, and cooking products.*

## 12. MANUFACTURER IMPACT ANALYSIS

Recently, the Department announced changes to the manufacturer impact analysis format through a report issued to Congress on January 31, 2006 (as required by section 141 of EPACT 2005). This report, entitled "Energy Conservation Standards Activities," (Standards Activities) is available on the DOE website at: http://www.eere.energy.gov/buildings/appliance_standards/2006_schedule_setting.html. Previously, DOE did not report any manufacturer impact analysis results during the ANOPR phase; however, under this new format, DOE will collect, evaluate, and report preliminary information and data in the ANOPR. Standards Activities, page 48. Such preliminary information includes the anticipated conversion capital expenditures by efficiency level and the corresponding, anticipated impacts on jobs. The Department will solicit this information during the ANOPR engineering analysis manufacturer interviews. Sample preliminary manufacturer impact analysis data needs are contained in Appendix B.

The analysis of impacts on manufacturers is intended to provide the Department with an assessment of the potential impacts of energy conservation standards on manufacturers of commercial clothes washers and residential dishwashers, dehumidifiers, and cooking products. The Department will execute a separate manufacturer impact analysis for each of the four products. 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. The Department will identify these effects through interviews with manufacturers and other stakeholders.

### 12.1 Sources of Information for the Manufacturer Impact Analysis

Many of the analyses described earlier provide important information that the Department uses as inputs for the manufacturer impact analysis. Such information includes financial parameters developed in the market assessment (section 3.1), manufacturing costs and prices from the engineering analysis (sections 5.2 and 5.3), retail price forecasts (section 7), and shipments forecasts (section 9). The Department supplements this information with information gathered during manufacturer interviews. The interview process plays a key role in the manufacturer impact analysis, since it provides an opportunity for interested parties to privately express their views on important issues.

The Department will conduct detailed interviews with manufacturers to gain insight into the range of potential impacts of standards. During the interviews, the Department 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. The Department will schedule interviews well in advance

to provide every opportunity for key individuals to be available. In addition, the questionnaire will be provided before the interviews to allow the manufacturers to gather the appropriate information. Although a written response to its questionnaire is acceptable, DOE prefers an interactive interview process because it helps clarify responses and provides the opportunity for additional issues to be identified. The Department will prepare a different questionnaire for each of the four products.

The Department will ask interview participants to identify all confidential information provided in writing or orally. It will consider information gathered, as appropriate, in its decision-making process. However, DOE will not make confidential information available in the public record. The Department 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. The Department will incorporate this information into the public record but will report it without attribution.

The Department 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.

***Item 12-1*** *What procedures should the Department follow when scheduling interviews and requesting information?*

## 12.2 Industry Cash Flow Analysis

The industry cash flow analysis relies primarily on the Government Regulatory Impact Model (GRIM). The Department uses the GRIM to analyze the financial impacts of more stringent energy conservation standards on the industry that produces the products covered by the standard.

The GRIM analysis uses a number of factors—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 arrive at a series of annual cash flows beginning from the announcement of the new standard and continuing for several years after its implementation. The Department compares the results against base case projections that involve no new standards. The financial impact of new standards is then 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.

The Department will gather this information from two primary sources: the analyses conducted to this point, and interviews with manufacturers and other stakeholders. Information gathered from previous analyses will include financial parameters, manufacturing costs, price forecasts, and shipments forecasts. Interviews with manufacturers and other stakeholders will be essential in supplementing this information.

## 12.3 Manufacturer Subgroup Analysis

It is possible that the use of average industry cost values will not adequately assess differential impacts among subgroup manufacturers. The Department recognizes that smaller manufacturers, niche players, and manufacturers exhibiting a cost structure that differs largely from the industry average may be more negatively impacted by the imposition of standards. Ideally, the Department would consider the impact on every firm individually. In highly concentrated industries, this may be possible. In industries having numerous participants, however, the Department will use the results of the market and technology assessment to group manufacturers into subgroups, as appropriate.

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

***Item 12-2*** *The Department seeks comment on the establishment of manufacturer subgroups for each of the four products.*

## 12.4 Competitive Impacts Assessment

EPCA directs the Department to consider any lessening of competition that is likely to result from an imposition of standards. (42 U.S.C. 6295(o)(2)(B)(i)(V) and 6316(a)) 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) and 6316(a)) The Department will make a determined effort to gather and report firm-specific financial information and impacts. The competitive analysis will focus on assessing the impacts to smaller, yet significant, manufacturers. DOE will provide the Attorney General with a copy of the NOPR for consideration in his evaluation of the impact of standards on the lessening of competition. The Department 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 would 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).

## 12.5 Cumulative Regulatory Burden

The Department will address and seek to mitigate the overlapping effects of amended DOE standards and other regulatory actions on manufacturers of commercial clothes washers and residential dishwashers, dehumidifiers, and cooking products. The Department 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 others. These issues will be taken into consideration during the manufacturer impact analysis.

The Department is aware that there are other regulations that could affect this industry. These regulations include:

- Department standards for dishwashers, room air conditioners, clothes dryers, and residential clothes washers enacted since 1990;
- Recently amended test procedures for clothes washers and dishwashers;
- Potential refrigerator/freezer anti-circumvention;
- EPACT 2005 prescribed standards for commercial clothes washers and residential dehumidifiers; and
- Replacement of ozone-depleting chemicals previously used in dehumidifiers.

***Item 12-3*** *What other regulations or pending regulations should the Department consider in the manufacturer impact analysis?*

## 13. UTILITY IMPACT ANALYSIS

To perform the utility impact analysis, which will include an analysis of the electric and gas utility industries, the Department plans to use a variant of the EIA's National Energy Modeling System (NEMS), called NEMS-BT (BT is DOE's Building Technologies Program). NEMS-BT is a large, multi-sectoral partial equilibrium model of the U.S. energy sector that has been developed over several years by the EIA, primarily for the purpose of preparing the AEO. NEMS-BT produces a widely recognized reference case forecast for the United States through 2030 and is available in the public domain. Outputs of the utility analysis can parallel results that appear in the latest AEO, with some additions. Typical outputs include forecasts of sales, price, and avoided capacity. The Department plans on conducting the utility impact analysis as a scenario departing from the latest AEO reference case. In other words, the energy savings impacts from amended energy conservation standards will be modeled using NEMS-BT to generate forecasts that deviate from the AEO reference case.[8]

***Item 13-1*** *The Department seeks input from stakeholders on its proposed use of NEMS-BT to conduct the utility impact analysis.*

***Item 13-2*** *Should the Department consider using methods other than NEMS in the utility impact analysis?*

## 14. EMPLOYMENT IMPACT ANALYSIS

The imposition of standards can impact employment both directly and indirectly. Direct employment impacts are changes in the number of employees at the plants that produce the covered equipment, along with the affiliated distribution and service companies, resulting from

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

the imposition of standards. Evaluation of direct employment impacts will be done in the manufacturer impact analysis, as described in section 12. Indirect employment impacts may result from expenditures shifting between goods (the substitution effect) and changes in income and overall expenditure levels (the income effect) that occur due to the imposition of standards. The combined direct and indirect employment impacts will be investigated in the employment impact analysis using the Pacific Northwest National Laboratory's 'Impact of Sector Energy Technologies' (ImSET) model. ImSET was developed for the Department's Office of Planning, Budget, and Analysis, and estimates the employment and income effects of energy-saving technologies in buildings, industry, and transportation. In comparison with simple economic multiplier approaches, ImSET allows for more complete and automated analysis of the economic impacts of energy efficiency investments.

***Item 14-1*** *Is this an acceptable approach to assessing employment impacts?*

## 15. ENVIRONMENTAL ASSESSMENT

The primary environmental effects of energy conservation standards for commercial clothes washers and residential dishwashers, dehumidifiers, and cooking products will be reduced emissions resulting from reduced electrical energy consumption. The environmental impact analysis will track the impact of possible standards on three types of energy-related emissions: carbon dioxide ($CO_2$), oxides of nitrogen ($NO_x$), and sulfur dioxide ($SO_2$). The Department intends to base these calculations on the NEMS-BT modeling work proposed for the utility impact analysis. This approach has the advantage of examining the marginal impact of standards for commercial clothes washers and residential dishwashers, dehumidifiers, and cooking products on the utility generation mix and the subsequent environmental emissions.

Carbon emissions are tracked in NEMS-BT by a detailed module that produces robust results because of its broad coverage of all sectors and inclusion of interactive effects. NEMS-BT also includes a module for $SO_2$-allowance trading and delivers a forecast of $SO_2$-allowance prices. It is important to note, however, that simulation of $SO_2$ trading tends to imply that physical emissions effects will be zero. However, there is an $SO_2$ benefit from conservation in the form of a lower allowance price and, if big enough to be calculable by NEMS, this value can be reported. NEMS-BT also has an algorithm for estimating $NO_x$ emissions from power generation.

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 appliances (e.g., gas water heaters used to heat water for commercial clothes washers and residential dishwashers, and gas cooking products). Therefore, the Department 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-$SO_2$-emissions savings will be reported because the $SO_2$ emissions caps do not apply to the residential sector.

***Item 15-1*** *Are there any other environmental factors the Department should consider in this rulemaking?*

***Item 15-2*** *Are there other approaches to the environmental assessment that the Department should consider?*

## 16. REGULATORY IMPACT ANALYSIS

The Department will, in the NOPR stage, prepare a regulatory impact analysis (RIA) pursuant to Executive Order (E.O.) 12866, "Regulatory Planning and Review," 58 FR 51735, October 4, 1993, which is subject to review under the Executive Order by the Office of Information and Regulatory Affairs (OIRA) at the Office of Management and Budget. The regulatory impact analysis will address the potential for non-regulatory approaches to supplant or augment energy conservation standards to improve the efficiency of commercial clothes washers and residential dishwashers, dehumidifiers, and cooking products on the market.

The Department recognizes that voluntary or other non-regulatory efforts by manufacturers, utilities, and other interested parties can result in substantial efficiency improvements. The Department intends to consider the likely effects of non-regulatory initiatives on product energy use, consumer utility, and life-cycle costs. The Department will attempt to base its assessment on the actual impacts of any such initiatives to date, but also will consider information presented regarding the impacts that any existing initiative might have in the future.

## APPENDIX A – DRAFT ENGINEERING ANALYSIS DATA REQUEST SHEETS

The Department 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. For commercial clothes washers and residential dishwashers, there are also tables requesting energy and water use data.

*Shipments*
For some products, the AHAM *2003 Fact Book* offers historical shipments and efficiency data, but not disaggregated by product class. As shown in the 'shipment request' tables below, the Department hopes to collect both shipments data and shipment-weighted average efficiency data dating back to 1990. In addition, the Department hopes to collect market share efficiency (i.e., data on the distribution of product shipments by efficiency) for each of the product classes.

For cooking products, the Department is requesting only historical product shipments. Because cooking products do not need to comply with minimum performance standards, the Department presumes that energy efficiency data for products sold in the U.S. are not readily available. With regard to historical product shipments, the Department is seeking shipments data for free-standing ranges in addition to the product classes identified above, in order to account for all cooking product shipments.

*Energy and Water Use*
The Department seeks detailed energy use and water use data from manufacturers for the energy efficiency levels that it will analyze for commercial clothes washers and residential dishwashers in the engineering analysis.

*Manufacturer Costs*
Incremental cost data (in U.S. dollars) includes 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 the Department to understand. The Department is therefore requesting information about conversion capital expenditures by efficiency level.

The Department requests notification from those stakeholders planning to submit data by the close of the framework comment period, specifically May 11, 2006. Data submitted to the Department must be received by June 15, 2006. The Department will not accept any data submitted after the June 15, 2006 deadline.

# APPENDIX A1 - ENGINEERING ANALYSIS DATA REQUEST SHEETS FOR COMMERCIAL CLOTHES WASHERS

**Table A1.1 Commercial Clothes Washer Shipment and Shipment-Weighted Average Efficiency Data**

| Year | Shipments, Domestic + Imports (Thousands of Units) | Shipment-Weighted Average Efficiency (EF or MEF) | Shipment-Weighted Average Efficiency (Water Factor) |
|---|---|---|---|
| 1990 | | | |
| 1991 | | | |
| 1992 | | | |
| 1993 | | | |
| 1994 | | | |
| 1995 | | | |
| 1996 | | | |
| 1997 | | | |
| 1998 | | | |
| 1999 | | | |
| 2000 | | | |
| 2001 | | | |
| 2002 | | | |
| 2003 | | | |
| 2004 | | | |
| 2005 | | | |

**Table A1.2 Commercial Clothes Washer Market Share Efficiency Data**

| Efficiency Bins (MEF) | Market Share (percent) 2002 | 2003 | 2004 | Efficiency Bins (Water Factor) | Market Share (percent) 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|
| **< 1.20** | | | | **> 9.5** | | | |
| **1.20-1.29:** Baseline = 1.26 | | | | **8.6-9.5:** Baseline = 9.5 | | | |
| **1.30-1.59:** CEE Tier 1 = 1.42 | | | | **8.6-9.5:** CEE Tier 1 = 9.5 | | | |
| **1.60-1.69:** CEE Tier 2 = 1.60 | | | | **8.1-8.5:** CEE Tier 2 = 8.5 | | | |
| **1.70-1.79:** 2007 E. Star =1.72 | | | | **7.6-8.0:** 2007 E. Star = 8.0 | | | |
| **1.80-1.89:** CEE Tier 3A =1.80 | | | | **6.1-7.5:** CEE Tier 3A = 7.5 | | | |
| **1.80-1.89:** CEE Tier 3B =1.80 | | | | **4.0-6.0:** CEE Tier 3B = 5.5 | | | |
| **> 1.89:** Max Available = 2.79 | | | | **< 4.0:** Min Available = 3.5 | | | |

**Table A1.3 Required Energy and Water Use Data for Commercial Clothes Washers**

| Product Characteristics | | Energy Use | | | Water Use |
|---|---|---|---|---|---|
| Efficiency Level (MEF) | Clothes Container (cu.ft.) | Hot Water (kWh/cycle) | Machine (kWh/cycle) | Dryer* (kWh/cycle) | (gallons/cycle) |
| 1.42 | | | | | |
| 1.60 | | | | | |
| 1.72 | | | | | |
| 1.80 | | | | | |
| 2.79 | | | | | |

* Because the MEF accounts for the energy used to dry clothes, dryer energy use is included.

## Table A1.4 Commercial Clothes Washer Manufacturer Cost Data

| Product Class ➔ | Top-Loading and Front-Loading | | | | |
|---|---|---|---|---|---|
| Efficiency Level | 1 | 2 | 3 | 4 | 5 |
| MEF | 1.42 | 1.60 | 1.72 | 1.80 | 2.79 |
| Water Factor+ | | | | | |
| | **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 | | | | | |

+ While CEE and ENERGY STAR have established pairings of water factor and MEF, manufacturer respondents should suggest the water factor that they believe should be paired with each MEF (Water Factor should be < 9.5).
# 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 commercial clothes washers (effective 2007) and is equal to 1.26 MEF and a water factor of 9.5 for all product classes.

**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); research and development (R&D); interest; or profit (accounted for by the Department 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 A2 - ENGINEERING ANALYSIS DATA REQUEST SHEETS FOR RESIDENTIAL DISHWASHERS

## Table A2.1 Dishwasher Shipment and Shipment-Weighted Average Efficiency Data

| Year | Shipments, Domestic + Imports (Thousands of Units) | | Shipment-Weighted Average Efficiency (EF) | |
|---|---|---|---|---|
| | Standard | Compact | Standard | Compact |
| 1990 | | | | |
| 1991 | | | | |
| 1992 | | | | |
| 1993 | | | | |
| 1994 | | | | |
| 1995 | | | | |
| 1996 | | | | |
| 1997 | | | | |
| 1998 | | | | |
| 1999 | | | | |
| 2000 | | | | |
| 2001 | | | | |
| 2002 | | | | |
| 2003 | | | | |
| 2004 | | | | |
| 2005 | | | | |

## Table A2.2 Dishwasher Market Share Efficiency Data

| Standard | | | | Compact | | | |
|---|---|---|---|---|---|---|---|
| | Market Share (percent) | | | | Market Share (percent) | | |
| Efficiency Bins (EF) | 2002 | 2003 | 2004 | Efficiency Bins (EF) | 2002 | 2003 | 2004 |
| **0.45-0.49:** Baseline = 0.46 | | | | **0.60-0.64:** Baseline = 0.62 | | | |
| **0.50-0.59:** ENERGY STAR = 0.58 | | | | **0.65-0.79:** ENERGY STAR = 0.78 | | | |
| **0.60-0.64:** CEE Tier 1 = 0.62 | | | | **0.80-0.84:** CEE Tier 1 = 0.84 | | | |
| **0.65-0.67:** 2007 E. Star = 0.65 | | | | **0.85-0.89:** 2007 E. Star = 0.88 | | | |
| **0.68-0.69:** CEE Tier 2 = 0.68 | | | | **0.90-0.94:** CEE Tier 2 = 0.92 | | | |
| **0.70-0.79**: Gap Fill = 0.75 | | | | **0.95-1.04**: Gap Fill = 1.01 | | | |
| **0.80-0.84**: Gap Fill = 0.80 | | | | **1.05-1.09**: Gap Fill = 1.08 | | | |
| **> 0.84:** Market Max = 1.11 | | | | **> 1.09:** Market Max = 1.74 | | | |

**Table A2.3 Required Energy and Water Use Data for Standard Dishwashers**

| | Energy Use | | | Water Use |
|---|---|---|---|---|
| Efficiency Level (EF) | Hot Water (kWh/cycle) | Booster (kWh/cycle) | Machine (kWh/cycle) | (gallons/cycle) |
| 0.58 | | | | |
| 0.62 | | | | |
| 0.65 | | | | |
| 0.68 | | | | |
| 0.75 | | | | |
| 0.80 | | | | |
| 1.11 | | | | |

**Table A2.4 Required Energy and Water Use Data for Compact Dishwashers**

| | Energy Use | | | Water Use |
|---|---|---|---|---|
| Efficiency Level (EF) | Hot Water (kWh/cycle) | Booster (kWh/cycle) | Machine (kWh/cycle) | (gallons/cycle) |
| 0.78 | | | | |
| 0.84 | | | | |
| 0.88 | | | | |
| 0.92 | | | | |
| 1.01 | | | | |
| 1.08 | | | | |
| 1.74 | | | | |

## Table A2.5 Residential Dishwasher Manufacturer Cost Data

| Product Class ➔ | Compact Dishwashers | | | | | | | Standard Dishwashers | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Efficiency Level | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| EF | 0.78 | 0.84 | 0.88 | 0.92 | 1.01 | 1.08 | 1.74 | 0.58 | 0.62 | 0.65 | 0.68 | 0.75 | 0.80 | 1.11 |
| **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 dishwashers and is equal to 0.62 cycles/kWh for compact dishwashers and 0.46 cycles/kWh for standard dishwashers.

**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); research and development (R&D); interest; or profit (accounted for by the Department 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 A3 - ENGINEERING ANALYSIS DATA REQUEST SHEETS FOR RESIDENTIAL DEHUMIDIFIERS

**Table A3.1 Dehumidifier Shipment and Shipment-Weighted Average Efficiency Data**

| Year | Shipments, Domestic + Imports (Thousands of Units) | | | | | | Shipment-Weighted Average Efficiency (liters/kWh) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ≤ 25.00 | 25.01-35.00 | 35.01-45.00 | 45.01-54.00 | 54.01-74.99 | ≥75.00 | ≤ 25.00 | 25.01-35.00 | 35.01-45.00 | 45.01-54.00 | 54.01-74.99 | ≥75.00 |
| 1990 | | | | | | | | | | | | |
| 1991 | | | | | | | | | | | | |
| 1992 | | | | | | | | | | | | |
| 1993 | | | | | | | | | | | | |
| 1994 | | | | | | | | | | | | |
| 1995 | | | | | | | | | | | | |
| 1996 | | | | | | | | | | | | |
| 1997 | | | | | | | | | | | | |
| 1998 | | | | | | | | | | | | |
| 1999 | | | | | | | | | | | | |
| 2000 | | | | | | | | | | | | |
| 2001 | | | | | | | | | | | | |
| 2002 | | | | | | | | | | | | |
| 2003 | | | | | | | | | | | | |
| 2004 | | | | | | | | | | | | |
| 2005 | | | | | | | | | | | | |

**Table A3.2 Dehumidifier Market Share Efficiency Data, ≤ 25.00 and 25.01–35.00 pints/day Product Classes**

| ≤ 25.00 pints/day | | | | 25.01 35.00 pints/day | | | |
|---|---|---|---|---|---|---|---|
| | Market Share (percent) | | | | Market Share (percent) | | |
| Efficiency Bins (Liters/kWh) | 2002 | 2003 | 2004 | Efficiency Bins (Liters/kWh) | 2002 | 2003 | 2004 |
| **< 1.00** | | | | **< 1.20** | | | |
| **1.00-1.09:** Baseline = 1.00 | | | | **1.20-1.24:** Baseline = 1.20 | | | |
| **1.10-1.19:** Mid Point 1 = 1.10 | | | | **1.25-1.29:** Mid Point 1 = 1.25 | | | |
| **1.20-1.29:** EPACT 2005=1.20 | | | | **1.30-1.39:** EPACT 2005=1.30 | | | |
| **1.30-1.37:** Mid Point 2 = 1.30 | | | | **1.40-1.44:** Mid Point 2 = 1.40 | | | |
| **> 1.37:** Max Available = 1.38 | | | | **> 1.44:** Max Available = 1.45 | | | |

**Table A3.3 Dehumidifier Market Share Efficiency Data, 35.01–45.00 and 45.01–54.00 pints/day Product Classes**

| 35.01 45.00 pints/day | | | | 45.01 54.00 pints/day | | | |
|---|---|---|---|---|---|---|---|
| | Market Share (percent) | | | | Market Share (percent) | | |
| Efficiency Bins (Liters/kWh) | 2002 | 2003 | 2004 | Efficiency Bins (Liters/kWh) | 2002 | 2003 | 2004 |
| **< 1.30** | | | | **< 1.40** | | | |
| **1.30-1.34:** Baseline = 1.30 | | | | **1.40-1.44:** Baseline = 1.40 | | | |
| **1.35-1.39:** Mid Point 1 = 1.35 | | | | **1.45-1.49:** Mid Point 1 = 1.45 | | | |
| **1.40-1.49:** EPACT 2005=1.40 | | | | **1.50-1.59:** EPACT 2005=1.50 | | | |
| **1.50-1.59:** Mid Point 2 = 1.50 | | | | **1.60-1.69:** Mid Point 2 = 1.60 | | | |
| **> 1.59:** Max Available = 1.74 | | | | **> 1.69:** Max Available = 2.02 | | | |

**Table A3.4 Dehumidifier Market Share Efficiency Data, 54.01–74.00 and ≥75.00 pints/day Product Classes**

| 54.01 74.99 pints/day | | | | ≥ 75.00 pints/day | | | |
|---|---|---|---|---|---|---|---|
| | Market Share (percent) | | | | Market Share (percent) | | |
| **Efficiency Bins** (Liters/kWh) | **2002** | **2003** | **2004** | **Efficiency Bins** (Liters/kWh) | **2002** | **2003** | **2004** |
| **< 1.50** | | | | **< 2.25** | | | |
| **1.50-1.54:** Baseline = 1.50 | | | | **2.25-2.34:** Baseline = 2.25 | | | |
| **1.55-1.59:** Mid Point 1 = 1.55 | | | | **2.35-2.44:** Mid Point 1 = 2.38 | | | |
| **1.60-1.69:** EPACT 2005=1.60 | | | | **2.45-2.54:** EPACT 2005=2.50 | | | |
| **1.70-1.79:** Mid Point 2 = 1.70 | | | | **2.55-2.64:** Mid Point 2 = 2.60 | | | |
| **> 1.79:** Max Available = 1.88 | | | | **> 2.64:** Max Available = 2.75 | | | |

## Table A3.5 Residential Dehumidifier Manufacturer Cost Data

| Product Class ➔ | 35.01-45.00 pints/day | | | |
|---|---|---|---|---|
| Efficiency Level | 1 | 2 | 3 | 4 |
| liters / kWh | 1.35 | 1.40 | 1.50 | 1.74 |
| | **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 dehumidifiers (effective 2007) and is equal to 1.30 liters/kWh for 35.01-45.00 pints/day.

**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); research and development (R&D); interest; or profit (accounted for by the Department 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 A4 - ENGINEERING ANALYSIS DATA REQUEST SHEETS FOR RESIDENTIAL COOKING PRODUCTS

## Table A4.1 Gas Cooking Product Shipment Data

| | **Shipments, Domestic + Imports** (Thousands of Units) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Free-Standing Ranges** | | | | **Built-In Ovens** | | | | | |
| | **Standard** | | | | **Standard** | | | | **Cooktops** | |
| **Year** | **Pilot** | **No Pilot** | **Self-Clean** | **Other** | **Pilot** | **No Pilot** | **Self-Clean** | **Other** | **Pilot** | **No Pilot** |
| 1990 | | | | | | | | | | |
| 1991 | | | | | | | | | | |
| 1992 | | | | | | | | | | |
| 1993 | | | | | | | | | | |
| 1994 | | | | | | | | | | |
| 1995 | | | | | | | | | | |
| 1996 | | | | | | | | | | |
| 1997 | | | | | | | | | | |
| 1998 | | | | | | | | | | |
| 1999 | | | | | | | | | | |
| 2000 | | | | | | | | | | |
| 2001 | | | | | | | | | | |
| 2002 | | | | | | | | | | |
| 2003 | | | | | | | | | | |
| 2004 | | | | | | | | | | |
| 2005 | | | | | | | | | | |

## Table A4.2 Electric Cooking Product Shipment Data

| | **Shipments, Domestic + Imports** (Thousands of Units) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Free-Standing Ranges*** | | | | | **Built-In Ovens**** | | | **Cooktops^** | | | **MW Ovens** |
| **Year** | **Coil/Std** | **Coil/SC** | **Smth/Std** | **Smth/SC** | **Other** | **Std** | **SC** | **Other** | **Coil** | **Smth** | **Other** | |
| 1990 | | | | | | | | | | | | |
| 1991 | | | | | | | | | | | | |
| 1992 | | | | | | | | | | | | |
| 1993 | | | | | | | | | | | | |
| 1994 | | | | | | | | | | | | |
| 1995 | | | | | | | | | | | | |
| 1996 | | | | | | | | | | | | |
| 1997 | | | | | | | | | | | | |
| 1998 | | | | | | | | | | | | |
| 1999 | | | | | | | | | | | | |
| 2000 | | | | | | | | | | | | |
| 2001 | | | | | | | | | | | | |
| 2002 | | | | | | | | | | | | |
| 2003 | | | | | | | | | | | | |
| 2004 | | | | | | | | | | | | |
| 2005 | | | | | | | | | | | | |

* Free-Standing Range product classes: Coil Cooktop/Standard Oven; Coil Cooktop/Self-Cleaning Oven; Smooth Cooktop/Standard Oven; Smooth Cooktop/Self-Cleaning Oven; and Other.

** Built-In Oven product classes: Standard; Self-Cleaning; and Other.

^ Cooktop product classes: Coil; Smooth; and Other.

**Table A4.3 Required Energy Use Data for Gas Cooktops**

| Efficiency Level (EF) | Cooking Efficiency (Eff) | Standing Pilot | |
|---|---|---|---|
| | | Number of Pilots | Input Rate per Pilot (Btu/hr) |
| 0.156* | | | |
| 0.399# | | NA | NA |
| 0.420 | | NA | NA |

* Baseline efficiency level assumes the inclusion of a standing pilot ignition system.
# First efficiency level assumes the elimination of the standing pilot system.

**Table A4.4 Required Energy Use Data for Gas Standard Ovens with or without a catalytic line**

| Efficiency Level (EF) | Cooking Efficiency (Eff) | Standing Pilot Input Rate (Btu/hr) | Electrical Test Energy Consumption** (Watt-hr) |
|---|---|---|---|
| 0.030* | | | NA |
| 0.058# | | NA | |
| 0.062 | | NA | |
| 0.065 | | NA | |

* Baseline efficiency level assumes the inclusion of a standing pilot ignition system.
# First efficiency level assumes the elimination of the standing pilot ignition system.
** Electrical test energy consumption as measured by DOE test procedure. Includes electrical energy use for ignition system plus any other electrical energy use.

**Table A4.5 Required Energy Use Data for Gas Self-Clean Ovens**

| Efficiency Level (EF) | Cooking Efficiency (Eff) | Self-Cleaning Energy Consumption | | Electrical Test Energy Consumption* (Watt-hr) | Clock Power (Watts) |
|---|---|---|---|---|---|
| | | Gas Use per cycle (Btu/cycle) | Secondary Electricity Use per cycle (Watt-hr/cycle) | | |
| 0.054 | | | | | |
| 0.062 | | | | | |
| 0.063 | | | | | |
| 0.065 | | | | | |

* Electrical test energy consumption as measured by DOE test procedure. Includes electrical energy use for ignition system plus any other electrical energy use not used during the self-cleaning cycle.

**Table A4.6 Required Energy Use Data for Electric Standard Ovens with or without a catalytic line**

| Efficiency Level (EF) | Cooking Efficiency (Eff) | Clock Power (Watts) |
|---|---|---|
| 0.107 | | |
| 0.111 | | |
| 0.118 | | |
| 0.180 | | |

**Table A4.7 Required Energy Use Data for Electric Self-Clean Ovens**

| Efficiency Level (EF) | Cooking Efficiency (Eff) | Self-Cleaning Energy Consumption per cycle (Watt-hr/cycle) | Clock Power (Watts) |
|---|---|---|---|
| 0.096 | | | |
| 0.133 | | | |
| 0.136 | | | |
| 0.137 | | | |

**Table A4.8 Required Energy Use Data for Microwave Ovens**

| Efficiency Level (EF) | Input Power* (Watts) | Auxiliary Power** (Watts) | Efficiency*** |
|---|---|---|---|
| 0.557 | | | |
| 0.586 | | | |
| 0.588 | | | |
| 0.597 | | | |
| 0.602 | | | |

* Includes power to: magnetron tube filament, magnetron power supply, fan motor/turntable/light.
** Any other power not included as input power.
*** Efficiency is the product of the following efficiencies: high-voltage power supply, magnetron, and wave guide and cavity.

## Table A4.9 Residential Gas Cooktop Manufacturer Cost Data

| Product Class ➔ | Conventional Burners | |
|---|---|---|
| Efficiency Level | 1 | 2 |
| EF | 0.399 | 0.420 |
| | **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 proposed baseline residential gas cooktop is assumed to have an EF of 0.156.

**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); research and development (R&D); interest; or profit (accounted for by the Department 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 A4.10 Residential Electric Cooktop Manufacturer Cost Data

| Product Class ➔ | Low or high wattage open (coil) elements | | | Smooth elements | | |
|---|---|---|---|---|---|---|
| Efficiency Level | 1 | 2 | 3 | 1 | 2 | 3 |
| EF | 0.753 | 0.769 | 0.777 | 0.753 | 0.797 | 0.840 |
| **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 proposed baseline coil element electric cooktop is assumed to have an EF of 0.737 and the proposed baseline smooth element electric cooktop is assumed to have an EF of 0.742.

**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); research and development (R&D); interest; or profit (accounted for by the Department 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 A4.11 Residential Gas Oven Manufacturer Cost Data

| Product Class ➔ | Standard oven with or without catalytic line | | | Self-clean oven | | |
|---|---|---|---|---|---|---|
| Efficiency Level | 1 | 2 | 3 | 1 | 2 | 3 |
| EF | 0.058 | 0.062 | 0.065 | 0.062 | 0.063 | 0.065 |
| | **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 proposed baseline standard gas oven is assumed to have an EF of 0.030 and the proposed baseline self-cleaning gas oven is assumed to have an EF of 0.054.

**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); research and development (R&D); interest; or profit (accounted for by the Department 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 A4.12 Residential Electric Oven Manufacturer Cost Data

| Product Class ➔ | Standard oven with or without catalytic line | | | Self-clean oven | | |
|---|---|---|---|---|---|---|
| Efficiency Level | 1 | 2 | 3 | 1 | 2 | 3 |
| EF | 0.111 | 0.118 | 0.180 | 0.133 | 0.136 | 0.137 |
| **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 proposed baseline standard electric oven is assumed to have an EF of 0.107 and the proposed baseline self-cleaning electric oven is assumed to have an EF of 0.096.

**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); research and development (R&D); interest; or profit (accounted for by the Department 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 A4.13 Residential Microwave Oven Manufacturer Cost Data

| Product Class ➔ | Microwave Oven | | | |
|---|---|---|---|---|
| Efficiency Level | 1 | 2 | 3 | 4 |
| EF | 0.586 | 0.588 | 0.597 | 0.602 |
| | **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 proposed baseline residential microwave oven is assumed to have an EF of 0.557.

**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); research and development (R&D); interest; or profit (accounted for by the Department 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 INTERVIEWS AND PRELIMINARY MANUFACTURER IMPACT ANALYSIS

### DESIGN FOR ENERGY IMPROVEMENT INFORMATION REQUEST

The Department would like to confirm information on the incremental costs of increasing product efficiency by understanding the design options involved in the efficiency improvement. Questions for commercial clothes washers, dehumidifiers, and cooking products will follow the same format as the sample questions for dishwashers listed below.

*Residential Dishwashers*

1. Which design features impacting energy use are generally incorporated into a "baseline" dishwasher?

2. What design changes are generally required to convert a typical standard size dishwasher (0.46 EF) to the ENERGY STAR level (0.58 EF)? Are these design changes comparable for compact dishwashers? What are the costs of the individual design options selected? Are the aggregated industry costs representative of your firm's costs?

3. What additional design changes are required to achieve the 2007 ENERGY STAR levels (0.65 EF for standard dishwashers and 0.88 EF for compact dishwashers)? What are the costs of the individual design options selected? Are the aggregated industry costs representative of your firm's costs?

4. What are the fundamental differences between required design changes that make the cost increment much higher for some product class/sizes than others?

5. Would you help the Department 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 (or at a similar "high efficiency" level for those products without ENERGY STAR specifications) 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 dishwashers and dehumidifiers and commercial 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?