Rulemaking Framework for Residential Dehumidifiers

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
BT	Building Technologies Program
CAIR	Clean Air Interstate Rule
CEC	California Energy Commission
CFR	Code of Federal Regulations
CO_2	carbon dioxide
CSA	Canadian Standards Association
CSL	candidate standard level
D.C.	District of Columbia
DOE	U.S. Department of Energy
DOJ	U.S. Department of Justice
EERE	Office of Energy Efficiency and Renewable Energy
EF	energy factor
EGU	electric generating unit
EIA	Energy Information Administration
EISA	Energy Independence and Security Act of 2007
EPACT	Energy Policy Act of 2005
EPA	U.S. Environmental Protection Agency
EPCA	Energy Policy and Conservation Act
FR	*Federal Register*
GDP	gross domestic product
GHG	greenhouse gas
GRIM	Government Regulatory Impact Model
Hg	Mercury
HCFC	hydrochlorofluorocarbon
IEC	International Electrotechnical Commission
ImSET	Impact of Sector Energy Technologies
kWh	kilowatt-hour
LCC	life-cycle cost
NAICS	North American Industry Classification System
NECPA	National Energy Conservation Policy Act of 1978
NEMS	National Energy Modeling System
NES	national energy savings
NESHAP	national emissions standards for hazardous air pollutants
NOPR	notice of proposed rulemaking
NO_x	oxides of nitrogen
NPV	net present value
OMB	U.S. Office of Management and Budget
PM	particulate matter
PNNL	Pacific Northwest National Laboratory
PBP	payback period

R&D	research and development
RECS	Residential Energy Consumption Survey
SCC	social cost of carbon
SEC	Securities and Exchange Commission
SG&A	selling, general, and administrative costs
SNOPR	supplemental notice of proposed rulemaking
SO_2	sulfur dioxide
SWEF	shipment-weighted efficiency
TSD	technical support document
TSL	trial standard level
U.S.	United States
U.S.C.	United States Code

Rulemaking Framework for Residential Dehumidifiers

1. INTRODUCTION

The purpose of this document is to describe the procedural and analytical approaches the U.S. Department of Energy (DOE) anticipates using to evaluate energy conservation standards for residential dehumidifiers.

The DOE Appliances and Commercial Equipment Standards Program, in the Office of Energy Efficiency and Renewable Energy's (EERE's) Building Technologies Program, develops and promulgates test procedures and energy conservation standards for consumer appliances and commercial equipment. The process for developing standards involves analyses, 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 having an interest in the standards and test procedures.

This document is intended to inform stakeholders of the standards rulemaking process for dehumidifiers 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 17 discuss analyses DOE intends to conduct to follow the statutory guidance and requirements for this standards rulemaking. In determining whether amended energy conservation standards are feasible and justified, DOE will conduct an engineering analysis, a life-cycle cost (LCC) and payback period (PBP) analysis, a national impact analysis, and a manufacturer impact analysis, among others.

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

This document contains comment boxes that highlight issues on which DOE seeks comment and requests feedback from interested parties. The comment boxes also 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

Title III, Part B of the Energy Policy and Conservation Act (EPCA) of 1975, Pub. L. 94-163, (42 U.S.C. 6291–6309), as amended, established an energy conservation program for consumer products other than automobiles.[1]

[1] Upon codification in the U.S. Code, Part B was re-designated Part A for editorial reasons.

The Energy Policy Act of 2005 (EPACT 2005), Pub. L. 109-58, amended EPCA to establish energy conservation standards for dehumidifiers[2] manufactured as of October 1, 2007. (Section 135(c)(4)) EPACT 2005 also required that DOE issue a final rule by October 1, 2009, to determine whether these standards should be amended. (*Id.*) Compliance with any amended standards would be required for dehumidifiers manufactured as of October 1, 2012. (*Id.*) In the event that DOE did not publish a final rule, EPACT 2005 specified a new set of amended standards with a compliance date of October 1, 2012. (*Id.*)

DOE issued an advance notice of proposed rulemaking (ANOPR) to consider energy conservation standards for dehumidifiers and other products. 72 FR 64432 (Nov. 15, 2007). The Energy Independence and Security Act of 2007 (EISA 2007), Pub. L 110-140 subsequently amended EPCA to prescribe new energy conservation standards for dehumidifiers manufactured on or after October 1, 2012. DOE codified the EISA 2007 standards at 10 CFR 430.32(v)(2). 74 FR 12058 (Mar. 23, 2009).

EPCA also requires that, not later than 6 years after the issuance of a final rule establishing or amending a standard, DOE publish a notice of proposed rulemaking (NOPR) proposing new standards or a notice of determination that the existing standards do not need to be amended. (42 U.S.C. 6295(m)(1))

1.2 Overview of the Rulemaking Process

The rulemaking process for dehumidifiers is comprised of several steps: establishing test procedures to evaluate energy consumption of products; performing various preliminary analyses of the technological and economic feasibility of standards; issuing a notice of proposed rulemaking; and issuing a final rule. The Department encourages stakeholder participation in the rulemaking process.

1.2.1 Test Procedures

EPCA specifies that the test procedure for dehumidifiers must be based on the U.S. Environmental Protection Agency (EPA)'s test criteria used under the ENERGY STAR Program in effect on August 8, 2005, unless DOE revises the test procedures. (42 U.S.C. 6293(b)(13)) Those ENERGY STAR test criteria require that American National Standards Institute (ANSI)/Association of Home Appliance Manufacturers (AHAM) Standard DH-1 be used to measure capacity in pints of moisture removed per day, while Canada's CAN/Canadian Standards Association (CSA)-C749-94 is used to calculate the energy factor (EF) in terms of liters of moisture removed per kilowatt-hour (kWh). DOE codified the test procedure requirements from EPCA for dehumidifiers at 10 CFR part 430 subpart B, appendix X. 71 FR 71340 (Dec. 8, 2006).

[2] 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. (42 U.S.C. 6291(34))

EPCA requires that DOE amend the test procedures for certain residential products, including dehumidifiers, to incorporate measures of standby mode and off mode energy use, if technically feasible. DOE published a NOPR in which it proposed to incorporate by reference in the test procedures for dehumidifiers and other products an international test method for measuring standby mode and off mode power consumption, International Electrotechnical Commission (IEC) Standard 62301. 75 FR 75290 (Dec. 2, 2010). DOE subsequently published a supplemental notice of proposed rulemaking (SNOPR) to propose referencing the updated version of IEC Standard 62301. 76 FR 58346 (Sept. 20, 2011). In a second SNOPR, DOE proposed in relevant part to measure both capacity and EF for dehumidifiers according to the current version of AHAM Standard DH-1. 77 FR 31444 (May 25, 2012).

1.2.2 Rulemaking Process and Stakeholder Participation

Under EPCA, when DOE establishes 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)) Other statutory requirements include those set forth in 42 U.S.C. 6295 (o)(1)–(2)(A), (2)(B)(ii)–(iii), and (3)–(4).

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 public comment on the Framework Document and during subsequent comment periods, interactions among stakeholders provide a balanced discussion of critical information required to conduct the standards rulemaking. Additionally, the Department encourages the development and submission of consensus agreements between stakeholders.

In conducting the energy conservation standards rulemakings, DOE involves stakeholders through public notifications (*i.e.*, *Federal Register* notices). Subsequent to notice of the Framework Document, the standards rulemaking process involves three public notices. The Preliminary Analysis (*see* section 1.3) incorporates stakeholder comments to the Framework Document and 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 Preliminary Analysis; the analysis of the impacts of standards on consumers, manufacturers and the nation; the Department's weighing 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 weighing of the impacts; any final standards adopted by DOE; and the compliance dates of such standards.

1.3 Preliminary Analysis

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 identifying the key issues and design options or efficiency levels to be considered by the Department in the rulemaking.

At the start of the Preliminary Analysis, the Department considers potential 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 Preliminary Analysis stage, DOE presents consumer LCC impact and PBP 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 bases the selection of efficiency or energy use levels to analyze 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 other efficiency levels considered.

The efficiency or energy use levels analyzed serve to demonstrate the functions and outputs of the models and tools used by DOE . During the Preliminary Analysis, these models and tools are tested for the different product classes at each efficiency or energy use level analyzed.

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 Preliminary Analysis. When the Department publishes the Preliminary Analysis, 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 Preliminary Analysis, there is a public comment period and a public meeting. DOE also conducts 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 emissions analysis (*see* section 15), and a regulatory impact analysis (*see* section 17).

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 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 and costs of the standards. 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 public comment period that includes a 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 TSLs 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 any final standard levels based on the complete record of the standards rulemaking. The final rule will promulgate any final standard levels and their compliance date and explain the basis for their selection. The final rule will be accompanied by a final TSD.

2. ANALYSES FOR RULEMAKING

EPCA requires DOE to establish energy conservation standards that achieve the maximum improvement in energy efficiency that is technologically feasible and economically justified. 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 ensure 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, 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.

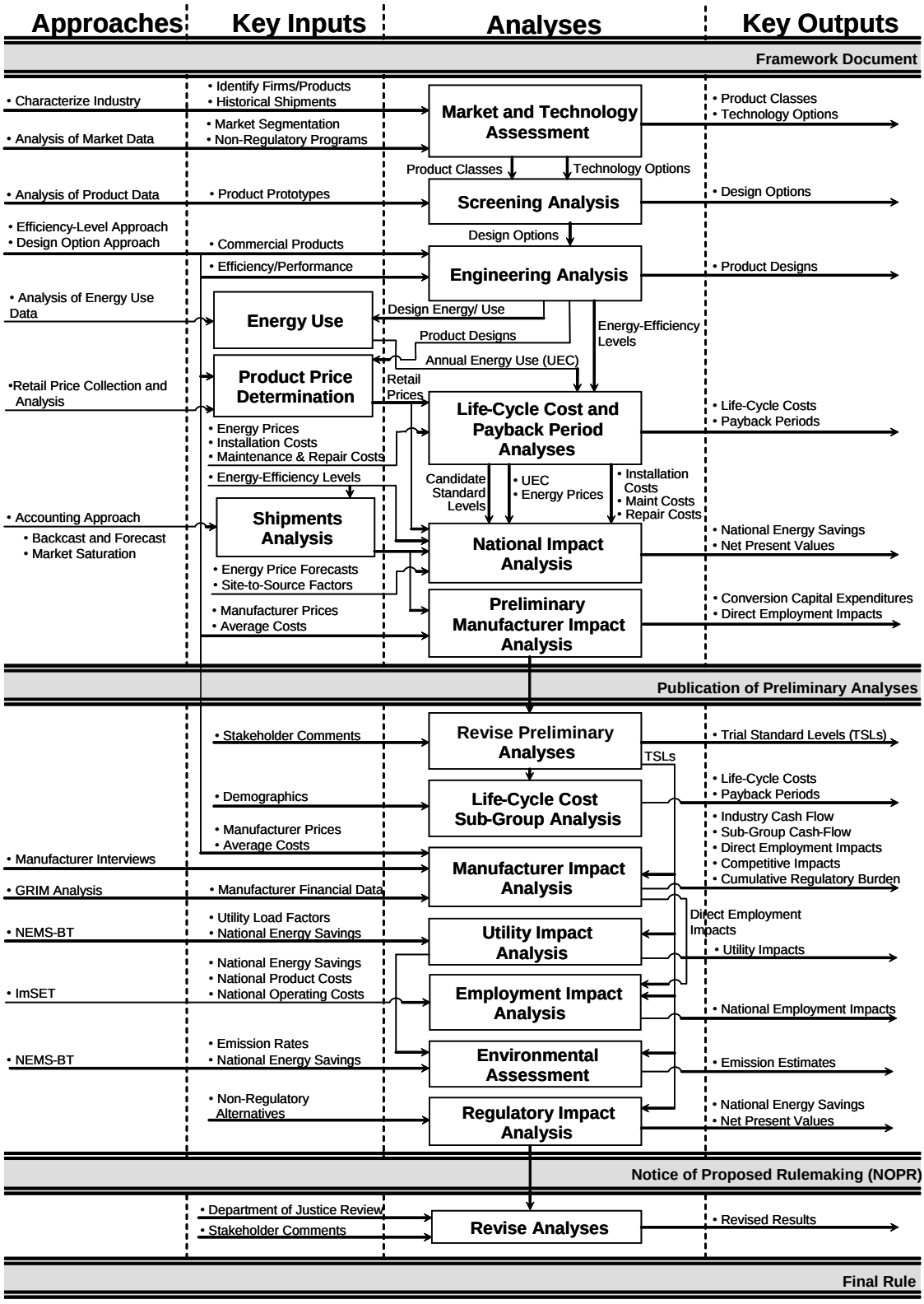

Figure 2-1 Flow Diagram of Analyses for the Residential Dehumidifier Energy Conservation Standards Rulemaking Process

3. MARKET AND TECHNOLOGY ASSESSMENT

The market and technology assessment will provide information about the residential dehumidifier product industries. This assessment is used to determine product classes and 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 residential dehumidifier product industries and markets. In the market assessment, the Department will identify and characterize the manufacturers of dehumidifiers; 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 dehumidifiers; and explore the potential for technological improvements in the design and manufacturing of dehumidifiers.

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 used to assess 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 dehumidifiers into product classes. The Department will consider a separate energy conservation standard for each product class. The criteria for separation into different classes are: type of energy used and capacity or other performance-related features that justify a separate energy conservation standard. In determining product classes, DOE is required to consider the utility of the feature to the consumer and other factors deemed appropriate by the Secretary. (42 U.S.C. 6295(q))

For dehumidifiers, EPCA establishes product classes based on the capacity of the unit as measured in pints of water extracted per day. (42 U.S.C. 6295(cc)) The Department will analyze whether there are unique design constraints associated with a unit's capacity that warrant the creation of separate product classes. In this Framework Document, the Department is considering the following product classes as they were established in the EISA 2007 amendments to EPCA for dehumidifiers manufactured on or after October 1, 2012 (42 U.S.C. 6295(cc)(2)):[3]

[3] For standards effective October 1, 2007, EPACT 2005, in section 135(c), specified 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. EISA 2007, in section 311(a)(1), prescribed a new set of standards for dehumidifiers to take effect on October 1, 2012. In providing a new set of standards, EISA 2007 consolidated the two smallest product classes (25.00 pints/day or less and 25.01 – 35.00 pints/day) and subdivided 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.

- Up to 35.00 pints/day;
- 35.01–45.00 pints/day;
- 45.01–54.00 pints/day;
- 54.01–75.00 pints/day; and
- Greater than 75.00 pints/day.

DOE notes that whole-home units generally use equivalent dehumidification technologies as portable units, but are designed to operate in a ducted installation, typically in conjunction with the home's central air conditioning system. Therefore, whole-home dehumidifier performance is affected by the air flow and pressure impacts resulting from the ducting and possibly other factors. In addition, whole-home dehumidifiers may be installed with a fresh air intake rather than having conditioned air at the intake side. DOE's research indicates that the capacity of whole-home dehumidifiers ranges from approximately 65 to 200 pints/day, with no distinct correlation between capacity and EF, as measured by the current DOE test procedure in an unducted configuration. Therefore, DOE is considering an additional product class for whole-home dehumidifiers, with the five product classes listed above applying only to portable dehumidifiers.

DOE also recognizes that some portable dehumidifiers can be operated in a ducted installation. Because as noted above dehumidifier performance is affected by the backpressure and airflow associated with ducting, DOE requests information on how such units should be classified. Options may included classifying under the least energy-intensive configuration (*i.e.*, as a portable unit with no ducting), a more energy-intensive configuration (*i.e.*, with ducting in place, similar to a whole-home or through-the-wall installation), or some alternative or combination thereof.

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? Should DOE consider separate product class(es) for whole-home dehumidifiers? How should DOE classify portable dehumidifiers that can be operated in a ducted installation?*

3.3 Technology Assessment

The Department uses information about commercially available 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 that may improve energy efficiency and will serve to establish the maximum technologically feasible design. In the screening analysis, DOE will eliminate from consideration technologies that are not technologically feasible, or that fail to meet certain criteria as to practicability to manufacture, install and service, impacts on product utility or availability, or impacts on health or safety.

In the previous standards rulemaking for dehumidifiers, DOE identified the following designs which may be used to improve dehumidifier performance. 72 FR 64432, 64451 (Nov. 15, 2007):

- Built-in hygrometer/humidistat
- Improved compressor efficiency
- Improved condenser performance
- Improved controls
- Improved defrost methods
- Improved demand-defrost controls
- Improved evaporator performance
- Improved fan-motor efficiency
- Improved fan efficiency
- Improved flow-control devices
- Low-standby-loss electronic controls
- Washable air filters

DOE has also identified through research and review of product literature for this rulemaking additional designs which may be used to decrease dehumidifier energy use, including heat pipe technology.

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. The baseline model in each product class represents the characteristics of products in that class. Typically, a baseline model would be a model that just meets currently required energy conservation standards.

The Department will use the baseline models in the engineering analysis and the LCC and PBP 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.

As identified in section 3.2, the Department proposes six product classes for dehumidifiers—the five product classes defined for the October 2012 standards and one product class for whole-home dehumidifiers. An initial review of dehumidifier models in DOE's *Compliance Certification Database* shows a correlation between efficiency and capacity for portable units. Because efficiency seems to be a function of capacity for these dehumidifiers, the Department

plans to complete the engineering and LCC analyses on the existing product classes that represent the majority of portable unit shipments, and then extrapolate to the other two portable product classes. Based on these criteria, DOE is considering the 35.01–45.00 pints/day, 45.01–54.00, and 54.01–75.00 pints/day product classes as the representative product classes. DOE also plans to include the whole-home product class for the engineering and LCC analyses.

EPCA sets minimum energy conservation standards for dehumidifiers based on the unit's capacity (in pints/day). (42 U.S.C. 6295(cc)) The Department will use the EPCA standards of 1.50 liters/kWh and 1.70 liters/kWh, which become effective October 1, 2012, as the baseline efficiencies for these representative units in the 35.01–45.00 pints/day and 54.01–75.00 pints/day product classes, respectively. In addition, DOE will conduct the engineering and LCC analysis on whole-home dehumidifiers, which are largely classified as greater than 75.00 pints/day product class. DOE is considering the 2012 EPCA standard of 2.5 liters/kWh for greater than 75.00 pints/day as the baseline efficiency for these units. This baseline level may be adjusted if DOE determines new test methods are appropriate for whole-home dehumidifiers or if other information suggests that a different baseline level is more appropriate.

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

Item 3-6 *The Department seeks input from stakeholders on whether the above energy efficiency/conservation levels are appropriate for characterizing the performance of baseline units, including the baseline selected for whole home 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 DOE will not consider in the rulemakings for residential dehumidifiers.

As an initial matter, DOE will develop a list of design options (through its own research and in consultation with interested parties) for consideration in the engineering analysis (*see* section 5). The identified candidate design options will encompass all those technologies that may improve energy efficiency. Thereafter, DOE will review each design option in light of the following four criteria:

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

2. *Practicability to manufacture, install, and service.* If DOE determines that mass production of a 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 by the time of the effective date of the standard, then it will not consider that technology further.

3. *Adverse impacts on product or equipment utility or availability.* If DOE determines a technology 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 consider that technology further.

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

DOE will document the reasons for eliminating any design options during the screening analysis and will publish this documentation for stakeholder review and comment as part of the Preliminary Analysis.

5. ENGINEERING ANALYSIS

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

5.1 Engineering Analysis Overview

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

DOE will derive cost estimates for the engineering analysis (which it also will use in the manufacturer impact analysis) from a reverse-engineering process, supplemented by manufacturer-supplied data. The reverse-engineering process consists of a detailed product disassembly process, whereby: (1) representative units are torn down; (2) all components, processes, assembly, and manufacturing steps are noted in an activities-based cost model; and (3) all manufacturing costs are calculated. Representative units are chosen based on the range of efficiencies, design options, and capacities.

The result is a "green-field" model[4] of the subject unit and the factory in which it would be built. These unit-specific factory requirements can then be aggregated by market share, unit shipments, or any other method DOE wishes to utilize to derive industry-wide estimates.

The industry-wide estimates will consist of detailed incremental cost data, disaggregated into the incremental costs of material,[5] labor,[6] and overhead.[7] DOE will associate incremental costs with specific design options or design option combinations required to achieve a given efficiency level or with the efficiency levels themselves, depending on the analysis approach, as described in section 5.3.

DOE seeks design, efficiency, and cost information to determine the cost of improving the efficiency of the baseline models. In addition, in tandem with a review of the efficiencies of units currently on the market, DOE will use the reverse-engineering to identify design options or design option combinations associated with the most efficient products to establish the highest efficiency that is technologically feasible (*i.e.*, the max-tech level) within each product class.

5.2 Baseline Models

DOE will select a baseline model as a reference point for each product class it reverse-engineers against which it can measure changes resulting from energy conservation standards. The baseline model in each product class represents the characteristics of common or typical equipment in that class. As discussed in section 3.4, a baseline model would be a model that just meets the required energy conservation standards as of October 1, 2012, as measured by the EF in liters/kWh.

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

Table 5-1 sets forth the minimum energy conservation standards effective October 1, 2012, for the six dehumidifier product classes. (10 CFR 430.32(v)(1)) As discussed in section 3.2, DOE is considering classifying whole-home dehumidifiers as a separate product class. Therefore, DOE

[4] A "green-field" model estimates the cost of a product as if it were built in a brand-new facility that had just broken ground. DOE accounts separately for items such as depreciation and one-time costs that may be incurred.

[5] Direct material costs are the costs of raw materials such as steel, copper, and insulation, and also include scrap metal that can be traced to final or end equipment. 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 pieces of equipment (*e.g.*, lubricating oil for production machinery).

[6] Labor costs are the earnings of workers who assemble parts into a finished good or operate machines in the production process. Direct labor includes the fringe benefits of direct laborers such as group health care, as well as overtime pay. Direct labor does not include indirect labor, which is defined as the earnings of employees who do not work directly in assembling a piece of equipment—such as supervisors, janitors, stockroom personnel, inspectors, and forklift operators.

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

seeks comment on an appropriate baseline EF for whole-home dehumidifiers, and whether such energy efficiency may be measured by the DOE dehumidifier test procedure.

Table 5-1 Dehumidifier Energy Conservation Standards and Proposed Baseline Unit Efficiencies

Product Class	**EF** (*liters/kWh*)
Portable, up to 35.00 pints/day	1.35
Portable, 35.01–45.00 pints/day	1.50
Portable, 45.01–54.00 pints/day	1.60
Portable, 54.01–75.00 pints/day	1.70
Portable, greater than 75.00 pints/day	2.5
Whole-home	2.5

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

Item 5-2 *DOE seeks input on an appropriate baseline unit efficiency for whole-home dehumidifiers and whether the DOE test procedure is capable of measuring the performance of these units.*

Item 5-3 *DOE seeks information regarding the specific technological characteristics of the baseline model for each product class, including the technologies described in section 3.3.*

5.3 Approach for Determining the Cost-Efficiency Relationship

DOE intends to utilize a design-option approach, using reverse engineering (physical teardowns and testing of existing equipment in the market) to identify the incremental cost and efficiency improvement associated with each design option or design option combination. DOE has reviewed existing dehumidifier product databases, including those compiled by DOE,[8] the California Energy Commission (CEC),[9] and AHAM,[10] and determined that there is little variation in EF within most product classes for dehumidifiers that are currently on the market. Therefore, it is appropriate to analyze design options individually to understand what technologies manufacturers utilize to affect efficiency. DOE notes that should the dehumidifier

[8] A database of residential dehumidifiers for which manufacturers have submitted compliance certification to DOE is available at: www.regulations.doe.gov/certification-data/Category.html

[9] A database of available dehumidifiers for sale in California is available on CEC's website at: www.appliances.energy.ca.gov.

[10] A database of dehumidifiers which have been certified by AHAM's voluntary program is available on AHAM's website at: www.ahamdir.com/aham_cm/site/pages/index.html?code=r.deh.aboutThisProgram.

test procedure be revised to capture the benefits of high-efficiency dehumidifiers (such as those that incorporate heat-pipe technology), a wider range in EF would result.

DOE will analyze technologies and associated costs representative of baseline units as part of the reverse-engineering process. DOE intends, at a minimum, to perform reverse engineering on the four representative product classes being analyzed. Whenever possible, DOE will attempt to reverse engineer test units that share similar platforms to better identify the efficiency benefits and costs of design options. As units are torn down, all design options used in them are noted and reviewed.

Prior to tear down, DOE also plans to conduct limited testing to establish what control strategies are being used by manufacturers in conjunction with design options and platform design. Unit testing will likely include the measurement of disaggregated energy consumption to identify the relationship between particular components and control strategies taken by manufacturers to achieve rated EFs. As part of the reverse-engineering process, DOE will attempt to generate a cost-efficiency relationship for each design option identified.

In support of this design-option approach, DOE requests incremental cost data for each dehumidifier design option. DOE intends the data to represent the average industry-wide incremental production cost for each technology.

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. This information allows DOE to better understand the industry and its associated cost structure, and, thus, it helps predict the most likely impact that new energy efficiency regulations would have. For example, the reverse-engineering methodology allows DOE to estimate the "green-field" costs of building new facilities, yet the majority of plants in any given industry are comprised of a mix of assets in different stages of depreciation. Interviews with manufacturers not only help DOE refine its capital expenditure estimates, but they also allow DOE to refine depreciation and other financial parameters.

DOE will refine the cost-efficiency data it generates through the reverse-engineering activities with information obtained through follow-up manufacturer interviews and, as necessary, information contained in the market and technology assessment and further review of publicly available cost and performance information.

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

Item 5-4 *DOE requests feedback on the use of a design-option approach to determine the relationship between manufacturer cost and energy efficiency for residential dehumidifiers.*

5.4 Efficiency Levels

The following tables present the efficiency levels DOE intends to analyze for residential dehumidifiers. It should be noted that the "maximum available" efficiency levels in the tables correspond to models with the maximum efficiency currently available in the market, but may not necessarily correspond to the "max-tech" levels. "Maximum available" models may not incorporate all possible design options for increasing efficiency and, therefore, may not achieve an efficiency level as high as the "max-tech" level. Also, it is possible that some of the design options that have met the screening criteria (*i.e.*, passed the screening analysis) may not yet be commercially available (*e.g.*, working prototypes) and, therefore, would not be found in today's "maximum available" products. DOE seeks stakeholder input to determine appropriate max-tech efficiency levels. (42 U.S.C. 6295 (p)(2))

DOE believes that the technologies relevant to portable residential dehumidifiers are comparable among the various product classes, and for some classes there are too few models available to reverse engineer without divulging proprietary information. Therefore, DOE proposes to test three portable dehumidifier capacity ranges in its reverse-engineering analysis that represent the majority of shipments and to then extrapolate to the other identified product classes. DOE will also reverse-engineer whole-home dehumidifiers, which may be defined as a separate product class, to determine whether there are different technologies available for these units.

DOE expects to examine four product classes: 35.01–45.00 pints/day portable, 45.01–54.00 pints/day portable, 54.01–75.00 pints/day portable, and whole-home dehumidifiers, which may be similar to the 75.00 pints/day or more product class for portable units. Once the incremental product costs and design options have been identified for these four product classes, DOE intends to extrapolate its results to determine similar results for the remaining product classes, a process which may include teardowns.

Table 5-2 provides both the efficiency level and the reference source of each level for the four dehumidifier product classes that DOE will analyze. The first efficiency level corresponds to the ENERGY STAR program's qualification criteria as of October 1, 2012. The second efficiency level is a gap fill between the ENERGY STAR levels and the maximum available efficiencies, while the third efficiency level is the maximum available efficiencies according to the ENERGY STAR qualification database as of May 2012. The efficiency levels for whole-home dehumidifiers are based on testing according to the current test procedure; thus, these levels may be adjusted according to any test procedure amendments for this type of dehumidifier.

Table 5-2 Efficiency Levels for Dehumidifier (Representative) Analysis

Level	Efficiency Level Source	Efficiency Levels (*liters/kWh*)			
		Portable, 35.01–45.00 pints/day	Portable, 45.01–54.00 pints/day	Portable, 54.01–75.00 pints/day	Whole-Home
Baseline	DOE Standard	1.50	1.60	1.70	2.50†
1	ENERGY STAR* (Max Available for 35.01–45.00 pints/day, Gap Fill for 45.01–54.00 pints/day)	1.62	1.70	1.85	2.80
2	Gap Fill (Max Available for 45.01–54.00 pints/day	--	1.8	2.10	3.50
3	Maximum Available	--	--	2.47	4.17

* ENERGY STAR qualification criteria effective October 1, 2012, require all portable and whole-home dehumidifiers less than 75 pints per day to have an EF of at least 1.85 liters/kWh, which is greater than the maximum available efficiency of 35.01–45.00 pints/day units. Units with 75–185 pints/day capacity must have an EF of at least 2.80 liters/kWh, while dehumidifiers with a capacity greater than 185 pints/day are excluded.
† The baseline efficiency for the whole home product class is specified as the DOE standard effective October 1, 2012, for dehumidifiers with a capacity greater than 75.00 pints/day.

Item 5-5 *DOE seeks input from stakeholders concerning the efficiency levels it proposes to use for collecting incremental cost data from manufacturers of residential dehumidifiers. DOE also seeks input from stakeholders on appropriate maximum technologically feasible efficiency levels.*

5.5 Proprietary Designs

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

DOE is sensitive to manufacturer concerns regarding proprietary designs and will make provisions to maintain the confidentiality of proprietary data submitted by manufacturers or discussed during manufacturer interviews. Materials provided to Navigant Consulting, Inc., a DOE contractor for this rulemaking, are generally subject to the terms of the applicable

agreement under which those materials are submitted. In the case of materials provided to NCI in the context of a DOE rulemaking and subject to a non-disclosure agreement, those materials are generally not shared with DOE, apart from aggregated data that do not identify particular submitters. These materials may also be subject to a variety of laws and regulations governing the disclosure of Federal agency information. Information submitted to DOE will be protected in accordance with all applicable federal laws, rules, or regulations, including but not limited to the Trade Secrets Act, 18 U.S.C. §1905, and the Freedom of Information Act (FOIA), 5 U.S.C. §552, and DOE's implementing regulations at 10 CFR 1004.

Item 5-6 *Are there proprietary designs or technologies of which DOE should be aware for any of the dehumidifiers under consideration in this rulemaking? If so, how should DOE acquire the cost data necessary for evaluating these designs?*

5.6 Outside Regulatory Changes Affecting the Engineering Analysis

In conducting an engineering analysis, DOE takes into consideration the effects of regulatory changes outside DOE'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 products covered under this rulemaking. DOE will attempt to identify all cumulative engineering issues that could impact the engineering analysis. The consideration of these issues is closely related to the cumulative regulatory burden assessment that DOE will carry out as part of the manufacturer impact analysis. Based on consideration of the comments received on the engineering analysis documented in the Preliminary Analysis, DOE will make the necessary changes to the analysis. It will reflect those changes in the documentation of the NOPR.

Item 5-7 *Are there outside regulatory issues that DOE should consider in its analysis of residential dehumidifiers?*

6. ENERGY USE

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

In DOE's 2007 ANOPR, DOE utilized studies documenting annual dehumidifier usage and data provided by AHAM. Based on the data AHAM provided, which utilized monthly dehumidifier usage to determine annual energy use, DOE derived an average value of 1,095 hours per year for characterizing dehumidifier usage. The data provided by AHAM was also used to determine the variability of energy consumption.

Because energy use by residential dehumidifiers varies greatly based on consumer usage patterns, the Department will conduct further research to establish a range of energy use for dehumidifiers. The Energy Information Administration (EIA)'s Residential Energy Consumption Survey is one source for defining the range of energy use for dehumidifiers.
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Item 6-1 *DOE seeks stakeholder input on its proposed approaches for specifying typical annual energy consumption. Most importantly, the Department is interested in sources of data that can assist in characterizing 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 consumption for dehumidifiers. The Department is particularly interested in field monitoring studies and data.*

7. MARKUPS FOR PRODUCT PRICE DETERMINATION

Because DOE uses retail (consumer) price data in its LCC, PBP, and national impact analyses, DOE typically uses manufacturer-to-consumer markups to convert estimates of the manufacturer selling price derived from the engineering analysis (section 5) to consumer prices. The manufacturer-to-consumer markups are in addition to the markups on production costs that DOE uses in estimating manufacturer selling price in the engineering analysis. To validate those markups, DOE will collect data on current market prices.

Before it can develop markup information, however, DOE first needs to identify distribution channels (*i.e.*, how the product is distributed from the manufacturer to the consumer). AHAM's 2005 Fact Book (the latest available version) shows that more than 93 percent of all appliances are distributed from the manufacturer directly to some type of retailer. Retailers identified in AHAM's 2005 Fact Book include home improvement stores (such as Lowe's or Home Depot), membership warehouse clubs/stores (such as Sam's Club or Costco), department stores (such as Sears or Kohl's), discount stores (such as Wal-Mart or Kmart), and appliance or consumer electronics stores. Because an overwhelming majority of appliances are sold through retail stores, DOE plans to analyze dehumidifier sales based on the assumption that the appliances are sold in a manufacturer-to-consumer distribution channel consisting of three parties: (1) the manufacturers producing the products; (2) the retailers purchasing the products from manufacturers and selling them to consumers; and (3) the consumers who purchase the products.

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

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

DOE will also use collected retail price data to validate the overall manufacturer-to-consumer markup. DOE has purchased dehumidifier sales data for 2007–2011 from NPD Group, Inc. (NPD), which provides sales-weighted retail price data. In addition to purchasing retail price data, DOE may also consult retailers' Internet sites, although the representativeness of any given price data point is unknown.

This analysis will generate retail prices for each potential efficiency level, assuming that each level represents a new minimum efficiency standard. DOE will make this assumption to capture the effect on retail prices that may be produced by manufacturers' higher production volumes of more efficient products as required by the standard. Because DOE expects to develop a range of price estimates, it may describe new retail prices within a range of uncertainty. If the results of DOE's analysis show a large range of retail prices for each product, DOE will develop probability distributions of retail price to use as inputs to the LCC and PBP analysis in order to determine the impact of uncertainty on the economic feasibility of amended energy conservation standards.

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

8. LIFE-CYCLE COST AND PAYBACK PERIOD ANALYSIS

This section describes the life-cycle cost (LCC) and payback period (PBP) analysis that DOE will perform for dehumidifiers, including how DOE develops the inputs to the calculation. The LCC analysis establishes the total cost of an appliance over its lifetime (including purchase price and operating costs). The PBP analysis calculates the amount of time required for energy cost savings to pay back any increased cost of a higher-efficiency product.

8.1 Overview

The effects of amended energy conservation standards on the consumer of a product include a change in operating cost (usually decreased) and a change in purchase price (usually increased). DOE usually analyzes the net effect on consumers by calculating the LCC and PBP, incorporating the engineering performance data (described in section 5), the energy consumption data (described in section 6), and the product retail price (described in section 7). Inputs to the calculation of LCC and PBP include the total installed cost to the consumer (purchase price plus any installation cost) and operating cost (energy expenditures and, if applicable, repair and maintenance costs). Additional inputs to the LCC calculation include energy price forecasts, the lifetime of the appliance or other defined period of analysis, and discount rates.

8.2 Approach

In the Preliminary Analysis stage of the dehumidifier rulemaking, DOE will conduct the LCC and PBP analysis by using Monte Carlo simulation and probability distributions to model both the uncertainty and variability in the inputs. The Monte Carlo approach provides a significant advantage over alternative approaches (*e.g.*, an approach using typical or average values to characterize inputs) because it identifies the percentages of consumers benefiting from or being impacted by a prospective standard.

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

DOE will use probability distributions to characterize most of the operating cost inputs to the LCC and PBP analysis, including product lifetimes and consumer discount rates. As described in section 7, DOE will use a combination of sales data from the NPD Group and data from the CEC model (as described in section 5.3) to establish the annual energy consumption of each product class. Dehumidifier energy use will be characterized using sales-weighted probability distributions. As described in section 8.3, the LCC and PBP analysis will capture the regional variability in electricity prices. The methodology for developing maintenance and repair costs is described in section 8.4.

DOE expects to use point values to characterize most of the inputs to total installed cost, including the manufacturer markup and retailer markup. DOE expects installation costs to be negligible for portable dehumidifiers. For whole-home dehumidifiers, installation costs can include electrical and duct work. If the manufacturer cost estimates developed in the engineering analysis are characterized using uncertainty or variability, DOE will use probability distributions to capture this uncertainty and variability; otherwise, DOE will use single-point values for this input. DOE will characterize sales taxes using probability distributions that capture their regional variability.

Another factor in identifying how consumers would be impacted by a particular standard is the distribution of product efficiencies currently sold in the marketplace. In the case of dehumidifiers, product efficiency is expressed as annual energy use. Assuming those data are available, DOE will use probability distributions to characterize the current product mix. DOE will determine the LCC and PBP for a particular standard level based on the distribution of appliance efficiencies. For example, in performing an iteration of the Monte Carlo simulation for a given consumer, product efficiency will be chosen based on its probability. If the chosen product efficiency is greater than or equal to the efficiency of the standard level under consideration, the LCC and PBP calculation will reveal that a consumer is not impacted by the standard level. By accounting for consumers who already purchase more efficient products, DOE avoids overstating the potential benefits from increasing product efficiency. To enable DOE to use this methodology, DOE will ask stakeholders to provide data on the current mix of product

efficiencies. DOE could also use the CEC model data described in section 5.3 to develop efficiency distributions based on availability of various models.

DOE will determine as part of the LCC and PBP analyses whether there may be a rebound (or "take back") effect associated with more efficient dehumidifiers. The "take-back" in energy consumption associated with the rebound effect typically involves greater use that can result from increases in energy efficiency and the associated reduction in operating costs. The rebound effect assumes that consumers will increase their overall annual usage of a more efficient product, thereby decreasing their overall annual savings

DOE will conduct the LCC and PBP analysis for the representative product classes on which it plans to perform an engineering analysis (section 5.2). To identify the consumers who benefit from or are burdened by a prospective standard, DOE requests base case efficiency distribution or market-share efficiency data from the industry.

Based on the results of the LCC analysis, DOE would select candidate standard levels (CSLs) for the Preliminary Analysis. The range of CSLs typically includes the efficiency level with the minimum LCC, the highest efficiency level that is technologically feasible, and other intermediate levels.

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

DOE is also required to perform a PBP analysis to determine whether the rebuttable presumption of economic justification applies (whether the higher installed cost of more energy efficient equipment is less than three times the value of the lowered operating costs in the first year of the energy conservation standard). (42 U.S.C. 6295(o)(2)(B)(iii)) To determine the rebuttable-presumption PBP, DOE would determine the value of the first year's energy savings by calculating the quantity of those savings in accordance with DOE's test procedure. Although DOE will examine the rebuttable-presumption criteria, DOE determines whether selected CSLs are economically justified through an analysis of the economic impacts of increased efficiency pursuant to section 325(o)(2)(B)(i) of EPCA. (42 U.S.C. 6295(o)(2)(B)(i))

In preparing the NOPR, DOE carefully reviews all the comments it receives on the Preliminary Analysis LCC analysis, makes any necessary revisions to the analysis, and if necessary evaluates additional parameters not included in the Preliminary Analysis.

Item 8-1 *DOE seeks stakeholder input on its proposed approach of using probability distributions and Monte Carlo simulation to conduct the LCC and PBP analysis*

Item 8-2 *DOE requests data from stakeholders to characterize the current mix of dehumidifier efficiencies in the market.*

8.3 Electricity Prices

DOE plans to estimate average electricity prices using EIA data covering 13 geographic areas—the nine U.S. Census divisions, with four large states (New York, Florida, Texas, and California) treated separately. For Census divisions that contain one of the large states, DOE calculates the regional average values leaving out data for the large state—for example, the Pacific region average does not include California, and the West South Central region average does not include Texas. DOE will develop a discrete probability distribution consisting of 13 regional electricity prices based on the household population in each region to assess the variability of energy prices at the regional level.

To calculate electricity prices for residential consumers in each of the above geographic areas, DOE will use information provided by electric utilities as summarized in the most recent EIA Form 861 data.[11] These data, which cover the residential, commercial, and industrial sectors for every utility serving final customers, are published annually and include annual electricity sales in kWh, revenues from electricity sales, and number of customers. DOE's calculation of an average residential electricity price proceeds in two steps: (1) for each utility, estimate an average residential price by dividing residential revenues by residential sales; and (2) calculate a regional average price, weighting each utility that has customers in a region by the number of residential customers served in that region.

In its LCC analysis DOE uses projections of national average electricity prices to residential consumers to estimate future energy prices. DOE uses the most recently available edition of EIA's *Annual Energy Outlook* (*AEO*) as the default source of projections for future energy prices.

Item 8-3 *DOE seeks stakeholder input on the planned approach for estimating current and forecasted energy prices.*

8.4 Maintenance, Repair, and Installation Costs

DOE will consider any expected changes to maintenance, repair, and installation costs for the dehumidifiers subject to new standards. Typically, small incremental changes in product efficiency incur little or no change in repair and maintenance costs over baseline products. Products having efficiencies that are significantly higher than the baseline are more likely to incur increased repair and maintenance costs, because such products are more likely to incorporate technologies that are not widely available. DOE will use input from manufacturers and other stakeholders to develop appropriate repair and maintenance cost estimates, as necessary.

With regard to installation costs, unless the increased efficiency levels considered for this rulemaking result in significantly larger or heavier products, DOE expects that more efficient portable dehumidifiers will incur no increased installation costs. For whole-home dehumidifiers, installation costs may include electrical and duct work.

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

Item 8-4 *DOE seeks stakeholder input on the merits of its proposed analytical assumption that changes in maintenance, repair, and installation costs will be negligible for more-efficient residential dehumidifiers. If that assumption is incorrect, DOE is interested in the reasons why this is so and in specific ways to correct that assumption.*

8.5 Product Lifetimes

The product lifetime is the age at which a product is retired from service. From one source[12], DOE identified dehumidifier lifetime ranging from a low of 5 years, a high of 10 years, and an average of 7 years. DOE has characterized dehumidifier survival functions using Weibull distributions. DOE tentatively plans to use those averages for the analyses. In addition, DOE plans to use additional literature sources, industry experts, and input from manufacturers and other interested parties to determine a range for the lifetime of residential dehumidifiers.

Item 8-5 *DOE seeks stakeholder input on appropriate product lifetimes for dehumidifiers. Specifically, DOE seeks data sources for establishing product lifetimes.*

8.6 Discount Rates

The calculation of consumer LCC requires the use of an appropriate discount rate. DOE uses a discount rate to determine the present value of lifetime operating expenses. The discount rate used in the LCC analysis represents the rate from an individual consumer's perspective.[13] For residential consumers of dehumidifiers, DOE plans to use estimates of the interest or "finance cost" to purchase residential products. The finance cost of raising funds to purchase 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 for determining the cost of debt and equity comes from the Federal Reserve Board's triennial *Survey of Consumer Finances*.[14]

Item 8-6 *DOE seeks stakeholder input on its planned approach for estimating discount rates for residential consumers.*

Based on consideration of the comments received on the LCC and PBP analysis documented for the Preliminary Analysis, DOE would make the necessary changes to the analysis, and reflect those changes in the NOPR and TSD.

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[12] *Appliance Magazine*, "U.S. Appliance Industry: Market Value, Life Expectancy & Replacement Picture for 2005–2012", January 2011.

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

[14] Available at www.federalreserve.gov/econresdata/scf/scfindex.htm.

8.7 Energy Efficiency in the Base Case

To estimate the share of consumers affected by a standard at a particular efficiency level, DOE's LCC and PBP analysis considers the projected distribution (*i.e.*, market shares) of product efficiencies that consumers will purchase in the first compliance year under the base case (the case without amended energy conservation standards). DOE requests market-share efficiency data (*i.e.*, data on the distribution of shipments by efficiency) for the product classes of residential dehumidifiers.

In its prior 2007 rulemaking on dehumidifiers, DOE based its analysis of base-case market shares on AHAM data showing the distribution of dehumidifier efficiencies in 2005 for two of the six product classes examined for that rulemaking: 35.01–45.00 and 54.01–74.99 pints per day. In cases where market-share efficiency data are not available, DOE will use efficiency distributions based on available models as a proxy. In the prior rulemaking, for example, because DOE conducted the engineering and LCC and PBP analyses on the combined product class of 0–35.00 pints per day, DOE estimated that the market share data for the 0–35.00 pints per day combined product class were equivalent to the market shares for the closest product class—that for 35.01–45.00 pints per day.

Forecasted market shares will use available data on recent market trends in residential dehumidifier efficiency and will take into account the potential impacts of the ENERGY STAR program and other programs or policies (such as consumer rebate programs or State tax credits to consumers for the purchase more efficient products, and manufacturer tax credits that encourage the production of more efficient products) that may affect the demand for more efficient residential dehumidifiers.

> ***Item 8-7*** *DOE seeks stakeholder input on dehumidifier efficiency in the base case, historical efficiency data on dehumidifiers, and projected trends in dehumidifier efficiency. DOE is especially interested in any data pertaining to whole-home dehumidifiers.*

9. SHIPMENTS ANALYSIS

DOE uses shipments forecasts to calculate the national impacts of standards and to calculate the future cash flows of manufacturers. DOE develops shipments forecasts based on an analysis of key market drivers for a particular product.

9.1 Base-Case Forecast

To evaluate the impacts of standards, DOE first develops a base-case forecast against which to compare forecasts for higher efficiency levels. (Forecasts for higher efficiency levels are also referred to as standards-case forecasts.) DOE designs the base case to depict what would be anticipated to happen to energy consumption and costs over time if DOE does not adopt energy conservation standards. In determining the base case for products, DOE calibrates its forecasts against historical shipments. DOE also considers the mix of efficiencies that would be sold in the

absence of new standards and how that mix might change over time. As a result, DOE must acquire data on historical product shipments and the market shares of the various efficiency levels offered in each product class. Based on detectable trends in the collected efficiency data, DOE forecasts base case shipment-weighted efficiencies (SWEF). Forecasts of SWEFs are discussed in greater detail in section 10.1.

DOE has reviewed historical shipments data from three sources: (1) from *Appliance Magazine*,[15] (2) as provided by AHAM as part of the 2007 residential dehumidifier standards rulemaking, and (3) from the ENERGY STAR program. [16] The shipments data from *Appliance Magazine* are for 2006–2012; the data from AHAM are for 1989–2005; and the data from ENERGY STAR are for 2004–2010. When it develops base case shipments forecasts, DOE plans to use public sources of data, such as data from the NPD Group.

Because little is known about the adoption of dehumidifiers in established and new households, and the historical data may not provide observable trends that can be relied on to forecast shipments trends into the future, DOE likely will use various scenarios to forecast base case shipments. The scenarios may range from constant shipments (based either on a historical average observed in the AHAM and/or *Appliance Magazine* or NPD data sets to increases in shipments tied to overall economic growth as indicated by the gross domestic product.

Item 9-1 *DOE seeks historical shipments data from stakeholders. If such data are provided, DOE requests market share data showing the percentage of dehumidifier shipments for portable and whole-home products and including within each category dehumidifier type (i.e. compressor/condenser-based, dessicant, etc.).*

Item 9-2 *If stakeholders are unable to provide historical shipments data, DOE seeks comment on whether the AHAM and Appliance Magazine shipments data or the NPD sales data is more representative of historical shipments and why.*

Item 9-3 *DOE seeks input on the types of scenarios it should use to forecast base case shipments and the reason(s) for the suggested scenario(s).*

9.2 Impacts of Standards on Product Shipments

DOE will develop a set of shipment forecasts for each set of efficiency levels analyzed for each product class. DOE uses the standards-case forecasts to evaluate the impacts of standards on product shipments. DOE derives standards-case forecasts using the same data sets as used for the base-case forecasts. Because the standards-case forecasts take into account the increase in purchase price and the decrease in operating costs caused by standards, forecasted shipments for a standards case typically deviate from those for the base case. Household income also factors into consumer purchase decisions. Therefore, the magnitude of the difference between the shipment forecasts for the standards and base cases depends on the estimated purchase price

[15] Available for purchase at www.appliancemagazine.com.
[16] Available in the ENERGY STAR archives at www.energystar.gov/index.cfm?c=partners.unit_shipment_data_archives.

increase and operating cost savings relative to household income. Because purchase price tends to have a larger impact than operating cost on appliance purchase decisions, standards-case forecasts typically show a decrease in product shipments relative to the base case.

DOE's past standards analyses have attempted to quantify the sensitivity of shipments to increased purchase price and operating cost savings, as well as to changes in household income. DOE has conducted literature reviews and analyses of historical appliance price and efficiency data to develop sensitivities. DOE will attempt to develop purchase price and operating cost sensitivities for dehumidifiers. If the data required to develop those sensitivities are unavailable, DOE will consider modeling standards-case shipments forecasts using scenarios (*i.e.*, specified impacts to product shipments).

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 forecasts of standards-case shipments. To the extent that such programs exist, DOE will consider their impact on the forecast of both base-case and standards-case shipments.

Item 9-4 *As part of the preliminary manufacturer impact analysis, DOE seeks input from manufacturers on the potential impact of new energy conservation standards on dehumidifier shipments. DOE also seeks input from other stakeholders on the potential impact of standards on product shipments.*

Item 9-5 *DOE also requests input on any current market-pull programs that promote the adoption of more efficient dehumidifiers.*

10. NATIONAL IMPACT ANALYSIS

This section discusses DOE's assessment of the aggregate impacts of potential efficiency standards at the national level. Measures of impact that DOE will report include the future national energy savings (NES) from each efficiency level and the net present value (NPV) of total consumer LCCs.

10.1 Inputs to Forecasts

In analyzing impacts of Federal energy conservation standards for dehumidifiers, DOE compares projected U.S. energy consumption with, and without, new or amended standards. The forecasts contain projections of annual appliance shipments (section 9), the annual energy consumption of new appliances (section 6), and the purchase price of new appliances (section 7).

A key component of DOE's estimates of NES and NPV are the product energy efficiencies forecasted over time for the base case (without new standards) and each standards case. Forecasted efficiencies represent the annual shipment-weighted annual energy consumption of covered dehumidifiers during the forecast period (*i.e.*, from the assumed compliance date of a new standard to 30 years after that date). Because key inputs to the calculation of NES and NPV

(annual energy consumption for the NES, and retail prices and annual operating costs for the NPV) depend on estimated efficiencies, those efficiencies are vital to the analysis.

To develop SWEFs for the various standards cases, DOE seeks market-share efficiency data (*i.e.*, data on the distribution of product shipments by efficiency) for the four representative dehumidifier product classes DOE currently is considering. These market-share efficiency data (otherwise known as base-case efficiency distributions) are the same as those DOE is requesting for the LCC and PBP analysis (*see* section 8.2). DOE uses input from stakeholders to develop estimates of base-case historical SWEFs. For the 2007 ANOPR, AHAM and manufacturers provided market share efficiency distributions for two of the six product classes: 35.01–45.00 pints/day and 54.10–74.99 pints/day. DOE applied the market share efficiency distributions of the 35.01–45.00 pints/day class to product classes up through 54.00 pints/day, and applied the market share efficiency distribution of the 54.10–74.99 pints/day class to the ≥75.00 pints/day class. DOE asks AHAM, manufacturers, and other interested parties to provide historical SWEF data for dehumidifiers for this rulemaking. If such data are not be available, DOE may use the CEC model data described in section 5.3 to develop efficiency distributions for each year for which CEC data are available.

The market-share efficiency data will enable DOE to estimate the effect on efficiency that standards may have in the year manufacturers must begin to comply with them. For the dehumidifier rulemaking, DOE plans to use a "roll-up" scenario. Under this scenario, DOE assumes (1) product efficiencies in the base case that do not meet the standard level under consideration will "roll up" to meet the new standard level; and (2) product efficiencies that exceed the standard level under consideration will not be affected.[17] After DOE establishes the SWEF for the assumed effective date of a standard, it can estimate future SWEFs by using the same rate of forecasted efficiency growth as for the base-case efficiency trend.

Item 10-1 *DOE seeks historical SWEF data for dehumidifiers. DOE also seeks historical market share data showing the percentages of product shipments by efficiency level.*

10.2 National Energy Savings

DOE intends to calculate national energy consumption for each year beginning with the expected compliance date of the standard. It will calculate national energy consumption for the base case and each standard level analyzed to estimate the NES associated with each standard level. DOE plans to perform this calculation using a spreadsheet model that accounts for the stock of equipment affected by standards.[18] The energy savings are measured over the entire lifetime of products purchased in the 30-year projection period.[19]

[17] DOE believes that a "shift" scenario, in which there is change in the market above the standard level, is not likely for dehumidifiers due to the limited consumer interest in the efficiency of this product.

[18] For example, the NIA spreadsheet model from the rulemaking for residential clothes washers can be found, along with the TSD chapters, on DOE's website at http://www1.eere.energy.gov/buildings/appliance_standards/residential/rcw_direct_final_rule_tsd.html.

[19] In the past DOE presented energy savings results for only the 30-year period that begins in the year of compliance. In the calculation of economic impacts, however, DOE considered operating cost savings measured

DOE intends to determine whether there may be a rebound effect associated with more efficient dehumidifiers. If data indicate that there may be a rebound affect and allow for the quantification of this effect for dehumidifiers, DOE will account for the rebound effect into its calculation of NES.

DOE has historically presented NES in terms of primary energy savings. On August 18, 2011, DOE announced its intention to use full-fuel-cycle (FFC) measures of energy use and greenhouse gas and other emissions in the national impact analyses and emissions analyses included in future energy conservation standards rulemakings. (76 FR 51282) While DOE stated in that notice that it intended to use the Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) model to conduct the analysis, it also said it would review alternative methods, including the use of NEMS. After evaluating both models and the approaches discussed in the August 18, 2011 notice, DOE has determined NEMS is a more appropriate tool for this specific use. Therefore, DOE intends to use the NEMS model, rather than the GREET model, to conduct future FFC analyses. The method used to derive the FFC multipliers will be described in the preliminary TSD.

Based on consideration of the comments DOE may receive on the Preliminary Analysis, DOE will make any necessary changes to the analysis. It will reflect those changes in the documentation for the NOPR.

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

10.3 Net Present Value

In conjunction with the NES, DOE calculates the national net present value (NPV) of energy conservation standards. It calculates annual energy expenditures based on annual energy consumption by incorporating forecasted energy prices, using the forecasts of shipments and average energy efficiency described in section 9. DOE calculates annual product expenditures by multiplying the price per unit by the number of forecasted shipments. The difference between a base case and a standards-case scenario gives the national energy cost savings and increased product expenditures in dollars. The difference each year between energy cost savings and increased product expenditures is the net savings (if positive) or net costs (if negative). DOE discounts those annual values to the present time and sums them to obtain a NPV. Consistent with guidelines set by the U.S. Office of Management and Budget (OMB), DOE will conduct two NPV calculations, one using a real discount rate of 3 percent and the other using a real discount rate of 7 percent (OMB, Circular A-4: Regulatory Analysis (Sept. 17, 2003). The discount rates for the determination of NPV differ from the discount rates used in the LCC

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over the entire lifetime of products purchased in the 30-year period. DOE has chosen to modify its presentation of national energy savings to be consistent with the approach used for its national economic analysis.

analysis (which are developed from a consumer's perspective). The 7-percent real value is an estimate of the average before-tax rate of return on private capital in the U.S. economy. The 3-percent real value represents the "societal rate of time preference," which is the rate at which society discounts future consumption flows to their present value. Based on consideration of any comments received on the Preliminary Analysis, DOE will make any necessary changes to the analysis and the CSLs.

As noted in section 10.2, DOE intends to consider whether there may be a rebound effect associated with more efficient dehumidifiers in its determination of NES. As discussed in section 8.2, increased product utilization may result from an increase in energy efficiency. If data indicate that there may be a rebound affect and allow quantification of this effect for dehumidifiers, DOE will account for the rebound effect in its calculation of NPV.

11. CONSUMER SUBGROUP ANALYSIS

DOE analyzes the consumer impact of any new standards by dividing consumers into subgroups that comprise subsets of the population that are likely, for one reason or another, to be affected disproportionately by new or revised energy conservation standards. The purpose of a subgroup analysis is to determine the extent of this disproportional impact. DOE will work with stakeholders early in the rulemaking process to identify any subgroups for consideration. DOE will analyze the consumer subgroups during the NOPR stage of the analysis.

In comparing potential effects on different consumer subgroups, DOE will evaluate variations in regional electricity prices, energy use profiles, and purchase prices that might affect the LCC of an energy conservation standard for identified 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. DOE will discuss with stakeholders the variability in each input variable and likely sources of information on that variability.

Item 11-1 *The Department requests input as to what consumer subgroups are appropriate to evaluate for residential dehumidifiers.*

12. MANUFACTURER IMPACT ANALYSIS

DOE will collect, evaluate, and report preliminary information and data on manufacturer impacts in the preliminary TSD. Such preliminary information includes the anticipated conversion capital expenditures by efficiency level and the corresponding anticipated impacts on employment in the dehumidifier industry. DOE will solicit further information during the preliminary engineering analysis manufacturer interviews.

DOE intends the manufacturer impact analysis to provide an assessment of the potential impacts of energy conservation standards on manufacturers of residential dehumidifiers. In addition to financial impacts, a wide range of quantitative and qualitative effects may occur following adoption of a standard that may require changes to the manufacturing practices for these

products. DOE will identify these effects through interviews with manufacturers, as well as other interested parties and experts.

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

12.1 Sources of Information for the Manufacturer Impact Analysis

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

DOE will conduct detailed interviews with manufacturers to gain insight into the range of potential impacts of standards. The interview process plays a key role in the manufacturer impact analysis, since it provides an opportunity for directly affected parties to express their views on important issues. During the interviews, DOE will solicit information on the possible impacts of standards on manufacturing costs, equipment prices, sales, direct employment, capital assets, and industry competitiveness. Both qualitative and quantitative information are valuable in terms of this analysis. DOE prefers an interactive interview process, because it helps clarify responses and provides the opportunity to identify additional issues.

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

DOE will prepare a summary of the major issues and outcomes resulting from the manufacturer interviews. This summary will become part of the TSD produced for this rulemaking.

12.2 Industry Cash-Flow Analysis

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

The GRIM analysis uses a number of inputs—annual expected revenues; manufacturer costs such as costs of goods sold; selling, general, and administrative costs; taxes; and capital

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

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

12.3 Manufacturer Subgroup Analysis

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

Small businesses, as defined by the U.S. Small Business Administration (SBA) for electric housewares and household fan manufacturers, which includes residential portable electric dehumidifiers, are enterprises with 750 employees or fewer. Small businesses are also defined by the SBA for air-conditioning and warm air heating equipment and commercial and industrial refrigeration equipment manufacturers as having 750 employees or fewer. Small business size standards are listed by North American Industry Classification System (NAICS) code and industry description. Electric housewares and household fan manufacturing is classified under NAICS 335211, while air-conditioning and warm air heating equipment and commercial and industrial refrigeration equipment manufacturing is classified under NAICS 333415. A search of small businesses of this NAICS code listed in the SBA website and the Dun & Bradstreet reports indicates that there are at least five small businesses that manufacture residential dehumidifiers that would be covered by this rulemaking. As part of its subgroup analysis, DOE will identify small businesses that manufacture these products and interview small businesses affected by the rulemaking to determine if there are differential impacts on these companies that may result from new energy conservation standards. DOE will examine publicly available data and contact manufacturers, when needed, to determine if they meet the SBA's definition of a small manufacturing facility and if their manufacturing facilities are located within the United States. DOE will also consider this information in satisfying the requirements of the Regulatory Flexibility Act for this rulemaking.

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

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

Item 12-2 *DOE seeks comment on small businesses that could be impacted by energy conservation standards for dehumidifiers, and what the impacts on small businesses of potential standards might be.*

12.4 Competitive Impacts Assessment

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

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

12.5 Cumulative Regulatory Burden

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

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

- *DOE standards for residential dehumidifiers.* Manufacturers have gone through redesign cycles mandated by standards since 2007. Most recently, EISA 2007 prescribed standards for residential dehumidifiers that will take effect October 1, 2012.
- *EPA-mandated phase-out of HCFCs.* The EPA-mandated phase-out of hydrochlorofluorocarbon (HCFC) refrigerants affected multiple residential products (*i.e.*, refrigerators, room air-conditioners, and dehumidifiers), requiring manufacturers to switch to non-ozone-depleting refrigerants as of January 1, 2010.
- *Reduction of Hazardous Substances (RoHS) directive.* The *Directive on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment* was adopted in February 2003 by the European Union (EU) and became effective July 1,

2006.[20] RoHS identifies specific categories of products that can contain no more than threshold amounts of mercury, lead, cadmium, hexavalent chromium, and two fire retardants. While this legislation does not extend to products in the United States, domestic manufacturers selling to the EU market must produce RoHS-compliant appliances. These manufacturers may choose to promulgate the associated design changes across their entire product line.

Item 12-3 *What other regulations or pending regulations should DOE consider in its examination of cumulative regulatory burden?*

13. UTILITY IMPACT ANALYSIS

To estimate the impacts that energy conservation standards for residential dehumidifiers would have on electric utility industries, DOE plans to use a variant of the EIA's National Energy Modeling System (NEMS), called NEMS-BT. NEMS is a large, multi-sectoral, partial-equilibrium model of the U.S. energy sector that EIA has developed over several years, primarily for preparing the *AEO*. NEMS, which is available in the public domain, produces what is termed a reference-case forecast for the United States through 2035.[21]

In the utility impact analysis, the NEMS-BT model results for the base case and standards cases are compared. Outputs of the analysis usually parallel results that appear in the latest *AEO*, with some additions. Typical outputs of the utility impact analysis include forecasts of electricity sales, generation, and avoided capacity. DOE plans to conduct the utility impact analysis as a scenario departing from the latest *AEO* reference case. In other words, DOE will model the energy savings impacts from amended energy conservation standards using NEMS-BT to generate forecasts that deviate from the *AEO* reference case.[22]

Item 13-1 *DOE seeks input from stakeholders on its plans to use NEMS-BT to conduct the utility impact analysis. Examples of the type of input sought by DOE include, but are not limited to, whether the NEMS-BT model is appropriate for assessing the utility impacts of efficiency standards — and if not, what a more appropriate model would be.*

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

[21] For more information on NEMS, refer to the DOE Energy Information Administration documentation. A useful summary is National Energy Modeling System: An Overview 2000, DOE/EIA-0581(March 2000), available at http://tonto.eia.doe.gov/ftproot/forecasting/05812000.pdf. EIA approves use of the name NEMS to describe only an official version of the model without any modification to code or data. Because this analysis entails some minor code modifications and runs the model under policy scenarios that are variations on EIA assumptions, DOE refers to the model as NEMS-BT ("BT" refers to DOE's Building Technologies Program, under whose aegis this work has been performed).

[22] A description of the NEMS-BT model from a rulemaking for residential furnaces and boilers can be found on DOE's website at http://www1.eere.energy.gov/buildings/appliance_standards/residential/pdfs/fb_fr_tsd/chapter_13.pdf.

14. EMPLOYMENT IMPACT ANALYSIS

In addition to estimating the effects of standards on employment for product manufacturers (direct employment impacts, see section 12), DOE estimates the effects of standards on employment in the economy in general. Indirect impacts may result from expenditures shifting among goods (the substitution effect) and changes in income that lead to a change in overall expenditure levels (the income effect). DOE defines indirect employment impacts as net jobs eliminated or created in the general economy as a result of increased spending driven by the increased product prices and reduced spending on energy related to standards.

DOE investigates combined direct and indirect employment impacts using the Pacific Northwest National Laboratory (PNNL)'s "Impact of Sector Energy Technologies" (ImSET) model. PNNL developed ImSET for DOE's Office of Planning, Budget, and Analysis. The model estimates the employment and income effects of energy-saving technologies in buildings, industry, and transportation. 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 *DOE welcomes feedback on its planned approach for assessing national employment impacts, and it is interested in whether tools other than ImSet or additional factors should be considered for its analysis. If other tools or factors should be considered, please identify them and explain why, and how, they should be integrated into DOE's analysis.*

15. EMISSIONS ANALYSIS

In the emissions analysis, DOE uses the NEMS-BT model to estimate the standards-related reduction in power sector emissions of carbon dioxide (CO_2), nitrogen oxides (NO_X), and mercury (Hg). In the emissions analysis, NEMS-BT is run similarly to the *AEO* NEMS, except that dehumidifier product energy use is reduced by the amount of energy saved (by fuel type) due to each considered standard level. The input, national energy savings, comes from the spreadsheet model used for the national impact analysis; the output is the forecasted physical emissions. The net benefit of each considered standard level is the difference between the emissions estimated by NEMS-BT at that level and the *AEO* reference case.

In addition to estimating impacts of standards on power sector emissions, DOE will estimate emissions impacts in production activities that provide the energy inputs to power plants. (These are referred to as "upstream" emissions.) This FFC analysis includes impacts on emissions of methane and nitrous oxide, both of which are recognized as greenhouse gases.

15.1 Carbon Dioxide

In the absence of any Federal regulation of power plant emissions of CO_2, a DOE standard is likely to result in reductions of those emissions. NEMS-BT tracks CO_2 emissions using a

detailed module that provides results with broad coverage of all sectors and inclusion of interactive effects. The net reduction is the difference between CO_2 emissions estimated by NEMS-BT at each standard level considered and the *AEO* reference case.

15.2 Sulfur Dioxide

SO_2 emissions from affected electric generating units (EGUs) are subject to nationwide and regional emissions cap-and-trade programs, which DOE preliminarily has determined create uncertainty about the potential standards' impact on SO_2 emissions. Title IV of the Clean Air Act sets an annual emissions cap on SO_2 for affected EGUs in the 48 contiguous states and the District of Columbia (D.C.). SO_2 emissions from 28 eastern states and D.C. are also limited under the Clean Air Interstate Rule (CAIR, 70 Fed. Reg. 25162 (May 12, 2005)), which created an allowance-based trading program. CAIR was remanded to the EPA by the U.S. Court of Appeals for the District of Columbia Circuit (D.C. Circuit), see *North Carolina v. EPA*, 550 F.3d 1176 (D.C. Cir. 2008), though it remained in effect temporarily, consistent with the D.C. Circuit's earlier opinion in *North Carolina v. EPA*, 531 F.3d 896 (D.C. Cir. 2008). On July 6, 2011 EPA issued a replacement for CAIR, the Cross-State Air Pollution Rule. 76 FR 48208 (Aug. 8, 2011). (See www.epa.gov/crossstaterule/). On December 30, 2011, however, the D.C. Circuit stayed the new rules while a panel of judges reviews them, and told EPA to continue enforcing CAIR (see *EME Homer City Generation v. EPA*, No. 11-1302, Order at *2 (D.C. Cir. Dec. 30, 2011)).

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

15.3 Nitrogen Oxides

Under CAIR, there is a cap on NO_X emissions in 28 eastern states and D.C. All those states and D.C. have elected to reduce their NO_X emissions by participating in cap-and-trade programs for EGUs. Therefore, energy conservation standards for residential dehumidifiers may have little or no physical effect on those emissions in the 28 eastern states and D.C. for the same reasons that they may have little or no physical effect on SO_2 emissions. DOE will use the NEMS-BT to estimate NO_X emissions reductions from potential standards in the states where emissions are not capped.

15.4 Mercury

On February 16, 2012, EPA issued national emissions standards for hazardous air pollutants (NESHAPs) for mercury and certain other pollutants emitted from coal and oil-fired EGUs. 77 FR 9304. The NESHAPs do not include emissions caps and, as such, DOE's energy conservation

standards would likely reduce Hg emissions. For this rulemaking, DOE plans to estimate Hg emissions reductions using NEMS-BT based on *AEO2012*, which does not incorporate the NESHAPs. DOE expects that future versions of the NEMS-BT model will reflect implementation of the NESHAPs.

15.5 Particulate Matter

DOE acknowledges that particulate matter (PM) exposure can affect human health. Power plant emissions can have either direct or indirect impacts on PM. Some pollutants emitted by a power plant are in the form of particulates leaving the smoke stack. Those are direct, or primary, PM emissions. The great majority of PM emissions associated with power plants, however, are in the form of secondary sulfates, which are produced at a significant distance from power plants by complex atmospheric chemical reactions that often involve the gaseous (non-particulate) emissions of power plants, SO_2 and NO_X. The quantity of the secondary sulfates produced is determined by a complex set of factors that include the atmospheric quantities of SO_2 and NO_X and other atmospheric constituents and conditions. Because those highly complex chemical reactions produce PM comprised of various constituents from various sources, EPA, does not distinguish direct PM emissions from power plants from the secondary sulfate particulates in its ambient air quality requirements, monitoring of ambient air quality, or PM emissions inventories. For these reasons, it currently is impossible to determine how amended standards would affect either direct or indirect PM emissions. Therefore, DOE is not planning to assess the impact of standards on PM emissions. Further, as described previously, it is uncertain whether efficiency standards will result in a net decrease in power plant emissions of SO_2, which are now largely regulated by cap-and-trade systems.

Item 15-1 *DOE seeks input on its plans to use NEMS-BT to analyze emissions associated with the dehumidifiers covered by this potential rulemaking.*

16. MONETIZING CARBON DIOXIDE AND OTHER EMISSIONS REDUCTIONS

DOE plans to consider the estimated monetary benefits likely to result from the reduced emissions of CO_2 and NO_X that are expected to result from each of the standard levels considered for dehumidifiers.

In order to estimate the monetary value of benefits resulting from reduced emissions of CO_2, DOE plans to use the most current social cost of carbon (SCC) values developed and/or agreed to by an interagency process. The SCC represents a monetary measure of the incremental damage resulting from greenhouse gas (GHG) emissions, including, but not limited to, net loss of agricultural productivity, human health effects, property damage from sea level rise, and changes in ecosystem services. Any effort to quantify and monetize the harms associated with climate change raises serious questions of science, economics, and ethics. But with full regard for the limits of both quantification and monetization, the SCC can be used to provide estimates of the social benefits of reductions in GHG emissions.

At the time of this notice, the most recent interagency estimates of the potential global benefits resulting from reduced CO_2 emissions in 2010, expressed in 2011$, were $5.1, $23.0, $37.7, and $69.6 per metric ton avoided. For emissions reductions that occur in later years, those values grow in real terms over time. Additionally, the interagency group determined that a range of values from 7 percent to 23 percent should be used to adjust the global SCC when calculating domestic effects, although DOE will give preference to consideration of the global benefits of reducing CO_2 emissions.

DOE recognizes that scientific and economic knowledge continues to evolve rapidly regarding the contribution of CO_2 and other GHG to changes in the global climate and the potential resulting damages to the world economy. Thus, the values are subject to change.

DOE also intends to estimate the potential monetary benefit of reduced NO_X emissions resulting from the standard levels it considers. For NO_x emissions, available estimates suggest a very wide range of monetary values for NO_X emissions, ranging from $460 to $4,722 per ton in 2011$.[23] In accordance with OMB guidance, DOE will conduct two calculations of the monetary benefits derived for NO_X, one using a real discount rate of 3 percent and the other a real discount rate of 7 percent.[24]

DOE does not plan to monetize estimates of Hg in this rulemaking. DOE has decided to await further guidance regarding consistent valuation and reporting of Hg emissions before it monetizes Hg in its rulemakings.

Item 16-1 *Are there any other environmental factors the Department should consider in this rulemaking?*

Item 16-2 *Are there other approaches to the emissions analysis that the Department should consider?*

17. REGULATORY IMPACT ANALYSIS

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

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

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

If DOE proposes energy conservation standards for residential dehumidifiers, and the NOPR constitutes a significant regulatory action as defined under section 3(f) of Executive Order 12866, "Regulatory Planning and Review," 58 FR 51735 (October 4, 1993), DOE will prepare and submit to OMB for review the assessment of costs and benefits required under section 6(a)(3) of the order.

APPENDIX A – SUMMARY OF ITEMS FOR COMMENT FROM INTERESTED PARTIES

DOE requests comments from interested parties on the following issues: