DEPARTMENT OF ENERGY

10 CFR Parts 429 and 430

[Docket Number EERE–2012–BT–STD–0027]

RIN 1904–AC81

Energy Conservation Program: Energy Conservation Standards for Dehumidifiers

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

ACTION: Final rule.

SUMMARY: The Energy Policy and Conservation Act of 1975 (EPCA), as amended, prescribes energy conservation standards for various consumer products and certain commercial and industrial equipment, including dehumidifiers. EPCA also requires the U.S. Department of Energy (DOE) to periodically determine whether more-stringent standards would be technologically feasible and economically justified, and would save a significant amount of energy. In this final rule, DOE is adopting more-stringent energy conservation standards for dehumidifiers. It has determined that the amended energy conservation standards for these products would result in significant conservation of energy, and are technologically feasible and economically justified.

DATES: The effective date of this rule is August 12, 2016. Compliance with the amended standards established for dehumidifiers in this final rule is required on and after June 13, 2019.

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

A link to the docket Web page can be found at: *http://www.regulations.gov/#!docketDetail;D=EERE-2012-BT-STD-0027*. The *www.regulations.gov* Web page will contain instructions on how to access all documents, including public comments, in the docket.

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

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SUPPLEMENTARY INFORMATION:

Table of Contents

I. Synopsis of the Final Rule

Title III, Part B [1] of the Energy Policy and Conservation Act of 1975 (EPCA or the Act), Public Law 94–163 (42 U.S.C. 6291–6309, as codified), established the Energy Conservation Program for Consumer Products Other Than Automobiles.[2] These products include dehumidifiers, the subject of this document.

Pursuant to EPCA, any new or amended energy conservation standard must be designed to achieve the maximum improvement in energy efficiency that DOE determines is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A)) Furthermore, the new or amended standard must result in significant conservation of energy. (42 U.S.C. 6295(o)(3)(B)) EPCA also provides that not later than 6 years after issuance of any final rule establishing or amending a standard, DOE must publish either a notice of determination that standards for the product do not need to be amended, or a notice of proposed rulemaking including new proposed energy conservation standards. (42 U.S.C. 6295(m))

In accordance with these and other statutory provisions discussed in this document, DOE is adopting amended energy conservation standards for dehumidifiers. The amended standards, which are expressed in the minimum allowable integrated energy factor (IEF), expressed in liters (L) of moisture removed per kilowatt-hour (kWh), are shown in Table I.1. These standards apply to all products listed in Table I.1 and manufactured in, or imported into, the United States on and after June 13, 2019.

TABLE I.1—ENERGY CONSERVATION STANDARDS FOR DEHUMIDIFIERS (COMPLIANCE STARTING JUNE 13, 2019)

Portable dehumidifier product capacity (pints/day)	Minimum integrated energy factor (L/kWh)
25.00 or less	1.30
25.01–50.00	1.60
50.01 or more	2.80
Whole-home dehumidifier product case volume (cubic feet)	
8.0 or less	1.77
More than 8.0	2.41

A. Benefits and Costs to Consumers

Table I.2 presents DOE's evaluation of the economic impacts of the adopted standards on consumers of dehumidifiers, as measured by the average life-cycle cost (LCC) savings and the simple payback period (PBP).[3] The average LCC savings are positive or zero for all product classes, and the PBP is less than the average lifetime of portable and whole-home dehumidifiers, which is estimated to be 11 years and 19 years, respectively (see section IV.F).

TABLE I.2—IMPACTS OF AMENDED ENERGY CONSERVATION STANDARDS ON CONSUMERS OF DEHUMIDIFIERS

Product class	Average LCC savings (2014$)	Simple payback period (years)
PC1: Portable Dehumidifier: ≤25.00 pints/day	107	0.5
PC2: Portable Dehumidifier: 25.01–50.00 pints/day	119	0.4
PC3: Portable Dehumidifier: ≥50.01 pints/day	142	4.5
PC4: Whole-home Dehumidifier: ≤8ft^3.		
PC5: Whole-home Dehumidifier: >8ft^3.		

DOE's analysis of the impacts of the adopted standards on consumers is described in section IV.F of this document.

B. Impact on Manufacturers

The industry net present value (INPV) is the sum of the discounted cash flows to the industry from the base year through the end of the analysis period (2016 to 2048). Using a real discount rate of 8.4 percent, DOE estimates that the INPV for manufacturers of dehumidifiers in the case without amended standards is $179.5 million in 2014$. Under the adopted standards, DOE expects that manufacturers may lose up to 20.9 percent of this INPV, which is approximately $37.5 million. Additionally, DOE identified five other DOE regulations that impact dehumidifier manufacturers and considered potential manufacturer impacts associated with the cumulative burden of these regulations, as discussed in section V.B.2.e of this document. Based on DOE's interviews with the manufacturers of dehumidifiers and impacts analysis, DOE does not expect significant impacts on manufacturing capacity or loss of employment for the industry as a whole to result from the standards for dehumidifiers.

DOE's analysis of the impacts of the adopted standards on manufacturers is described in section IV.J of this document.

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

[2] All references to EPCA in this document refer to the statute as amended through the Energy Efficiency Improvement Act of 2015, Public Law 114–11 (Apr. 30, 2015).

[3] The average LCC savings are measured relative to the efficiency distribution in the no-new-standards case, which depicts the market in the compliance year in the absence of standards (see section IV.F.9). The simple PBP, which is designed to compare specific dehumidifier efficiency levels, is measured relative to the baseline model (see section IV.C.1.a).

C. National Benefits and Costs[4]

DOE's analyses indicate that the adopted energy conservation standards for dehumidifiers would save a significant amount of energy. Relative to the case without amended standards the lifetime energy savings for dehumidifiers purchased in the 30-year period that begins in the anticipated year of compliance with the amended standards (2019–2048), amount to 0.30 quadrillion Btu (quads).[5] This represents a savings of 7.4 percent relative to the energy use of these products in the case without amended standards (referred to as the ''no-new-standards case'').

The cumulative net present value (NPV) of total consumer costs and savings of the standards for dehumidifiers ranges from $1.28 billion (at a 7-percent discount rate) to $2.71 billion (at a 3-percent discount rate). This NPV expresses the estimated total value of future operating-cost savings minus the estimated increased product costs for dehumidifiers purchased in 2019–2048.

In addition, the standards for dehumidifiers are projected to yield significant environmental benefits. DOE estimates that the standards would result in cumulative greenhouse gas emission reductions (over the same period as for energy savings) of 18.6 million metric tons (Mt)[6] of carbon dioxide (CO_2), 11.0 thousand tons of sulfur dioxide (SO_2), 33.1 tons of nitrogen oxides (NO_X), 77.9 thousand tons of methane (CH_4), 0.23 thousand tons of nitrous oxide (N_2O), and 0.04 tons of mercury (Hg).[7] The cumulative reduction in CO_2 emissions through 2030 amounts to 5.3 Mt.

The value of the CO_2 reductions is calculated using a range of values per metric ton of CO_2 (otherwise known as the ''Social Cost of Carbon,'' or SCC) developed by a Federal interagency working group.[8] The derivation of the SCC values is discussed in section 0. Using discount rates appropriate for each set of SCC values, DOE estimates that the net present monetary value of the CO_2 emissions reduction (not including CO_2 equivalent emissions of other gases with global warming potential) is between $0.1 billion and $1.9 billion, with a value of $0.6 billion using the central SCC case represented by $40.0/t in 2015. DOE also estimates that the net present monetary value of the NO_X emissions reduction to be $0.03 billion at a 7-percent discount rate, and $0.07 billion at a 3-percent discount rate.[9]

Table I.3 summarizes the national economic benefits and costs expected to result from the adopted standards for dehumidifiers.

TABLE I.3—SUMMARY OF NATIONAL ECONOMIC BENEFITS AND COSTS OF AMENDED ENERGY CONSERVATION STANDARDS FOR DEHUMIDIFIERS *

Category	Present value (billion 2014$)	Discount rate (%)
Benefits		
Consumer Operating Cost Savings	1.4	7
	2.9	3
CO_2 Reduction Value ($12.2/t case) **	0.1	5
CO_2 Reduction Value ($40.0/t case) **	0.6	3
CO_2 Reduction Value ($62.3/t case) **	1.0	2.5
CO_2 Reduction Value ($117/t case) **	1.9	3
NO_X Reduction Value †	0.03	7
	0.07	3
Total Benefits ††	2.0	7
	3.6	3
Costs		
Consumer Incremental Installed Costs	0.11	7
	0.19	3
Net Benefits		
Including CO_2 and NO_X Reduction Monetized Value ††	1.9	7
	3.4	3

* This table presents the costs and benefits associated with dehumidifiers shipped in 2019–2048. These results include benefits to consumers which accrue after 2048 from the products purchased in 2019–2048. The costs account for the incremental variable and fixed costs incurred by manufacturers due to the standard, some of which may be incurred in preparation for the rule.

[4] All monetary values in this section are expressed in 2014 dollars and, where appropriate, are discounted to 2015 unless explicitly stated otherwise. Energy savings in this section refer to the full-fuel-cycle savings (see section IV.H for discussion).

[5] The quantity refers to full-fuel-cycle (FFC) energy savings. FFC energy savings includes the energy consumed in extracting, processing, and transporting primary fuels (*i.e.*, coal, natural gas, petroleum fuels), and, thus, presents a more complete picture of the impacts of energy efficiency standards. For more information on the FFC metric, see section IV.H.2.

[6] A metric ton is equivalent to 1.1 short tons. Results for NO_X and Hg are presented in short tons.

[7] DOE calculated emissions reductions relative to the no-new-standards-case, which reflects key assumptions in the *Annual Energy Outlook 2015* (*AEO 2015*) Reference case, which generally represents current legislation and environmental regulations for which implementing regulations were available as of October 31, 2014.

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

[9] DOE estimated the monetized value of NO_X emissions reductions using benefit per ton estimates from the *Regulatory Impact Analysis for the Clean Power Plan Final Rule,* published in August 2015 by EPA's Office of Air Quality Planning and Standards. (Available at: *http://www.epa.gov/cleanpowerplan/clean-power-plan-final-rule-regulatory-impact-analysis.*) See section IV.L.2 for further discussion. Note that the agency is primarily using a national benefit-per-ton estimate for NO_X emitted from the Electricity Generating Unit sector based on an estimate of premature mortality derived from the ACS study (Krewski et al., 2009). If the benefit-per-ton estimates were based on the Six Cities study (Lepuele et al., 2011), the values would be nearly two-and-a-half times larger.

** The CO_2 values represent global monetized values of the SCC, in 2014$, in 2015 under several scenarios of the updated SCC values. The first three cases use the averages of SCC distributions calculated using 5%, 3%, and 2.5% discount rates, respectively. The fourth case represents the 95th percentile of the SCC distribution calculated using a 3% discount rate. The SCC time series incorporate an escalation factor.

† The $/ton values used for NO_X are described in section 0. DOE estimated the monetized value of NO_X emissions reductions using benefit per ton estimates from the *Regulatory Impact Analysis for the Clean Power Plan Final Rule*, published in August 2015 by EPA's Office of Air Quality Planning and Standards. (Available at: *http://www.epa.gov/cleanpowerplan/clean-power-plan-final-rule-regulatory-impact-analysis*.) See section IV.L.2 for further discussion. Note that the agency is primarily using a national benefit-per-ton estimate for NO_X emitted from the Electricity Generating Unit sector based on an estimate of premature mortality derived from the ACS study (Krewski et al., 2009). If the benefit-per-ton estimates were based on the Six Cities study (Lepuele et al., 2011), the values would be nearly two-and-a-half times larger.

†† Total Benefits for both the 3% and 7% cases are derived using the series corresponding to average SCC with 3-percent discount rate ($40.0/t case).

The benefits and costs of the adopted standards, for dehumidifiers sold in 2019–2048, can also be expressed in terms of annualized values. The monetary values for the total annualized net benefits are the sum of (1) the national economic value of the benefits in reduced consumer operating costs, minus (2) the increases in product purchase prices and installation costs, plus (3) the value of the benefits of CO_2 and NO_X emission reductions, all annualized.[10]

Although the value of operating cost savings and CO_2 emission reductions are both important, two issues are relevant. First, the national operating cost savings are domestic U.S. consumer monetary savings that occur as a result of market transactions, whereas the value of CO_2 reductions is based on a global value. Second, the assessments of operating cost savings and CO_2 savings are performed with different methods that use different time frames for analysis. The national operating cost savings is measured for the lifetime of dehumidifiers shipped in 2019–2048. Because CO_2 emissions have a very long residence time in the atmosphere,[11] the SCC values in future years reflect future CO_2-emissions impacts that continue beyond 2100.

Estimates of annualized benefits and costs of the adopted standards are shown in Table I.4. The results under the primary estimate are as follows. Using a 7-percent discount rate for benefits and costs other than CO_2 reduction, (for which DOE used a 3-percent discount rate along with the SCC series that has a value of $40.0/t in 2015),[12] the estimated cost of the standards in this rule is $11 million per year in increased equipment costs, while the estimated annual benefits are $136 million in reduced equipment operating costs, $34 million in CO_2 reductions, and $2.9 million in reduced NO_X emissions. In this case, the net benefit amounts to $163 million per year. Using a 3-percent discount rate for all benefits and costs and the SCC series has a value of $40.0/t in 2015, the estimated cost of the standards is $10 million per year in increased equipment costs, while the estimated annual benefits are $162 million in reduced operating costs, $34 million in CO_2 reductions, and $3.7 million in reduced NO_X emissions. In this case, the net benefit amounts to $189 million per year.

TABLE I.4—ANNUALIZED BENEFITS AND COSTS OF AMENDED STANDARDS FOR DEHUMIDIFIERS *

	Discount rate	Million 2014$/year		
		Primary estimate	Low net benefits estimate	High net benefits estimate
Benefits				
Consumer Operating Cost Savings	7%	136	131	141.
	3%	162	154	169.
CO_2 Reduction Value ($12.2/t case) **	5%	10	10	11.
CO_2 Reduction Value ($40.0/t case) **	3%	34	34	35.
CO_2 Reduction Value ($62.3/t case) **	2.5%	50	49	51.
CO_2 Reduction Value ($117/t case) **	3%	104	102	106.
NO_X Reduction Value †	7%	2.9	2.9	6.7.
	3%	3.7	3.7	8.6.
Total Benefits ††	7% plus CO_2 range	150 to 243	144 to 236	159 to 254.
	7%	173	167	183.
	3% plus CO_2 range	176 to 269	168 to 260	188 to 284.
	3%	200	192	213.
Costs				
Consumer Incremental Product Costs	7%	11	11	10.
	3%	10	12	10.
Net Benefits				
Total ††	7% plus CO_2 range	139 to 232	132 to 224	148 to 244.

[10] To convert the time-series of costs and benefits into annualized values, DOE calculated a present value in 2015, the year used for discounting the NPV of total consumer costs and savings. For the benefits, DOE calculated a present value associated with each year's shipments in the year in which the shipments occur (*e.g.*, 2020 or 2030), and then discounted the present value from each year to 2015. The calculation uses discount rates of 3 and 7 percent for all costs and benefits except for the value of CO_2 reductions, for which DOE used case-specific discount rates, as shown in Table I.3. Using the present value, DOE then calculated the fixed annual payment over a 30-year period, starting in the compliance year that yields the same present value.

[11] The atmospheric lifetime of CO_2 is estimated of the order of 30–95 years. Jacobson, MZ (2005), ''Correction to 'Control of fossil-fuel particulate black carbon and organic matter, possibly the most effective method of slowing global warming,' '' *J. Geophys. Res.* 110. pp. D14105.

[12] DOE used a 3-percent discount rate because the SCC values for the series used in the calculation were derived using a 3-percent discount rate (see section IV.L).

TABLE I.4—ANNUALIZED BENEFITS AND COSTS OF AMENDED STANDARDS FOR DEHUMIDIFIERS *—Continued

	Discount rate	Million 2014$/year		
		Primary estimate	Low net benefits estimate	High net benefits estimate
	7%	163	156	173.
	3% plus CO_2 range	165 to 259	157 to 248	178 to 274.
	3%	189	180	203.

* This table presents the annualized costs and benefits associated with dehumidifiers shipped in 2019–2048. These results include benefits to consumers which accrue after 2048 from the dehumidifiers purchased from 2019–2048. The results account for the incremental variable and fixed costs incurred by manufacturers due to the standard, some of which may be incurred in preparation for the rule. The Primary, Low Benefits, and High Benefits Estimates utilize projections of energy prices from the *AEO 2015* Reference case, Low Economic Growth case, and High Economic Growth case, respectively. In addition, incremental product costs reflect a medium decline rate in the Primary Estimate, a low decline rate in the Low Benefits Estimate, and a high decline rate in the High Benefits Estimate. The methods used to derive projected price trends are explained in section IV.F.

** The CO_2 values represent global monetized values of the SCC, in 2014$, in 2015 under several scenarios of the updated SCC values. The first three cases use the averages of SCC distributions calculated using 5%, 3%, and 2.5% discount rates, respectively. The fourth case represents the 95th percentile of the SCC distribution calculated using a 3% discount rate. The SCC time series incorporate an escalation factor.

† DOE estimated the monetized value of NO_X emissions reductions using benefit per ton estimates from the *Regulatory Impact Analysis for the Clean Power Plan Final Rule*, published in August 2015 by EPA's Office of Air Quality Planning and Standards. (Available at: *http://www.epa.gov/cleanpowerplan/clean-power-plan-final-rule-regulatory-impact-analysis*.) See section IV.L.2 for further discussion. For DOE's Primary Estimate and Low Net Benefits Estimate, the agency used a national benefit-per-ton estimate for particulate matter emitted from the Electric Generating Unit sector based on an estimate of premature mortality derived from the ACS study (Krewski et al., 2009). For DOE's High Net Benefits Estimate, the benefit-per-ton estimates were based on the Six Cities study (Lepuele et al., 2011), which are nearly two-and-a-half times larger than those from the ACS study.

†† Total Benefits for both the 3% and 7% cases are derived using the series corresponding to the average SCC with 3-percent discount rate ($40.0/t case). In the rows labeled "7% plus CO_2 range" and "3% plus CO_2 range," the operating cost and NO_X benefits are calculated using the labeled discount rate, and those values are added to the full range of CO_2 values.

DOE's analysis of the national impacts of the adopted standards is described in sections IV.H, IV.K, and IV.L of this document.

D. Conclusion

Based on the analyses culminating in this final rule, DOE found the benefits to the nation of the standards (energy savings, consumer LCC savings, positive NPV of consumer benefit, and emission reductions) outweigh the burdens (loss of INPV and LCC increases for some users of these products). DOE has concluded that the standards in this final rule represent the maximum improvement in energy efficiency that is technologically feasible and economically justified, and would result in significant conservation of energy.

II. Introduction

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

A. Authority

Title III, Part B of the Energy Policy and Conservation Act of 1975 (EPCA or the Act), Public Law 94–163 (42 U.S.C. 6291–6309, as codified) established the Energy Conservation Program for Consumer Products Other Than Automobiles, a program covering most major household appliances (collectively referred to as ''covered products''), which includes the dehumidifiers that are the subject of this rulemaking. (42 U.S.C. 6295(cc)) EPCA, as amended, prescribed energy conservation standards for dehumidifiers [13] manufactured on or after October 1, 2007, and more stringent energy conservation standards for dehumidifiers manufactured on or after October 1, 2012. (42 U.S.C. 6295(cc)) Under 42 U.S.C. 6295(m), the agency must periodically review its already established energy conservation standards for a covered product.

Pursuant to EPCA, DOE's energy conservation program for covered products consists essentially of four parts: (1) Testing; (2) labeling; (3) the establishment of Federal energy conservation standards; and (4) certification and enforcement procedures. The Federal Trade Commission (FTC) is primarily responsible for labeling, and DOE implements the remainder of the program. Subject to certain criteria and conditions, DOE is required to develop test procedures to measure the energy efficiency, energy use, or estimated annual operating cost of each covered product. (42 U.S.C. 6295(o)(3)(A)) Manufacturers of covered products must use the prescribed DOE test procedure as the basis for certifying to DOE that their products comply with the applicable energy conservation standards adopted under EPCA and when making representations to the public regarding the energy use or efficiency of those products. (42 U.S.C. 6293(c) and 6295(s)) Similarly, DOE must use these test procedures to determine whether the products comply with standards adopted pursuant to EPCA. (42 U.S.C. 6295(s)) The DOE test procedures for dehumidifiers currently appear at title 10 of the Code of Federal Regulations (CFR) part 430, subpart B, appendix X.

DOE must follow specific statutory criteria for prescribing new or amended standards for covered products, including dehumidifiers. Any new or amended standard for a covered product must be designed to achieve the maximum improvement in energy efficiency that is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A) and (3)(B)) Furthermore, DOE may not adopt any standard that would not result in the significant conservation of energy. (42 U.S.C. 6295(o)(3)) Moreover, DOE may not prescribe a standard: (1) For certain products, including dehumidifiers, if no test procedure has been established for the product, or (2) if DOE determines by rule that the standard is not technologically feasible or economically justified. (42 U.S.C. 6295(o)(3)(A)–(B)) In deciding whether a proposed standard is economically justified, DOE must determine whether the benefits of the standard exceed its burdens. (42

[13] 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))

U.S.C. 6295(o)(2)(B)(i)) DOE must make this determination after receiving comments on the proposed standard, and by considering, to the greatest extent practicable, the following seven statutory factors:

(1) The economic impact of the standard on manufacturers and consumers of the products subject to the standard;

(2) The savings in operating costs throughout the estimated average life of the covered products in the type (or class) compared to any increase in the price, initial charges, or maintenance expenses for the covered products that are likely to result from the standard;

(3) The total projected amount of energy (or as applicable, water) savings likely to result directly from the standard;

(4) Any lessening of the utility or the performance of the covered products likely to result from 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 standard;

(6) The need for national energy and water conservation; and

(7) Other factors the Secretary of Energy (Secretary) considers relevant. (42 U.S.C. 6295(o)(2)(B)(i)(I)–(VII))

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

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

Additionally, 42 U.S.C. 6295(q)(1) specifies requirements when promulgating an energy conservation standard for a covered product that has two or more subcategories. DOE must specify a different standard level for a type or class of products that has the same function or intended use if DOE determines that products within such group: (A) Consume a different kind of energy from that consumed by other covered products within such type (or class); or (B) have a capacity or other performance-related feature which other products within such type (or class) do not have and such feature justifies a higher or lower standard. (42 U.S.C. 6295(q)(1)) In determining whether a performance-related feature justifies a different standard for a group of products, DOE must consider such factors as the utility to the consumer of such a feature and other factors DOE deems appropriate. *Id.* Any rule prescribing such a standard must include an explanation of the basis on which such higher or lower level was established. (42 U.S.C. 6295(q)(2))

Federal energy conservation requirements generally supersede State laws or regulations concerning energy conservation testing, labeling, and standards. (42 U.S.C. 6297(a)–(c)) DOE may, however, grant waivers of Federal preemption for particular State laws or regulations, in accordance with the procedures and other provisions set forth under 42 U.S.C. 6297(d)).

EPCA also requires that, for any final rule for new or amended energy conservation standards promulgated after July 1, 2010, DOE must address standby mode and off mode energy use. (42 U.S.C. 6295(gg)(3)) Specifically, when DOE adopts a standard for a covered product after that date, it must, if justified by the criteria for adoption of standards under EPCA (42 U.S.C. 6295(o)), incorporate standby mode and off mode energy use into a single standard, or, if that is not feasible, adopt a separate standard for such energy use for that product. (42 U.S.C. 6295(gg)(3)(A)–(B)) DOE's test procedures for dehumidifiers address standby mode and off mode energy use, as do the amended standards adopted in this final rule.

B. Background

1. Current Standards

EPCA prescribes energy conservation standards for dehumidifiers manufactured on or after October 1, 2012. In a final rule published on March 23, 2009, DOE codified these standards at 10 CFR 430.32(v)(2). 74 FR 12058. These standards are set forth in Table II.1.

TABLE II.1—FEDERAL ENERGY EFFICIENCY STANDARDS FOR DEHUMIDIFIERS *

Product class * (pints/day)	Energy factor (EF) ** (L/kWh)
Up to 35.00	1.35
35.01–45.00	1.50
45.01–54.00	1.60
54.01–75.00	1.70
75.01 or more	2.5

* Product capacity in pints/day is measured according to the DOE test procedure in appendix X of 10 CFR 430.

** EF is a measure of the water removed from the air per unit of energy consumed by a dehumidifier and is calculated according to appendix X.

2. History of Standards Rulemaking for Dehumidifiers

EPCA, as amended, established the first energy conservation standards for dehumidifiers manufactured as of October 1, 2007, based on the EF metric. As discussed in section II.B.1, subsequent amendments prescribed energy conservation standards for dehumidifiers manufactured on or after October 1, 2012. DOE is conducting this rulemaking pursuant to 42 U.S.C. 6295(m)(1), which requires DOE, no later than 6 years after issuance of any final rule establishing or amending a standard, to publish either a notice of determination that standards for the product do not need to be amended, or a NOPR that includes new proposed energy conservation standards.

DOE initiated this rulemaking by issuing an analytical Framework Document, ''Energy Conservation Standards Rulemaking Framework Document for Dehumidifiers.'' 77 FR 49739 (Aug. 17, 2012). The Framework Document explained the issues, analyses, and process that DOE anticipated using to develop energy conservation standards for dehumidifiers.

DOE held a public meeting on September 24, 2012, to solicit comments from interested parties regarding the Framework Document and DOE's proposed analytical approach. DOE sought feedback from interested parties on these subjects and provided information regarding the rulemaking process that DOE would follow. Interested parties discussed the following major issues at the public meeting: Rulemaking schedule; test procedure revisions; product classes; technology options; efficiency levels; and approaches for each of the analyses performed by DOE as part of the rulemaking process.

Comments received following the publication of the framework document helped DOE identify and resolve issues related to the subsequent preliminary analysis. In the preliminary analysis, DOE conducted in-depth technical analyses in the following areas: (1) Engineering; (2) markups to determine product price; (3) energy use; (4) life-cycle cost and payback period; and (5) national impacts. The preliminary technical support document (TSD) that presented the methodology and results of each of these analyses is available at *http://www.regulations.gov/#!documentDetail;D=EERE-2012-BT-STD-0027-0015*.

DOE also conducted, and included in the preliminary TSD, several other analyses that supported the major analyses. These analyses included: (1) The market and technology assessment; (2) the screening analysis, which contributes to the engineering analysis; and (3) the shipments analysis,[14] which contributes to the LCC and PBP analysis and national impact analysis (NIA). In addition to these analyses, DOE began preliminary work on the manufacturer impact analysis (MIA) and identified the methods to be used for the consumer subgroup analysis, the emissions analysis, the employment impact analysis, the regulatory impact analysis, and the utility impact analysis.

DOE published a notice of public meeting and availability of the preliminary TSD on May 22, 2014. 79 FR 29380. DOE subsequently held a public meeting on June 13, 2014, to discuss and receive comments on the preliminary TSD. DOE received comments on topics including: Whole-home dehumidifier coverage and test procedures, product classes, design options, efficiency levels, use of experience curves, shipments projections, social cost of carbon estimates and the associated monetization of carbon dioxide, and small business impacts. After reviewing these comments, DOE gathered additional information, held further discussions with manufacturers, and completed and revised the various analyses described in the preliminary analysis.

On June 3, 2015, DOE published a notice of proposed rulemaking (hereafter, the ''June 2015 NOPR'') and notice of public meeting. 80 FR 31645. The June 2015 NOPR and accompanying TSD presented the results of DOE's updated analyses and proposed amended standards for dehumidifiers. On July 7, 2015, DOE held a public meeting to discuss the issues detailed in the June 2015 NOPR. Interested parties commented on various aspects of the proposed rule and submitted supplemental written comments. Following the public meeting, DOE gathered additional information and performed additional analyses to supplement the analyses presented in the June 2015 NOPR. The results of these analyses are detailed in the TSD accompanying this final rule, available in the docket at the *regulations.gov* Web site. DOE considered the comments received since publication of the June 2015 NOPR, including those received at the NOPR public meeting, in developing amended standards for dehumidifiers.

III. General Discussion

DOE developed this final rule after considering comments, data, and information from interested parties that represent a variety of interests. The following discussion addresses issues raised by these commenters.

A. Product Classes and Scope of Coverage

When evaluating and establishing energy conservation standards, DOE divides covered products into product classes by the type of energy used or by capacity or other performance-related features that justify differing standards. In making a determination whether a performance-related feature justifies a different standard, DOE must consider such factors as the utility of the feature to the consumer and other factors DOE determines are appropriate. (42 U.S.C. 6295(q))

Existing energy conservation standards divide portable and whole home dehumidifiers into five product classes based on product capacity in the number of pints per day (pints/day) of moisture that the product removes from ambient air at test conditions, as measured by the applicable DOE test procedure, appendix X. In this rulemaking, DOE is establishing new product classes that differentiate dehumidifiers not only by product capacity but by product configuration as well (*i.e.*, between portable and whole-home configurations). For portable dehumidifiers, DOE is establishing the following three product classes based on the product capacity:[15] (1) 25.00 pints/day or less; (2) 25.01 to 50.00 pints/day; and (3) 50.01 pints/day or more. For whole-home dehumidifiers, DOE is adopting the following two product classes based on product case volume:[16] (1) Less than or equal to 8.0 ft^3; and (2) greater than 8.0 ft^3.

The product classes for portable dehumidifiers analyzed for this final rule are different from those examined in DOE's initial analysis and the June 2015 NOPR, while the product classes for whole-home dehumidifiers are the same. In the May 2014 Preliminary TSD, DOE initially analyzed five product classes for portable dehumidifiers based on product capacity. Due, in part, to comments received on the preliminary TSD, DOE proposed only three product classes for portable dehumidifiers in the June 2015 NOPR: (1) 30.00 pints/day or less; (2) 30.01 to 45.00 pints/day; and (3) 45.01 pints/day or more. For this final rule, DOE adjusted the product capacity thresholds between these three product classes after considering comments and conducting additional discussions with manufacturers and further analysis. Comments received relating to the scope of coverage and product classes are discussed in section IV.A of this final rule.

B. Test Procedure

DOE's current energy conservation standards for dehumidifiers are expressed in terms of EF, in L/kWh, and are a function of the product capacity, expressed in pints/day. (*See* 10 CFR 430.32(v)(2)).

EPCA specifies that the dehumidifier test criteria used under the ENERGY STAR[17] program in effect as of January 1, 2001,[18] must serve as the basis for the DOE test procedure for dehumidifiers, unless revised by DOE. (42 U.S.C. 6293(b)(13)) The ENERGY STAR test criteria required that American National Standards Institute (ANSI)/Association of Home Appliance Manufacturers (AHAM) Standard DH–1, ''Dehumidifiers,'' be used to measure product capacity while the Canadian Standards Association (CAN/CSA) standard CAN/CSA–C749–1994 (R2005), ''Performance of Dehumidifiers,'' be used to calculate the EF. The version of AHAM Standard DH–1 in use at the time the ENERGY STAR test criteria were adopted was AHAM Standard DH–1–1992. In 2006, DOE adopted these test criteria, along

[14] Industry data track shipments from manufacturers into the distribution chain. Data on national unit retail sales are lacking, but are presumed to be close to shipments under normal circumstances.

[15] Note that the test conditions for the new product classes are different from those for the existing product classes.

[16] Product case volume is the rectangular volume that the product case occupies, exclusive of any duct attachment collars or other external components.

[17] For more information on the ENERGY STAR program, please visit *www.energystar.gov*.

[18] ''Energy Star Program Requirements for Dehumidifiers'', Version 1.0, U.S. Environmental Protection Agency (EPA), available online at: *www.energystar.gov/products/specs/system/files/DehumProgReqV1.0.pdf*.

with related definitions and tolerances, as its test procedure for dehumidifiers at 10 CFR part 430, subpart B, appendix X. 71 FR 71340, 71347, 71366–71368 (Dec. 8, 2006).

On October 31, 2012, DOE published a final rule to establish a new test procedure for dehumidifiers that references ANSI/AHAM Standard DH–1–2008, ''Dehumidifiers,'' (ANSI/AHAM DH–1–2008) for both energy use and product capacity measurements. 77 FR 65995 (Oct. 31, 2012). The final rule also adopted standby and off mode provisions that satisfy the requirement in EPCA for DOE to include measures of standby mode and off mode energy consumption in its test procedures for residential products, if technically feasible. (42 U.S.C. 6295(gg)(2)(A)) This new DOE test procedure, codified at that time at 10 CFR part 430, subpart B, appendix X1, established a new metric, IEF, which incorporates measures of active, standby, and off mode energy use, in addition to the existing EF metric.

DOE subsequently removed the existing test procedures at appendix X and redesignated the test procedures at appendix X1 as appendix X. 79 FR 7366 (Feb. 7, 2014). Any representations of energy use, including standby mode or off mode energy consumption, or efficiency of portable dehumidifiers must be made in accordance with the results of testing pursuant to the redesignated appendix X.

On May 21, 2014, DOE published a NOPR (the ''May 2014 Test Procedure NOPR'') proposing further amendments to the dehumidifier test procedures in appendix X. 79 FR 29272. In addition to making clarifications and corrections in appendix X, DOE proposed creating a new appendix, appendix X1, which would: (1) Require certain active mode testing at a lower ambient temperature; (2) add a measure of fan-only mode energy consumption in the IEF metric; and (3) include testing methodology and measures of performance for whole-home dehumidifiers.

On February 4, 2015, DOE published a supplemental notice of proposed rulemaking (the ''February 2015 Test Procedure SNOPR''). 80 FR 5994. In the SNOPR, DOE maintained its proposals from the NOPR, except that DOE proposed: (1) Adjustments and clarifications to the whole-home dehumidifier test setup and conduct; (2) a method to determine whole-home dehumidifier case volume; (3) a method for measuring energy use in off-cycle mode, including any fan operation; (4) a clarification to the relative humidity and product capacity equations; and (5) additional technical corrections and clarifications.

In response to the May 2014 Test Procedure NOPR, June 2014 public meeting, and February 2015 Test Procedure SNOPR, DOE received comments from interested parties related to the test procedure. DOE addressed these issues in the test procedure final rule to establish a new appendix X1 published on July 31, 2015 (the ''July 2015 Test Procedure Final Rule,'' 80 FR 45801), and based its analysis in this notice on product capacities and efficiencies determined according to the appendix X1 test procedure.

C. Technological Feasibility

1. General

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

After DOE has determined that particular technology options are technologically feasible, it further evaluates each technology option in light of the following additional screening criteria: (1) Practicability to manufacture, install, and service; (2) adverse impacts on product utility or availability; and (3) adverse impacts on health or safety. 10 CFR part 430, subpart C, appendix A, section 4(a)(4)(ii)–(iv). Additionally, it is DOE policy not to include in its analysis any proprietary technology that is a unique pathway to achieving a certain efficiency level. Section IV.B of this document discusses the results of the screening analysis for dehumidifiers, particularly the designs DOE considered, those it screened out, and those that are the basis for the standards considered in this rulemaking. For further details on the screening analysis for this rulemaking, see chapter 4 of the final rule TSD.

2. Maximum Technologically Feasible Levels

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

D. Energy Savings

1. Determination of Savings

For each trial standard level (TSL), DOE projected energy savings from application of the TSL to dehumidifiers purchased in the 30-year period that begins in the year of compliance with any amended standards (2019–2048).[19] The savings are measured over the entire lifetime of products purchased in the 30-year analysis period. DOE quantified the energy savings attributable to each TSL as the difference in energy consumption between each standards case and the no-new-standards case. The no-new-standards case represents a projection of energy consumption that reflects how the market for a product would likely evolve in the absence of amended energy conservation standards.

DOE used its NIA spreadsheet models to estimate energy savings from potential amended standards for dehumidifiers. The NIA spreadsheet model (described in section IV.H of this document) calculates savings in site energy, which is the energy directly consumed by products at the locations where they are used. Based on the site energy, DOE calculates national energy savings (NES) in terms of primary energy savings at the site or at power plants, and also in terms of full-fuel-cycle (FFC) energy savings. The FFC metric includes the energy consumed in extracting, processing, and transporting primary fuels (*i.e.*, coal, natural gas, petroleum fuels), and thus presents a more complete picture of the impacts of

[19] DOE also presents a sensitivity analysis that considers impacts for products shipped in a 9-year period.

energy conservation standards.[20] DOE's approach is based on the calculation of an FFC multiplier for each of the energy types used by covered products or equipment. For more information on FFC energy savings, see section IV.H.2 of this document. For natural gas, the primary energy savings are considered to be equal to the site energy savings.

2. Significance of Savings

To adopt standards for a covered product, DOE must determine that such action would result in ''significant'' energy savings. (42 U.S.C. 6295(o)(3)(B)) Although the term ''significant'' is not defined in the Act, the U.S. Court of Appeals, for the District of Columbia Circuit in *Natural Resources Defense Council* v. *Herrington*, 768 F.2d 1355, 1373 (D.C. Cir. 1985), indicated opined that Congress intended ''significant'' energy savings in the context of EPCA to be savings that were not ''genuinely trivial.'' The energy savings for all the TSLs considered in this rulemaking, including the adopted standards, are nontrivial, and, therefore, DOE considers them ''significant'' within the meaning of section 325 of EPCA.

E. Economic Justification

1. Specific Criteria

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

a. Economic Impact on Manufacturers and Consumers

In determining the impacts of a potential amended standard on manufacturers, DOE conducts an MIA, as discussed in section IV.J. DOE first uses an annual cash-flow approach to determine the quantitative impacts. This step includes both a short-term assessment—based on the cost and capital requirements during the period between when a regulation is issued and when entities must comply with the regulation—and a long-term assessment over a 30-year period. The industry-wide impacts analyzed include: (1) INPV, which values the industry on the basis of expected future cash flows; (2) cash flows by year; (3) changes in revenue and income; and (4) other measures of impact, as appropriate. Second, DOE analyzes and reports the impacts on different types of manufacturers, including impacts on small manufacturers. Third, DOE considers the impact of standards on domestic manufacturer employment and manufacturing capacity, as well as the potential for standards to result in plant closures and loss of capital investment. Finally, DOE takes into account cumulative impacts of various DOE regulations and other regulatory requirements on manufacturers.

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

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

EPCA requires DOE to consider the savings in operating costs throughout the estimated average life of the covered product in the type (or class) compared to any increase in the price of, or in the initial charges for, or maintenance expenses of, the covered product that are likely to result from a standard. (42 U.S.C. 6295(o)(2)(B)(i)(II)) DOE conducts this comparison in its LCC and PBP analysis.

The LCC is the sum of the purchase price of a product (including its installation) and the operating cost (including energy, maintenance, and repair expenditures) discounted over the lifetime of the product. The LCC analysis requires a variety of inputs, such as product prices, product energy consumption, energy prices, maintenance and repair costs, product lifetime, and discount rates appropriate for consumers. To account for uncertainty and variability in specific inputs, such as product lifetime and discount rate, DOE uses a distribution of values, with probabilities attached to each value.

The PBP is the estimated amount of time (in years) it takes consumers to recover the increased purchase cost (including installation) of a more-efficient product through lower operating costs. DOE calculates the PBP by dividing the change in purchase cost due to a more-stringent standard by the change in annual operating cost for the year that standards are assumed to take effect.

For its LCC and PBP analysis, DOE assumes that consumers will purchase the covered products in the first year of compliance with amended standards. The LCC savings for the considered efficiency levels are calculated relative to the case that reflects projected market trends in the absence of amended standards. DOE's LCC and PBP analysis is discussed in further detail in section IV.F.

c. Energy Savings

Although significant conservation of energy is a separate statutory requirement for adopting an energy conservation standard, EPCA requires DOE, in determining the economic justification of a standard, to consider the total projected energy savings that are expected to result directly from the standard. (42 U.S.C. 6295(o)(2)(B)(i)(III)) As discussed in section IV.H, DOE uses the NIA spreadsheet models to project national energy savings.

d. Lessening of Utility or Performance of Products

In establishing product classes, and in evaluating design options and the impact of potential standard levels, DOE evaluates potential standards that would not lessen the utility or performance of the considered products. (42 U.S.C. 6295(o)(2)(B)(i)(IV)) Based on data available to DOE, the standards adopted in this final rule would not reduce the utility or performance of the products under consideration in this rulemaking. DOE discusses potential impacts on product utility in section IV.C.1.b of this document.

e. Impact of Any Lessening of Competition

EPCA directs DOE to consider the impact of any lessening of competition, as determined in writing by the Attorney General, that is likely to result from a standard. (42 U.S.C. 6295(o)(2)(B)(i)(V)) It also directs the Attorney General to determine the impact, if any, of any lessening of competition likely to result from a standard and to transmit such determination to the Secretary within 60 days of the publication of a proposed rule, together with an analysis of the nature and extent of the impact. (42 U.S.C. 6295(o)(2)(B)(ii)) DOE transmitted a copy of its proposed rule to the Attorney General with a request that the Department of Justice (DOJ) provide its determination on this issue. DOE received no adverse comments from DOJ regarding the proposed rule.

[20] The FFC metric is discussed in DOE's statement of policy and notice of policy amendment. 76 FR 51282 (Aug. 18, 2011), as amended at 77 FR 49701 (Aug. 17, 2012).

f. Need for National Energy Conservation

DOE also considers the need for national energy conservation in determining whether a new or amended standard is economically justified. (42 U.S.C. 6295(o)(2)(B)(i)(VI)) The energy savings from the adopted standards are likely to provide improvements to the security and reliability of the nation's energy system. Reductions in the demand for electricity also may result in reduced costs for maintaining the reliability of the nation's electricity system. DOE conducts a utility impact analysis to estimate how standards may affect the nation's needed power generation capacity, as discussed in section IV.M of this document.

The adopted standards also are likely to result in environmental benefits in the form of reduced emissions of air pollutants and greenhouse gases associated with energy production and use. DOE conducts an emissions analysis to estimate how potential standards may affect these emissions, as discussed in section IV.K of this document; the emissions impacts are reported in section V.B.6 of this document. DOE also estimates the economic value of emissions reductions resulting from the considered TSLs, as discussed in section IV.L of this document.

g. Other Factors

EPCA allows the Secretary of Energy, in determining whether a standard is economically justified, to consider any other factors that the Secretary deems to be relevant. (42 U.S.C. 6295(o)(2)(B)(i)(VII)) To the extent interested parties submit any relevant information regarding economic justification that does not fit into the other categories described above, DOE could consider such information under ''other factors.''

2. Rebuttable Presumption

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

IV. Methodology and Discussion of Related Comments

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

DOE used several analytical tools to estimate the impact of the standards considered in this document. The first tool is a spreadsheet that calculates the LCC savings and PBP of potential amended or new energy conservation standards. The national impacts analysis uses a second spreadsheet set that provides shipments forecasts and calculates national energy savings and net present value of total consumer costs and savings expected to result from potential energy conservation standards. DOE uses the third spreadsheet tool, the Government Regulatory Impact Model (GRIM), to assess manufacturer impacts of potential standards. These three spreadsheet tools are available on the DOE Web site for this rulemaking: *https://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/55.* Additionally, DOE used output from the latest version of the Energy Information Administration's (EIA) *Annual Energy Outlook (AEO),* a widely known energy forecast for the United States, for the emissions and utility impact analyses.

A. Market and Technology Assessment

DOE develops information in the market and technology assessment that provides an overall picture of the market for the products concerned, including the purpose of the products, the industry structure, manufacturers, market characteristics, and technologies used in the products. This activity includes both quantitative and qualitative assessments, based primarily on publicly-available information. The subjects addressed in the market and technology assessment for this rulemaking include: (1) A determination of the scope of the rulemaking and product classes; (2) manufacturers and industry structure; (3) existing efficiency programs; (4) shipments information; (5) market and industry trends; and (6) technologies or design options that could improve the energy efficiency of dehumidifiers. The key findings of DOE's market assessment are summarized below. See chapter 3 of the final rule TSD for further discussion of the market and technology assessment.

1. Scope of Coverage and Product Classes

EPCA defines a dehumidifier as product that is self-contained, electrically operated, mechanically encased, and a product that incorporates a refrigerated surface to condense moisture from the atmosphere. It further defines it as having a refrigerating system with an electric motor; a fan for air circulation; and a means for collecting or disposing of the condensate. (42 U.S.C. 6291(34)) In the July 2015 Test Procedure Final Rule, DOE clarified that this definition of a dehumidifier, codified at 10 CFR 430.2, does not apply to portable air conditioners, room air conditioners, or packaged terminal air conditioners. 80 FR 45801, 45804–45805 (July 31, 2015).[21]

In the July 2015 Test Procedure Final Rule, DOE also added definitions to 10 CFR 430.2 for portable dehumidifiers and whole-home dehumidifiers. Portable dehumidifiers are designed to operate within the dehumidified space without ducting attached, although ducting may be attached optionally. Whole-home dehumidifiers are designed to be installed with inlet ducting for return process air and outlet ducting that supplies dehumidified process air to one or more locations in the dehumidified space. In the July 2015 Test Procedure Final rule, DOE further established that dehumidifiers that are able to operate as both a portable and whole-home dehumidifier be tested and rated for both configurations. 80 FR 45801, 45805–45806 (July 31, 2015).

When evaluating and establishing energy conservation standards, DOE may divide covered products into product classes by the type of energy used, by capacity, or by other performance-related features that justify

[21] Room air conditioners and packaged terminal air conditioners are defined as a separate covered products under EPCA. (42 U.S.C. 6292(a)(2), 6295(c), 6311((1)(I), 6311(10)(A), and 6313(a)(3)) Portable air conditioners were determined by DOE to be covered products under EPCA in a final determination published on 80 FR 45801, 45805–45806 (July 31, 2015).

a different standard. In making a determination whether a performance-related feature justifies a different standard, DOE must consider such factors as the utility of the feature to the consumer and other factors DOE determines are appropriate. (42 U.S.C. 6295(q))

Under 42 U.S.C. 6295(cc)(2), standards are established for five product classes of dehumidifiers, based on the capacity of the unit in pints of water extracted per day, as shown in Table IV.1. Representations of capacity to comply with the current dehumidifier energy conservation standards are determined based on the current DOE test procedure in appendix X, as designated in the test procedure final rule published on February 7, 2014. 79 FR 7366.

TABLE IV.1—CURRENT DEHUMIDIFIER PRODUCT CLASSES

Capacity (*pints/day*):
Up to 35.00.
35.01–45.00.
45.01–54.00.
54.01–75.00.
75.00 or more.

a. Preliminary Analysis and NOPR Proposals

In the preliminary analysis conducted for this rulemaking, DOE considered the following portable dehumidifier product classes that were based on the existing product classes, but with capacities adjusted for the lower ambient temperature proposed in the May 2014 Test Procedure NOPR.

TABLE IV.2—PRELIMINARY ANALYSIS PORTABLE DEHUMIDIFIER PRODUCT CLASSES

Capacity (*pints/day*):
20.00 or less.
20.01 to 30.00.
30.01 to 35.00.
35.01 to 45.00.
45.01 or more.

In the preliminary analysis, DOE also considered two product classes for whole-home dehumidifiers, differentiated by product case volume.

TABLE IV.3—PRELIMINARY ANALYSIS WHOLE-HOME DEHUMIDIFIER PRODUCT CLASSES

Case Volume (*cubic feet*):
less than or equal to 8.0.
greater than 8.0.

In response to the preliminary analysis, DOE received comments stating that the test procedure changes proposed in the May 2014 Test Procedure NOPR would increase test-to-test variation and make it more difficult to establish product classes based on capacity thresholds for the portable dehumidifiers. DOE subsequently conducted additional analysis that indicated that product construction and performance under the proposed test conditions were similar for products with capacities of 20 pints/day or less and 20.01 to 30 pints/day. DOE observed the same similarities between products in the 30.01 to 35 pints/day and 35.01 to 45 pints/day product classes. DOE, therefore, proposed to establish only three portable product classes based on capacity and maintained the same two proposed product classes for whole-home dehumidifiers. DOE proposed the revised product class structure in the June 2015 NOPR. 80 FR 31645, 31656–31658 (June 3, 2015).

TABLE IV.4—JUNE 2015 NOPR DEHUMIDIFIER PRODUCT CLASSES

Portable (*capacity, pints/day*):
30.00 or less.
30.01 to 45.00.
45.01 or more.
Whole-Home (*case volume, cubic feet*):
less than or equal to 8.0.
greater than 8.0.

b. Comments and Responses

Scope of Coverage

Aprilaire Inc. (Aprilaire) stated that not requiring air conditioners to meet dehumidifier standards results in unfair competition because air conditioners often provide a dehumidification mode, yet are regulated only for cooling mode. (Aprilaire, No. 34 at p. 3; Aprilaire, Public Meeting Transcript, No. 35 at p. 27)[22] [23] DOE notes that the definition for dehumidifier in 10 CFR 430.2 specifically excludes portable air conditioners, room air conditioners, and packaged terminal air conditioners because these products are the subject of either existing energy conservation standards (*e.g.,* room air conditioners and packaged terminal air conditioners (42 U.S.C. 6295(c) and 42 U.S.C. 6313(a)(3)) or a current rulemaking considering new standards (*e.g.,* portable air conditioners). The existing or proposed energy conservation standards for these products address representative energy use in active, standby, and off modes. When evaluating new or amended standards, DOE will consider all relevant operating modes, including any dehumidification mode.

Aprilaire does not believe that portable dehumidifiers and whole-home dehumidifiers should be classified and regulated under the same standards for the same reason that DOE does not regulate space heaters and home heaters in the same category. (Aprilaire, No. 34 at p. 3) Although portable dehumidifiers and whole-home dehumidifiers have different applications and overall performance, they both: (1) Fall under the statutory definition of a dehumidifier; (2) provide the same dehumidification function: And (3) can be characterized with the same energy efficiency performance metric. In contrast, EPCA provides separate definitions of ''furnace,'' ''heat pump,'' and ''unit heater'' as mutually exclusive covered products (42 U.S.C. 6291(23), (24), and (45)), subject to separate energy conservation standards (42 U.S.C. 6295(f), (d), and (aa)). In the absence of statutory differentiation between portable dehumidifiers and whole-home dehumidifiers, DOE is addressing both product configurations in this rulemaking for amended dehumidifier standards. DOE, however, is establishing separate product classes for portable and whole-home dehumidifiers.

Definitions

Aprilaire suggested that DOE re-evaluate the definition for whole-home dehumidifiers because both whole-home dehumidifiers and portable dehumidifiers may or may not include ducting. Aprilaire stated that the correct distinction between the two is that whole-home dehumidifiers come with integral or external controls that allow the dehumidifier to function in concert with the central air distribution system. Aprilaire commented that a definition based on a distinction of controls compatibility with a central air system would include air conditioners, which DOE specifically excluded from

[22] A notation in the form ''Aprilaire, No. 34 at p. 3'' identifies a written comment: (1) Made by Aprilaire Inc.; (2) recorded in document number 34 that is filed in the docked of this standards rulemaking (Docket No. EERE–2012–BT–STD–0027) and available for review at *www.regulations.gov;* and (3) which appears on page 3 of document number 34.

[23] A notation in the form ''Aprilaire, Public Meeting Transcript, No. 35 at p. 27'' identifies an oral comment that DOE received during the July 7, 2015, dehumidifier energy conservation standards NOPR public meeting. Oral comments were recorded in the public meeting transcript and are available the dehumidifier energy conservation standards rulemaking docket (Docket No. EERE–2012–BT–STD–0027). This particular notation refers to a comment: (1) Made by Aprilaire Inc. during the public meeting; (2) recorded in document number 35, which is the public meeting transcript that is filed in the docket of this energy conservation standards rulemaking; and (3) which appears on page 27 of document number 35.

coverage. Further, Aprilaire commented that the definitions of the two types of dehumidifiers should reflect a number of other distinctions, including: Application flexibility, air flow rates, typical installation, and necessary installation expertise. (Aprilaire, No. 34 at pp. 3–4; Aprilaire, Public Meeting Transcript, No. 35 at p. 28) In addition to establishing definitions for portable dehumidifiers and whole-home dehumidifiers, DOE acknowledged in the July 2015 Test Procedure Final Rule that certain dehumidifiers offer optional or removable ducting, and therefore can be operated as either a portable dehumidifier or a whole-home dehumidifier. DOE has addressed these types of products in appendix X1 by requiring manufacturers to test and rate these products in both configurations. For all other products available on the market, the presence of ducts or lack thereof is the only reliably identifiable characteristic to differentiate between the two product types. For certain units, the additional characteristics identified by Aprilaire may also differentiate between portable dehumidifiers and whole-home dehumidifiers, but information on those characteristics may be subjective or not publicly available. Therefore, DOE is maintaining the presence of ducts as the primary differentiator between portable dehumidifiers and whole-home dehumidifiers.

Product Classes

Pacific Gas and Electric Company, Southern California Gas Company, San Diego Gas and Electric, and Southern California Edison (California Investor-Owned Utilities (IOUs)) supported DOE's proposal to consolidate dehumidifiers into fewer product classes; however, they requested that DOE consider whether capacity or physical size and weight is the more appropriate attribute for setting product classes. They stated that if dehumidifiers are typically available in two size and weight ranges and that physical size defines unique utility, product class definitions should account for physical size in addition to capacity. They warned that setting product classes based solely on capacity ratings may inadvertently encourage manufacturers to build units rated for low capacity by simply using larger components that increase weight, resulting in negative impacts on portability and a corresponding loss of utility to consumers. (California IOUs, No. 41 at pp. 1–2) Therma-Stor LLC (Therma-Stor) and Aprilaire disagreed with the proposed product classes based on capacity and/or physical size for the purpose of applying substantially different minimum efficiency levels. They commented that the establishment of classes is arbitrary and may not have sufficient granularity. (Therma-Stor, No. 38 at p. 1; Aprilaire, Public Meeting Transcript, No. 35 at p. 25; Aprilaire, No. 34 at p. 2) During interviews, multiple manufacturers of portable dehumidifiers stated that their products are typically built upon two product platforms with different case sizes. They noted that the two product sizes provide consumers with unique utility because the smaller units are more portable and weigh less than the large units. Typically, condensate removal capacity is also correlated with case size. The manufacturers stated that DOE should ensure that both product platforms are maintained with any amended energy conservation standards to provide consumers the option of purchasing the smaller, more portable products. Consistent with 42 U.S.C. 6295(q), DOE retained multiple portable dehumidifier product classes based on product capacity in this final rule. In its engineering analysis, however, DOE did not consider technology changes that would significantly impact the portability of the two lower-capacity product classes. Manufacturers may choose different pathways to improve efficiency, including by increasing component sizes and weights, but DOE's analysis shows that there are pathways to improving efficiency that would not affect consumer utility.

For whole-home dehumidifiers, certain space-constrained installation locations limit the case size that may be installed. Accordingly, manufacturers of these space-constrained products would be limited in their ability to increase component sizes to achieve higher efficiencies. Because some technologies are only able to be implemented in larger case volumes, DOE continues to base the whole-home dehumidifier product classes on case volume to ensure that space-constrained whole-home dehumidifiers would be able to maintain their smaller product volumes at the analyzed efficiency levels.

Electrolux Major Appliances—North America (Electrolux) suggested that the second portable dehumidifier product class include units with capacities from 30.01 to 50.00 pints/day because, under the capacity thresholds proposed in the June 2015 NOPR, units previously rated at 70 pints/day would inappropriately be categorized into the highest-capacity proposed portable dehumidifier product class. According to Electrolux, these products would be rated at 46 pints/day under appendix X1, but based on DOE's description of products in each proposed product class, Electrolux expects that DOE intended for these products to be classified in the middle-capacity portable dehumidifier product class. Electrolux stated that the current 70 pint/day unit, which is a very high volume and popular capacity, would effectively be eliminated from the market under the proposed standard level for the highest-capacity portable dehumidifier product class. (Electrolux, No. 36 at p. 1)

AHAM noted that the reduced temperature conditions for portable dehumidifiers in appendix X1 decrease the measured capacity by about 35 percent, on average, as compared to the previous test conditions. Therefore, although AHAM and GE Appliances (GE) agreed with the establishment of three product classes, they suggested that the proposed product classes be slightly revised to reflect results from the test procedure at appendix X1. They suggested that the new portable dehumidifier product classes be: (1) less than 25.00 pints/day; (2) 25.01–50.00 pints/day; and (3) 50.01 pints/day or greater. (AHAM, No. 39 at pp. 2–4; GE, No. 42 at p. 1) Based on the comments in response to the June 2015 NOPR and on information gathered during confidential manufacturer interviews, DOE has revised the portable dehumidifier product classes, consistent with AHAM's recommendation, to better reflect how portable dehumidifiers are expected to perform when tested according to appendix X1. DOE estimates that the distribution of portable dehumidifier models among the three revised product classes is the same as was originally determined in the NOPR analysis because the rated capacity of these models would adjust in the same proportion as the capacity thresholds between the classes.

c. Final Rule Product Classes

After reviewing comments received in response to the June 2015 NOPR and evaluating additional information, DOE determined that an adjustment of the portable dehumidifier product classes is appropriate. DOE notes that these revised product classes more accurately capture the intent of DOE's original proposals when considering the impacts of the new test procedure at appendix X1, and are supported by data from manufacturers. In summary, DOE is establishing the following three portable dehumidifier product classes, based on product capacity, and two whole-home dehumidifier product classes, based on case volume, in this final rule.

TABLE IV.5—FINAL RULE DEHUMIDIFIER PRODUCT CLASSES

Portable (*capacity, pints/day*):
25.00 or less.
25.01 to 50.00.
50.01 or more.
Whole-Home (*case volume, cubic feet*):
less than or equal to 8.0.
greater than 8.0.

2. Technology Options

In the market analysis and technology assessment for the June 2015 NOPR, DOE identified 14 technology options that would be expected to improve the efficiency of dehumidifiers, as measured by the DOE test procedure (80 FR 31645, 31659 (June 3, 2015)):

TABLE IV.6—NOPR TECHNOLOGY OPTIONS FOR DEHUMIDIFIERS

1. Built-in hygrometer/humidistat.
2. Improved compressor efficiency.
3. Improved condenser and evaporator performance.
4. Improved controls.
5. Improved defrost methods.
6. Improved demand-defrost controls.
7. Improved fan and fan-motor efficiency.
8. Improved flow-control devices.
9. Low-standby-loss electronic controls.
10. Washable air filters.
11. Pre-cooling air-to-air heat exchanger.
12. Heat pipes.
13. Improved refrigeration system insulation.
14. Refrigerant-desiccant systems.

In the public meeting for the June 2015 NOPR, interested parties discussed the use of alternative refrigerants as another possible technology option for dehumidifiers. Aprilaire noted that dehumidifiers are a relatively small market and there are currently no alternative refrigerant compressors available for these products. (Aprilaire, Public Meeting Transcript, No. 35 at p. 47) Southern Company suggested that alternative refrigerants are currently being explored for refrigerators, which will likely impact the dehumidifier and other similar product's market in the near future. (Southern Company, Public Meeting Transcript, No. 35 at p. 47) GE stated that dehumidifiers would not transition to alternative refrigerants within the next five years. (GE, Public Meeting Transcript, No. 35 at p. 48) DOE included alternative refrigerants as a technology option for consideration in the final rule analysis because available information indicates that there are potential efficiency gains associated with this change.

After identifying all potential technology options for improving the efficiency of dehumidifiers, DOE performed a screening analysis (section IV.B of this document and chapter 4 of the final rule TSD) to determine which technologies merited further consideration. See chapter 5 of the final rule TSD for additional information on the technology options included in the engineering analysis.

B. Screening Analysis

DOE uses the following four screening criteria to determine which technology options are suitable for further consideration in an energy conservation standards rulemaking:

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

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

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

4. *Adverse impacts on health or safety.* If it is determined that a technology would have significant adverse impacts on health or safety, it will not be considered further. 10 CFR part 430, subpart C, appendix A, 4(a)(4) and 5(b).

In sum, if DOE determines that a technology, or a combination of technologies, fails to meet one or more of the above four criteria, it will be excluded from further consideration in the engineering analysis. The reasons for eliminating any technology are discussed below.

The subsequent sections include comments from interested parties pertinent to the screening criteria, DOE's evaluation of each technology option against the screening analysis criteria, and whether DOE determined that a technology option should be excluded (''screened out'') based on the screening criteria.

1. Screened-Out Technologies

For the June 2015 NOPR, DOE screened out pre-cooling air-to-air heat exchangers and heat pipes for portable dehumidifiers with capacities up to 45 pints/day because the likely increases in case size and overall weight would result in adverse impacts on product utility to consumers. 80 FR 31645, 31659–31660 (June 3, 2015).

Therma-Stor objected to the screening analysis determination that certain technology options are not suitable for low-capacity portable dehumidifiers. Therma-Stor believes that the improvements considered by DOE are applicable for all capacities and sizes of dehumidifiers. (Therma-Stor, No. 38 at p. 2) DOE agrees that these technology options are feasible for dehumidifiers of all capacities. However, as discussed in the June 2015 NOPR, DOE found that pre-cooling air-to-air heat exchangers and heat pipes are not currently incorporated in low-capacity portable dehumidifiers. DOE determined that including these technologies would require significantly larger case sizes for the low-capacity portable dehumidifiers, resulting in adverse impacts on consumer utility. For high-capacity portable dehumidifiers, DOE observes that certain products available on the market already incorporate air-to-air heat exchangers and a similar case size increase would be required for heat pipes. Therefore, DOE has maintained air-to-air heat exchangers and heat pipes as potential design options for this larger-capacity portable dehumidifier product class.

Although, as discussed in section b of this document, DOE is establishing the high-capacity portable dehumidifier product class for products with capacity greater than 50 pints/day rather than the 45 pints/day proposed in the June 2015 NOPR, the models that DOE considered to be high-capacity portable units in the preliminary analysis would remain classified in this product class based on available test data. Therefore, the determination to screen out pre-cooling air-to-air heat exchangers and heat pipes for portable dehumidifiers other than high-capacity dehumidifiers remains unchanged. DOE has retained these technology options for portable dehumidifiers with capacities greater than 50 pints/day and whole-home dehumidifiers.

2. Remaining Technologies

Through a review of each technology, DOE tentatively concludes that all of the other identified technologies listed in section IV.A.2 met all four screening criteria to be examined further as design

options in DOE's final rule analysis. In summary, DOE did not screen out the following technology options:

TABLE IV.7—FINAL RULE REMAINING DESIGN OPTIONS FOR DEHUMIDIFIERS

1. Built-in hygrometer/humidistat.
2. Improved compressor efficiency.
3. Improved condenser and evaporator performance.
4. Improved controls.
5. Improved defrost methods.
6. Improved demand-defrost controls.
7. Improved fan and fan-motor efficiency.
8. Improved flow-control devices.
9. Low-standby-loss electronic controls.
10. Washable air filters.
11. Pre-cooling air-to-air heat exchanger (high-capacity portable and whole-home dehumidifiers).
12. Heat pipes (high-capacity portable and whole-home dehumidifiers).
13. Improved refrigeration system insulation.
14. Refrigerant-desiccant systems.
15. Alternative refrigerants.

DOE determined that these design options are technologically feasible because they are technologies included in commercially available products or working prototypes. DOE also finds that all of the remaining design options meet the other screening criteria (*i.e.,* practicable to manufacture, install, and service and do not result in adverse impacts on consumer utility, product availability, health, or safety). For additional details, see chapter 4 of the final rule TSD.

C. Engineering Analysis

In the engineering analysis, DOE establishes the relationship between the manufacturer production cost (MPC) and improved dehumidifier efficiency. This relationship serves as the basis for cost-benefit calculations for individual consumers, manufacturers, and the Nation. DOE typically structures the engineering analysis using one of three approaches: (1) Design option; (2) efficiency level; or (3) reverse engineering (or cost assessment). The design-option approach involves adding the estimated cost and associated efficiency of various efficiency-improving design changes to the baseline product to model different levels of efficiency. The efficiency-level approach uses estimates of costs and efficiencies of products available on the market at distinct efficiency levels to develop the cost-efficiency relationship. The reverse-engineering approach involves testing products for efficiency and determining cost from a detailed bill of materials (BOM) derived from reverse engineering representative products. The efficiency ranges from that of the least-efficient dehumidifier sold today (*i.e.,* the baseline) to the maximum technologically feasible efficiency level. At each efficiency level examined, DOE determines the MPC; this relationship is referred to as a cost-efficiency curve.

1. Efficiency Levels

a. Baseline Efficiency Levels

A baseline unit is typically a product that just meets current Federal energy conservation standards and provides basic consumer utility. DOE uses the baseline unit for comparison in several phases of its rulemaking analyses, including the engineering analysis, LCC analysis, PBP analysis, and NIA. To determine energy savings that will result from an amended energy conservation standard, DOE compares energy use at each of the higher efficiency levels to the energy consumption of the baseline unit. Similarly, to determine the changes in price to the consumer that will result from an amended energy conservation standard, DOE compares the price of a unit at each higher efficiency level to the price of a unit at the baseline.

For the June 2015 NOPR, DOE determined baseline efficiency levels by adjusting the existing minimum EF levels to IEF values as would be measured under appendix X1. DOE determined the appropriate adjusted baseline efficiency levels based on its test sample, which included a market-representative range of manufacturers, capacities, and efficiencies, and additional numerical adjustments for baseline features identified through market analysis. The most significant adjustments accounted for the lower ambient test temperature, and energy consumption in standby mode, off mode, and fan-only mode. Where DOE combined portable dehumidifier product classes between the preliminary analysis and the June 2015 NOPR, it set the baseline efficiency level for the combined product classes at the lower of the two baseline IEF levels considered in the preliminary analysis for the two previously separate product classes, which represents the minimum IEF, as determined according to appendix X1, that DOE expects from any dehumidifiers within the combined product class that are currently compliant with the existing standards. DOE also proposed separate baseline efficiencies for the two whole-home dehumidifier product classes. 80 FR 31645, 31661 (June 3, 2015). Table IV.8 and Table IV.9 present the baseline efficiency levels proposed in the NOPR analysis.

TABLE IV.8—NOPR PORTABLE DEHUMIDIFIER BASELINE EFFICIENCY LEVELS

Capacity (pints/day)	IEF (L/kWh)
30.00 or less	0.77
30.01–45.00	0.94
45.01 or more	2.07

TABLE IV.9—NOPR WHOLE-HOME DEHUMIDIFIER BASELINE EFFICIENCY LEVELS

Case Volume (cubic feet)	IEF (L/kWh)
8.0 or less	1.77
More than 8.0	2.41

AHAM noted that DOE began the rulemaking analysis before the compliance date of the current energy conservation standards, and therefore the test sample may not represent products currently on the market. AHAM offered to share performance data if it received data from at least three manufacturers. (AHAM, Public Meeting Transcript, No. 35 at p. 40; AHAM, No. 39 at pp. 3–4) Although DOE conducted initial testing and analysis on units manufactured prior to October 1, 2012, DOE also supplemented that test sample when units complying with the most recent standards became available, beginning in 2013. In preparing and conducting the preliminary analysis, DOE acquired 12 additional portable dehumidifiers and conducted testing and teardowns to assess whether any technologies had changed to meet the currently applicable standards. DOE found that manufacturers incorporated more efficient compressors and larger heat exchangers to meet the new standards, but otherwise the products were similar in construction. DOE considered the more efficient components as technology options in the engineering analysis for the preliminary analysis, the June 2015 NOPR, and this final rule. DOE did not receive any additional performance data for this final rule.

Following publication of the June 2015 NOPR, DOE became aware of portable dehumidifiers available on the market with capacities greater than 50 pints/day (as measured under the new test procedure in appendix X1) that were not previously considered. The dehumidifiers previously considered in this higher-capacity portable dehumidifier product class are constructed similar to whole-home dehumidifiers, with more robust construction materials and components,

but are not designed to be installed with duct connections. The newly considered products are constructed similar to portable dehumidifiers with capacities less than 50 pints/day, with cases primarily made of plastic. DOE assessed the performance of these newly considered dehumidifiers with capacities greater than 50 pints/day and determined that they often include fan operation during off-cycle mode, as is common for portable dehumidifiers with lower capacities. Therefore, DOE determined that the baseline for this product class should be updated to account for fan operation in off-cycle mode, thereby reducing the baseline IEF. Based on test data, DOE estimated a fan power of 96.5 watts (W) for the greater than 50 pints/day product class, which was higher than the fan power estimated for the two lower-capacity portable dehumidifier product classes in order to maintain the necessary airflow through larger heat exchangers. DOE also incorporated the highest inactive mode or off-mode power, 2.12 W, observed in DOE's test sample to estimate inactive and off-mode energy use for the high-capacity portable dehumidifier product class.

Table IV.10 and Table IV.11 show the baseline efficiency levels for portable dehumidifiers and whole-home dehumidifiers covered in this final rule, respectively. Note that the whole-home dehumidifier baseline efficiency levels are unchanged from the June 2015 NOPR.

TABLE IV.10—FINAL RULE PORTABLE DEHUMIDIFIER BASELINE EFFICIENCY LEVELS

Capacity (pints/day)	IEF (L/kWh)
25.00 or less	0.77
25.01–50.00	0.94
50.01 or more	1.73

TABLE IV.11—FINAL RULE WHOLE-HOME DEHUMIDIFIER BASELINE EFFICIENCY LEVELS

Case Volume (cubic feet)	IEF (L/kWh)
8.0 or less	1.77
More than 8.0	2.41

Additional details on the selection of baseline units may be found in chapter 5 of the final rule TSD.

b. Higher Energy Efficiency Levels

For the June 2015 NOPR, DOE considered incremental efficiency levels beyond the baseline based on existing efficiency levels (*e.g.,* the ENERGY STAR level) available in the market and observed during investigative testing. Similar to the baseline efficiency levels discussed above, DOE adjusted the efficiency levels to reflect values that would be obtained when using appendix X1. In addition, DOE proposed that the first incremental efficiency level beyond the baseline for each portable dehumidifier product class, except for the highest-capacity product class, be achieved by the elimination of fan-only mode.

DOE further proposed max-tech efficiency levels that incorporate additional design options beyond those observed in its test sample. DOE then modeled the performance associated with these design options to estimate the max-tech IEF levels. 80 FR 31645, 31662–31663 (June 3, 2015).

Table IV.12 and Table IV.13 present the efficiency levels DOE considered in the June 2015 NOPR analysis.

TABLE IV.12—NOPR PORTABLE DEHUMIDIFIER EFFICIENCY LEVELS

Efficiency level	Efficiency level source	Integrated energy factor efficiency levels (L/kWh)		
		30.00 pints/day or less	30.01–45.00 pints/day	45.01 pints/day or more
Baseline	Current Baseline with Maximum Observed Off-cycle Mode Power	0.77	0.94	2.07
1	Current Baseline with no Fan Operation During Off-cycle Mode/Gap Fill 1	1.10	1.20	2.40
2	Gap Fill 1/Gap Fill 2	1.20	1.40	2.80
3	Gap Fill 2/Max Tech	1.30	1.60	3.66
4	Max Tech	1.57	1.80	.....

TABLE IV.13—NOPR WHOLE-HOME DEHUMIDIFIER EFFICIENCY LEVELS

Efficiency level	Efficiency level source	Integrated energy factor efficiency levels (*L/kWh*)	
		8.0 ft^3 or less (case volume)	More than 8.0 ft^3 (case volume)
Baseline	Minimum Available	1.77	2.41
1	Gap Fill 1	2.09	2.70
2	Gap Fill 2/Max Tech	2.53	3.52
3	Max Tech	.....	4.50

Additional details on the selection of incremental efficiency levels may be found in chapter 5, section 5.3.2 of the June 2015 NOPR TSD.

Fan Operation in Off-Cycle Mode

AHAM and GE suggested that elimination of fan operation in off-cycle mode at Efficiency Level 1 for portable dehumidifiers would impact air sampling and humidity control, and could require a change from active defrost to passive defrost. AHAM and GE also expect that Efficiency Level 1 would be difficult to achieve using other technology options, should a manufacturer choose to maintain fan operation in off-cycle mode. Therefore, they suggested that DOE include a gap fill efficiency level between baseline and Efficiency Level 1 that would not require the elimination of fan operation

in off-cycle mode. AHAM and GE further suggested that an IEF of 1.10 for portable dehumidifiers less than 30.00 pints/day is not an accurate representation of baseline efficiency with no fan operation in off-cycle mode. (AHAM, No. 39 at p. 5; GE, No. 42 at p. 2)

Due to the significant IEF decrease associated with continuous fan operation in off-cycle mode and the low cost of eliminating continuous fan operation, DOE continues to expect that manufacturers would eliminate fan operation in off-cycle mode as a first step to improving efficiency. Many dehumidifiers currently available on the market do not continuously operate the fan in off-cycle mode. DOE sought comment on this issue both in the proposed rule and in manufacturer interviews conducted in support of this final rule. DOE received comments and feedback that there would be no impact on consumer utility associated with removing continuous fan operation in off-cycle mode, and that many dehumidifiers either run the fan intermittently or for a short period of time during off-cycle mode. DOE also notes that, although it expects manufacturers to remove continuous fan operation in off-cycle mode to reach Efficiency Level 1, manufacturers may elect to switch from continuous fan operation to intermittent or short periods of fan operations along with other design options to improve efficiency. For its estimates of the IEF at the baseline, DOE assumed a baseline unit with continuous operation of the highest power fan motor in off-cycle mode, as observed in DOE's test sample. For Efficiency Level 1, DOE assumed that the continuous highest-power fan operation would be replaced by the typical off-cycle mode power consumption without a fan running, as observed in its test sample.

Heat Exchanger Modifications

Aprilaire agreed with DOE that adjusting the size of the heat exchanger coil is one of the primary means of improving dehumidifier efficiency, and that modifying the blower motor has less of an impact on efficiency. However, Aprilaire stated that installation size restrictions for whole-home dehumidifiers often inhibit a manufacturer's ability to increase the heat exchanger sizes to meet higher efficiency levels. (Aprilaire, Public Meeting Transcript, No. 35 at p. 49; Aprilaire, No. 34 at p. 2) DOE recognizes the constraints on case volume for whole-home dehumidifiers based on the installation location. Therefore, DOE constructed the whole-home dehumidifier product classes to ensure that units with case volume restrictions (*i.e.,* case volume of 8.0 cubic feet or less) would not be held to the same energy conservations standards as those without size constraints (*i.e.,* case volume more than 8.0 cubic feet).

Electrolux requested additional information on how DOE determined the increased heat exchanger size. (Electrolux, Public Meeting Transcript, No. 35 at p. 52) When adjusting the heat exchanger size in its model, DOE typically either added or removed a row of tube passes. The fins and other components of the heat exchangers were adjusted accordingly to accommodate the additional tube row, and the performance impacts were determined through modeling. When discussing increased heat exchanger size, DOE often refers to the resulting change in frontal surface area, although other associated heat exchanger characteristics were also adjusted.

Compressor Efficiency

In a joint comment, Appliance Standards Awareness Project (ASAP), Alliance to Save Energy, American Council for an Energy-Efficient Economy, Natural Resources Defense Council, and Northwest Energy Efficiency Alliance (hereinafter the ''Joint Commenters'') commented that although variable-speed compressors, which can achieve significant energy savings in the field, would not improve dehumidifier efficiency as measured by the DOE test procedure, these compressors generally have higher efficiencies at full power compared to traditional compressors currently used in dehumidifiers. For example, the Joint Commenters stated that one compressor manufacturer offers R–410A permanent-magnet inverter rotary compressors with energy efficiency ratio (EER) values of 11.0–11.8 for cooling capacities of 7,600–13,700 British thermal units per hour. (Joint Commenters, No. 40 at p. 2) While DOE is not aware of any dehumidifiers currently available on the market or any prototypes that incorporate variable-speed compressors, DOE considered high-efficiency compressors for the higher efficiency levels. Specifically, DOE accounted for compressors with EERs up to 11.2, within the range identified by the Joint Commenters for variable-speed compressors in its engineering analysis. See chapter 5 of the final rule TSD for additional information.

The California IOUs recommended that DOE account for likely changes in the room air conditioner and portable air conditioner markets, including energy conservation standards that may lead to greater availability of high efficiency compressors in the future. (California IOUs, No. 41 at p. 3) In this engineering analysis, DOE has considered the most efficient compressors currently available that are suitable for dehumidifiers. While DOE expects that dehumidifier manufacturers may shift to using more efficient available compressors in response to these amended standards, DOE does not necessarily expect that the maximum available compressor efficiency would increase in response to standards for dehumidifiers or closely related air conditioning products. If DOE becomes aware of more efficient compressors available or in working prototypes, it may consider those as potential technology options in any future rulemaking.

The California IOUs also recommended that DOE consider whether compressor availability, and the potential unavailability of dehumidifiers with certain capacities, would negatively impact consumers, assuming that other dehumidifiers with higher capacities were still available. Further, the California IOUs suggested that lower-capacity units provide no distinct utility from higher capacity units; instead, the product size and weight are more appropriate characteristics to define utility. (California IOUs, No. 41 at pp. 3–4) As discussed in section IV.A.1 of this document, DOE has established product classes for portable dehumidifiers based on product capacity, which is the primary consumer utility offered by dehumidifiers. DOE agrees with the California IOUs that lower product size and weight provide certain utility to consumers of low-capacity portable dehumidifiers. However, DOE observed that size and weight are directly correlated to product capacity, which is a measure of the primary function of the product to remove moisture from the conditioned space; therefore, DOE maintains capacity as the product class differentiator for portable dehumidifiers.

Additional Portable Dehumidifier Efficiency Level

The California IOUs, Joint Commenters, and ASAP recommended that DOE analyze an efficiency level for portable dehumidifiers at the maximum available efficiency, which would fall between Efficiency Level 3 and Efficiency Level 4 in the June 2015 NOPR and would closely align with Efficiency Level 4 from the preliminary analysis. According to these commenters, such an additional efficiency level would capture a

majority of the additional energy savings that would be associated with standards at the max-tech level while remaining cost-effective. The California IOUs further requested that DOE consider evaluating an additional efficiency level at ''near max-tech,'' excluding a shift to the highest-efficiency compressors. Acknowledging that the availability of high-efficiency compressors is currently a limiting factor, the California IOUs believe cost-effective energy savings would be achieved by optimizing other components without the use of the highest-efficiency compressors. (California IOUs, No. 41 at pp. 2–3; Joint Commenters, No. 40 at pp. 4–6; ASAP, Public Meeting Transcript, No. 35 at pp. 10, 38)

In the June 2015 NOPR analysis, DOE proposed the highest efficiency level at the maximum technologically feasible efficiency, which for dehumidifiers was slightly higher than the maximum efficiency available on the market. Because the difference between the max-tech and maximum available efficiencies was small (0.05 L/kWh) for the two lower-capacity portable dehumidifier product classes, DOE did not consider maintaining those maximum available efficiencies as separate efficiency levels in the June 2015 NOPR. Further, DOE notes that the same concerns regarding compressor availability would exist at a ''near max-tech'' level as at the max-tech. Accordingly, DOE did not analyze an additional efficiency level at the maximum available efficiency.

High-Capacity Portable Dehumidifier Efficiency Levels

Therma-Stor commented that the proposed efficiency levels are increased by a greater percentage for the higher-capacity portable dehumidifiers than for the lower-capacity portable dehumidifiers. Therma-Stor stated that high-capacity portable dehumidifiers already incorporate one or more efficiency features, yet of its seven current higher-capacity portable dehumidifier models, only one exceeds the proposed standard level. (Therma-Stor, No. 38 at pp. 2–3) For each product class analyzed in the standards rulemaking, DOE analyzed a representative sample of products to determine an appropriate baseline efficiency and improved efficiency levels. For the high-capacity portable dehumidifiers (50.01 pints/day or greater), DOE has updated the analysis for this product class to reflect new products on the market; however, DOE notes that multiple products in its test sample tested higher than the Efficiency Level 3 proposed in the June 2015 NOPR.

Whole-Home Dehumidifier Efficiency Levels

Aprilaire expressed concern that DOE's analysis of whole-home dehumidifiers, with only two efficiency levels, lacked the granularity of the portable dehumidifier analysis, and therefore may not properly evaluate the whole-home dehumidifier market. (Aprilaire, No. 34 at p. 2) The efficiency levels considered in the engineering analysis are developed based on the performance of products on the market and in DOE's test sample with different combinations of design options. Based on product testing and teardowns, DOE opted to include only one gap fill efficiency level for whole-home dehumidifiers with a case volume less than 8.0 cubic feet and two gap fill efficiency levels for whole-home dehumidifiers with case volumes greater than 8.0 cubic feet. DOE explains the design options associated with products at each of these efficiency levels in chapter 5 of the final rule TSD.

Therma-Stor commented that DOE's analysis of the whole-home dehumidifier market is incomplete due to the relatively small size of the segment, and the lack of substantial field studies. (Therma-Stor, No. 38 at p. 2) As described above for high-capacity portable dehumidifiers, DOE analyzed a representative sample of products for each whole-home dehumidifier product class to determine an appropriate baseline efficiency and improved efficiency levels.

Impact of Efficiency Levels

Southern Company recommended that DOE perform additional analysis to ensure that product utility is maintained at low temperatures when increasing the minimum efficiency under normal operating conditions. (Southern Company, Public Meeting Transcript, No. 35 at p. 38) In the rulemaking that established appendix X1, DOE determined that the representative operating condition for portable dehumidifiers is 65 degrees Fahrenheit (°F) dry-bulb temperature, and established this as the updated test condition for portable dehumidifiers. Accordingly, DOE based this final rule analysis on this test condition, which is lower than the dry-bulb temperature specified in the currently applicable test procedure, appendix X. As Southern Company suggested, lower operating temperatures may cause certain dehumidifiers to initiate defrosts, and thereby reduce overall performance. However, while some units designed to meet current energy conservation standards may enter a defrost mode at the 65 °F test condition, DOE expects that manufacturers would adjust their refrigeration systems to avoid defrosts due to any decrease in IEF required by amended standards. DOE does not expect the design options considered in this analysis to result in more frequent defrosts or any other impacts on performance at the representative operating conditions that would affect consumer utility compared to units currently available on the market.

In sum, DOE modified the baseline efficiency level from that proposed in the June 2015 NOPR and inserted a new Efficiency Level 1 for the high-capacity portable dehumidifier product class, and maintained all other efficiency levels as analyzed in the June 2015 NOPR. Table IV.14 and Table IV.15 present the efficiency levels DOE considered in this final rule analysis.

TABLE IV.14—FINAL RULE PORTABLE DEHUMIDIFIER EFFICIENCY LEVELS

Efficiency level	Efficiency level source	Integrated energy factor efficiency levels (L/kWh)		
		25.00 pints/day or less	25.01–50.00 pints/day	50.01 pints/day or more
Baseline	Current Baseline with Maximum Observed Off-cycle Mode Power	0.77	0.94	1.73
1	Current Baseline with no Fan Operation During Off-cycle Mode	1.10	1.20	2.15
2	Gap Fill 1	1.20	1.40	2.40
3	Gap Fill 2	1.30	1.60	2.80
4	Max Tech	1.57	1.80	3.66

TABLE IV.15—FINAL RULE WHOLE-HOME DEHUMIDIFIER EFFICIENCY LEVELS

Efficiency level	Efficiency level source	Integrated energy factor efficiency levels (L/kWh)	
		8.0 ft^3 or less (case volume)	More than 8.0 ft^3 (case volume)
Baseline	Minimum Available	1.77	2.41
1	Gap Fill 1	2.09	2.70
2	Gap Fill 2/Max Tech	2.53	3.52
3	Max Tech		4.50

Additional details on the selection of incremental efficiency levels may be found in chapter 5 of the final rule TSD.

2. Manufacturer Production Cost Estimates

Based on product teardowns and cost modeling, DOE developed overall cost-efficiency relationships for each product class considered in that analysis. DOE selected products covering the range of efficiencies available on the market for the teardown analysis. During the teardown process, DOE created detailed bills of materials (BOMs) that included all components and processes used to manufacture the products. DOE used the BOMs from the teardowns as an input to a cost model, which was used to calculate the MPC for products covering the range of efficiencies available on the market. The MPC accounts for labor, material, overhead, and depreciation costs that a manufacturer would incur in producing a specific dehumidifier. DOE also developed BOMs and MPCs for theoretical units that would implement the identified max-tech components for dehumidifiers.

DOE estimated that the costs for these products reflected the costs for typical units at their respective efficiency levels, consistent with the efficiency-level approach. DOE then used the design-option approach to determine what changes would be needed for a particular unit to meet each incrementally higher efficiency level. DOE constructed cost-efficiency curves for multiple manufacturers to reflect the incremental MPC corresponding to each manufacturer's product line and available platforms. DOE combined the individual cost-efficiency curves based on estimates of each manufacturer's market share to develop an overall cost-efficiency curve representative of the entire industry.

In improving the max-tech efficiencies beyond the maximum available, as discussed in section IV.C.1.b of the June 2015 NOPR, DOE determined that this was a technologically feasible change that would improve product efficiencies. DOE's determination was based on the general availability of these components, efficiency gains associated with these technology options, and the minimal cost impacts beyond the additional costs of the components. The MPCs for the June 2015 NOPR analysis reflected this design option, as well as others, at the max-tech efficiency level. 80 FR 31645, 31666 (June 3, 2015).

Table IV.16 presents the MPC estimates DOE developed for the June 2015 NOPR. *Id.*

TABLE IV.16—NOPR DEHUMIDIFIER INCREMENTAL MANUFACTURER PRODUCTION COSTS

[2013$]

Efficiency level	Portable product class capacities (pints/day)			Whole-home product class case volume (ft^3)	
	≤30.00	30.01–45.00	>45.00	≤8.0	>8.0
EL1	$—	$—	$42.81	$15.30	$6.20
EL2	1.69	2.39	53.66	129.22	37.20
EL3	4.27	8.07	120.33	N/A	161.39
EL4	19.38	22.42	N/A	N/A	N/A

Chapter 5 of the June 2015 NOPR TSD contains additional details on the analysis conducted in support of developing these MPC estimates.

Electrolux commented that a consumer would have to pay a cost adder of approximately $40 to buy a unit rated at 30 pints/day under the new test procedure at appendix X1 instead of a unit rated at 30 pints/day under the current appendix X, because the unit rated under appendix X1 would be a larger design that achieves 50 pints/day under appendix X). Electrolux was unsure whether the rated capacities at retail would shift lower (with no cost impact) or remain the same and result in much higher costs to consumers. (Electrolux, No. 36 at p. 1) As a result of discussions with manufacturers in confidential interviews, DOE has concluded that manufacturers will likely educate consumers to explain the reduction in rated capacity under appendix X1. Therefore, DOE believes that a consumer who previously would have purchased a 70 pints/day dehumidifier rated under appendix X would now purchase a similarly constructed unit with a rated capacity between 25 and 50 pints/day.

In this final rule, DOE estimated, as it did previously with portable dehumidifiers at lower capacities, that the cost to move from the baseline efficiency level to Efficiency Level 1 for portable dehumidifiers with capacities greater than 50 pints/day would not require any increase in manufacturer production costs, as the removal of fan operation in off-cycle mode is essentially a controls programming adjustment. DOE further notes that the same design options and subsequent efficiency improvements previously considered in the June 2015 NOPR for this product class are still applicable.

In this final rule DOE also updated the MPCs to 2014$, the most recent year for which full-year data was available at the time of this analysis. DOE notes that

when updating the costs to current dollars, some variables based on changing costs (*e.g.,* materials, shipping, *etc.*) increased while others decreased.

TABLE IV.17—FINAL RULE DEHUMIDIFIER INCREMENTAL MANUFACTURER PRODUCTION COSTS

[2014$]

Efficiency level	Portable product class capacities (pints/day)			Whole-Home product class case volume (ft^3)	
	≤25.00	25.01–50.00	>50.00	≤8.0	>8.0
EL1	.....	.....	.....	$15.78	$6.46
EL2	$1.69	$2.33	$49.27	125.95	38.82
EL3	4.29	8.00	61.32	N/A	183.42
EL4	19.63	22.62	173.63	N/A	N/A

Additional details on the development of the incremental cost estimates may be found in chapter 5 of the final rule TSD.

D. Markups Analysis

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

The manufacturer markup converts MPC to manufacturer selling price (MSP). DOE developed an average manufacturer markup by examining the annual Securities and Exchange Commission (SEC) 10–K reports filed by publicly traded manufacturers primarily engaged in appliance manufacturing and whose combined product range includes dehumidifiers.

For retailers, DOE developed separate markups for baseline products (baseline markups) and for the incremental cost of more efficient products (incremental markups). Incremental markups are coefficients that relate the change in the MSP of higher-efficiency models to the change in the retailer sales price. DOE relied on economic data from the U.S. Census Bureau to estimate average baseline and incremental markups.[24]

Aprilaire urged that the analysis be expanded for whole-home dehumidifiers to include the additional costs of shipping larger and heavier products and additional installation costs for larger units. (Aprilaire, No. 34 at p. 5)

As in the preliminary and NOPR analyses, DOE used two different distribution channels for portable dehumidifiers and whole-home dehumidifiers. For the final rule analysis, DOE amended the distribution channel of the high-capacity portable dehumidifier product class, PC3. A share of the PC3 market uses the same distribution channel as PC1 and PC2: Units move from manufacturer to retailer to consumer. For the other share of the PC3 market, the distribution channel reflects its larger size and uses the whole-home dehumidifier distribution channel. To represent additional steps in the purchase of a larger unit, the whole-home dehumidifier distribution channel reflects two additional markups to include wholesalers and contractors used in the purchase of the larger dehumidifiers, including the third portable dehumidifier product class and whole-home dehumidifiers. As a result, DOE concluded that the wholesaler and contractor markups for the larger units include additional costs of shipping and installation.

AHAM made the following comments regarding the use of incremental markups for appliance retailers to estimate future prices of efficient products: (1) The incremental markup approach relies on an assumption of perfect competition, which is an outdated model of the economy; (2) Relatively constant percent gross margins observed in aggregated appliance retail industry data imply the use of fixed-percent markups over time; (3) Interview responses from appliance retailers are consistent with the use of fixed-percent markups. (AHAM, No. 39 at p. 7)

DOE responds to these points as follows:

(1) DOE's incremental markup approach is based on the widely accepted economic view that prices closely reflect marginal costs in competitive markets and in markets with some degree of concentration.[25] In the absence of data to support a different assumption, DOE retains its assumption for this rulemaking.

(2) In examining the relatively constant appliance retail percent margin trend and its underlying prices, DOE found that the average inflation-adjusted prices of appliances are relatively fixed during this period as well. This set of historical data has no bearing on firm markup behavior under product price increases, such as DOE projects would occur when higher-efficiency products are introduced. If prices are relatively constant, the incremental markup approach will arrive at the same price prediction as applying fixed-percent margin; hence, the historically constant percent margins do not necessarily imply a constant percent margin in the future, especially in the case of increased input prices. DOE evaluated time series margin and price data from three industries that experienced rapidly changing input prices—the LCD television retail market,[26] the U.S. oil and gasoline market,[27] and the U.S. housing market.[28] The results indicate that dollar margins vary across different markets to reflect changes in input price, but the percent margins do not remain fixed over time in any of these industries. Appendix 6B in the TSD describes DOE's findings.

(3) Regarding the interviews with appliance retailers, it is difficult for DOE to evaluate the characterization of the responses without knowing what questions were posed to the retailers. DOE's analysis necessarily considers a simplified version of appliance retailing: Namely, a situation in which nothing changes except for those changes in appliance offerings that

[24] U.S. Census, *2012 Annual Retail Trade Survey* (*ARTS*), Electronics and Appliance Stores sectors.

[25] Pindyck, R. and Rubinfeld, D. *Microeconomics.* 8th Edition. Prentice Hall, 2012.

[26] LCD television data from DisplaySearch, a market research company affiliated with NPD Group.

[27] U.S. Energy Information Agency, Oil price: Spot price in Cushing, Oklahoma for 42 gallon barrel of oil; Retail gas price: U.S. average retail price of gasoline, all grades and formulations.

[28] Standard and Poors, Case-Shiller home price index, CPI-adjusted; REAL Trends, *http://www.realtrends.com.*

occur in response to new standards. DOE implicitly asks: Assuming the product cost increases while the other costs remain constant (no change in labor, material and operating costs), are retailers still able to keep the same markup over time as before? DOE recognizes that retailers are likely to seek to maintain the same markup on appliances if the price they pay goes up as a result of appliance standards, but DOE concludes that, over time, adjustment is likely to occur due to competitive pressures. Other retailers may find that they can gain sales by reducing the markup and maintaining the same per-unit operating profit. The incremental markup approach embodies the same perspective as the ''preservation of per-unit operating profit markup scenario'' used in the MIA (see section IV.J of this document).

DOE concludes that there is not sufficient evidence to support the application of fixed percent markups to the cost increment on efficient equipment. Firms generally cannot maintain fixed percent margins in the long run under changing cost conditions. Thus, DOE continues to apply the incremental markup approach to estimate the price increase for more efficient products.

Chapter 6 of the final rule TSD provides details on DOE's development of markups for dehumidifiers.

E. Energy Use Analysis

DOE's energy use analysis estimated the range of energy use of dehumidifiers in the field, *i.e.,* as they are actually used by consumers. The energy use analysis provided the basis for other analyses DOE performed, particularly assessments of the energy savings and the savings in consumer operating costs that could result from adoption of amended standards.

A dehumidifier uses energy when the compressor is operating to remove moisture from the air. When the compressor is not operating, the dehumidifier may use energy by operating the fan to circulate air through the unit to sample the ambient relative humidity and to defrost the evaporator coils. When neither the fan nor the compressor is operating, energy is used in standby mode or off mode to supply power for functions such as keeping a user panel lit.[29]

DOE determined the annual energy consumption of dehumidifiers by multiplying the capacity (liters per day) by the hours of operation in dehumidification mode, dividing that quantity by the product efficiency, and adding the energy use for the fan mode and the standby and off mode.

The efficiency and capacity values were measured using a temperature of 73 °F for whole-home dehumidifiers, 65 °F for portable dehumidifiers, and a humidity set point of 60 percent, as stipulated in the test procedure for dehumidifiers in appendix X1.

To estimate hours of operation in each mode, DOE used two recent field studies that measured daily hours of use in each operating mode for both portable and whole-home dehumidifiers.[30] DOE paired these data with estimates of the number of months that dehumidifiers are used in a representative sample of U.S. households. DOE used data from the EIA's *2009 Residential Energy Consumption Survey* (RECS 2009), which was the most recent such survey available at the time of DOE's analysis.[31] RECS is a national sample survey of housing units that collects statistical information on the consumption of and expenditures for energy in housing units along with data on energy-related characteristics of the housing units and occupants. RECS 2009 questioned each household on two aspects of dehumidifier use: (1) Ownership and (2) number of months of dehumidifier use. DOE estimated that consumers leave the dehumidifier to cycle on and off for the entire month or months of the dehumidification season.

DOE estimated the energy use for off-cycle mode and the standby and off mode using the hours of operation described above, along with data on average power in off-cycle and standby modes from the field studies.

Therma-Stor believes that there are many factors which influence dehumidifier operation and that there is no correlation between dehumidifier capacity and the amount of water vapor which must be removed. Therma-Stor stated that a dehumidifier will be run as long as required to reduce humidity until it reaches the consumer's setting. (Therma-Stor, No. 38 at pp. 1–2)

Based on available data, DOE has accounted for the factors influencing dehumidifier operation in its analysis. The engineering analysis provided data on capacities and efficiencies, field metered data in available literature showed ranges of time percentages spent in different modes of operation, and the RECS household sample showed variation in months of dehumidifier use as reported by consumers. DOE assumed that consumers use readily available guides when deciding the size of dehumidifier they need to purchase given the amount of humidity they experience.

Chapter 7 of the final rule TSD provides details on DOE's energy use analysis for dehumidifiers.

F. Life-Cycle Cost and Payback Period Analysis

In determining whether an energy conservation standard is economically justified, DOE considers the economic impact of potential standards on consumers. The effect of new or amended energy conservation standards on individual consumers usually involves a reduction in operating cost and an increase in purchase cost. DOE used the following two metrics to measure consumer impacts:

- LCC (life-cycle cost) is the total consumer cost of an appliance or product, generally over the life of the appliance or product. The LCC calculation includes total installed cost (equipment manufacturer selling price, distribution chain markups, sales tax, and installation costs), operating costs (energy, repair, and maintenance costs), equipment lifetime, and discount rate. Future operating costs are discounted to the time of purchase and summed over the lifetime of the appliance or product.
- PBP (payback period) measures the amount of time it takes consumers to recover the estimated higher purchase price of a more energy-efficient product through reduced operating costs. Inputs to the payback period calculation include the installed cost to the consumer and first-year operating costs.

For any given efficiency level, DOE measures the change in LCC relative to the LCC in the no-new-standards case, which reflects the market in the absence of new or amended energy conservation standards, and includes baseline products as well as products with higher efficiency. In contrast, the PBP for a given efficiency level is measured relative to the baseline product only.

For each product class efficiency level, DOE calculated the LCC and PBP for a nationally representative set of housing units. As stated previously, DOE developed household samples with RECS 2009 data. For each sample household, DOE determined the energy

[29] The energy use operating mode names used in this standards final rule to characterize energy use and subsequent analyses, reflect dehumidifier use in the field and are not the same as the test procedure operating mode names.

[30] Willem, H., *et al., Using Field-Metered Data to Quantify Annual Energy Use of Residential Portable Unit Dehumidifiers,* Lawrence Berkeley National Laboratory (Nov. 2013); Burke, T., *et al.,* Whole-Home Dehumidifiers Energy Use: A Field-Monitoring Study, Lawrence Berkeley National Laboratory (Dec. 2015).

[31] U.S. Department of Energy: Energy Information Administration, *Residential Energy Consumption Survey: 2009 RECS Survey Data* (2013) (Available at: *http://www.eia.gov/consumption/residential/data/2009/).*

consumption for the dehumidifier and the appropriate electricity price. By developing a representative sample of households, the analysis captured the variability in energy consumption and energy prices associated with the use of dehumidifiers.

The LCC and PBP analyses are designed to support DOE's consideration of the economic impact of potential standards on consumers of the products subject to the standard, as required by EPCA. (42 U.S.C. 6295(o)(2)(B)(i)(I)) The use of RECS 2009 to develop a consumer sample and to provide data for estimation of product energy use allows DOE to characterize the range of conditions in which covered appliances are operated. As a result, DOE is able to estimate how the energy savings would vary among households for each considered efficiency level.

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

The computer model DOE uses to calculate the LCC and PBP, which incorporates Crystal Ball™ (a commercially available software program), relies on a Monte Carlo simulation to incorporate uncertainty and variability into the analysis. The Monte Carlo simulations randomly sample input values from the probability distributions and dehumidifier user samples. The model calculated the LCC and PBP for products at each efficiency level for 10,000 housing units per simulation run.

DOE calculated the LCC and PBP for all customers as if each were to purchase a new product in the expected year of compliance with amended standards. The amended standards apply to dehumidifiers manufactured 3 years after the date on which the amended standards for dehumidifiers are published. Therefore, for purposes of its analysis, DOE used 2019 as the first year of compliance with these amended standards.

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

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

Inputs	Source/Method
Product Cost	Derived by multiplying MPCs by manufacturer and retailer markups and sales tax, as appropriate. Used historical data to derive a price scaling index to forecast product costs.
Installation Costs	For portable dehumidifiers, DOE assumed no installation costs with the baseline unit and no cost with efficiency level. For whole-home dehumidifiers, baseline installation cost were determined with data from RS Means Residential Cost Data. DOE assumed incremental installation costs with efficiency level.
Annual Energy Use	The total annual energy use derived from power demand of each mode multiplied by the hours per year. Average number of hours based on field data. Variability: Based on the 2009 RECS.
Energy Prices	Average and Marginal Electricity: Based on EEI 2014. Variability: Regional energy prices determined for 27 regions.
Energy Price Trends	Based on *AEO 2015* price forecasts.
Repair and Maintenance Costs	Assumed no change with efficiency level.
Product Lifetime	Appliance Magazine (2005), ACEEE (2001), Northeast Energy Star Lighting and Appliance.
Discount Rates	Approach involves identifying all possible debt or asset classes that might be used to purchase the considered appliances, or might be affected indirectly. Primary data source was the Federal Reserve Board's Survey of Consumer Finances** for 1995, 1998, 2001, 2004, 2007, 2010, and 2013.
Compliance Date	2019.

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

1. Product Cost

To calculate consumer product costs, DOE multiplied the MPCs developed in the engineering analysis by the markups described in this preamble (along with sales taxes). DOE used different markups for baseline products and higher-efficiency products, because DOE applies an incremental markup to the increase in MSP associated with higher-efficiency products.

2. Installation Cost

Installation cost includes labor, overhead, and any miscellaneous materials and parts needed to install the product. DOE used data from the 2015 R.S. Means Residential Cost Data book to estimate the baseline installation cost for whole-home dehumidifiers. DOE assumed that installation costs would not be impacted with increased efficiency levels in the NOPR analysis.

Aprilaire commented that large whole-home units will require additional installation work. (Aprilaire, No. 34 at p. 2) For this final rule, DOE reviewed the R.S. Means Residential Data, and estimated incremental installation costs for each efficiency level based on additional labor costs for larger sizes of HVAC ventilation work. See chapter 8 of the final rule TSD for further information on the derivation of the installation costs for whole-home dehumidifiers.

3. Annual Energy Consumption

For each sampled household, DOE determined the energy consumption for a dehumidifier at different efficiency levels using the approach described in section IV.E of this document.

4. Energy Prices

DOE derived marginal residential electricity and natural gas prices for 27 geographic areas.[32] Marginal prices are

[32] DOE characterized the geographic distribution into 27 geographic areas to be consistent with the 27 states and group of states reported in RECS 2009.

appropriate for determining energy cost savings associated with possible changes to efficiency standards.

For electricity, DOE derived marginal and average prices which vary by season, region, and baseline electricity consumption level. DOE estimated these prices using data published with the Edison Electric Institute (EEI), Typical Bill and Average Rates reports for summer and winter 2014.[33] For the residential sector each report provides, for most of the major investor-owned utilities (IOUs) in the country, the total bill assuming household consumption levels of 500, 750, and 1,000 kWh for the billing period. DOE defined the average price as the ratio of the total bill to the total electricity consumption. DOE also used the EEI data to define a marginal price as the ratio of the change in the bill to the change in energy consumption.

For the residential sector, DOE defined the average price as the ratio of the total bill to the total electricity consumption. DOE also used the EEI data to define a marginal price as the ratio of the change in the bill to the change in energy consumption. DOE first calculated weighted-average values for each geographic area for each type of price. Each EEI utility in an area was assigned a weight based on the number of consumers it serves. Consumer counts were taken from the most recent EIA Form 861 data (2012).[34]

DOE assigned seasonal average prices to all households in the LCC sample based on its location and its baseline monthly electricity consumption for an average summer or winter month. For sampled households who were assigned a product efficiency greater than or equal to the considered level for a standard, DOE then assigned marginal price to each household based on its location and the decremented electricity consumption. In the LCC sample, households could be assigned to one of 27 geographic areas.

To estimate future trends in electricity and natural gas prices, DOE used price forecasts in *AEO 2015.* To arrive at prices in future years, DOE multiplied the average and marginal prices described above by the forecast of annual average changes in national-average residential electricity and natural gas prices. Because the *AEO 2015* forecasts prices only to 2040, DOE used the average rate of change during 2025–2040 to estimate the price trends beyond 2040.

5. Maintenance and Repair Costs

Repair costs are associated with repairing or replacing product components that have failed in an appliance; maintenance costs are associated with maintaining the operation of the product. Typically, small incremental increases in product efficiency produce no, or only minor, changes in repair and maintenance costs.

During the 2013 preliminary analysis phase of the rulemaking, DOE requested information as to whether maintenance and repair costs are a function of efficiency level and product class. Manufacturers responded that these costs would not increase with efficiency. As a result, DOE assumed that repair and maintenance costs do not scale with the efficiency of dehumidifiers.

6. Product Lifetime

For portable dehumidifiers, DOE used lifetime estimates from the *Appliance Magazine* (2005),[35] an appliance lifetime report (Kubo, *et al.,* 2001),[36] and Northeast Energy Star Lighting and Appliance.[37] DOE assumed whole-home dehumidifiers have the same life span as residential room air conditioners and applied the lifetime parameters derived for room air conditioners in the 2011 rulemaking to whole-home dehumidifiers.[38] The analysis yielded an estimate of mean lifetime of approximately 11 years for portable dehumidifiers and approximately 19 years for whole-home dehumidifiers. DOE also used the data to develop a survival function that was incorporated as a probability distribution in the LCC analysis. See chapter 8, section 8.2.2.8 of the final rule TSD for further details on the method and sources DOE used to develop product lifetimes.

AHAM commented that DOE should use 10 years as the lifetime for portable dehumidifiers. (AHAM, No. 39 at p. 5) DOE used publically data and information including the three studies cited above to conclude that 11 years is the average lifetime for portable dehumidifiers.

7. Discount Rates

In the calculation of LCC, DOE applies discount rates appropriate to households to estimate the present value of future operating costs. DOE estimated a distribution of residential discount rates for dehumidifiers based on consumer financing costs and opportunity cost of funds related to appliance energy cost savings and maintenance costs.

To establish residential discount rates for the LCC analysis, DOE identified all relevant household debt or asset classes in order to approximate a consumer's opportunity cost of funds related to appliance energy cost savings and maintenance costs. DOE then estimated the average percentage shares of the various types of debt and equity by household income group using data from the Federal Reserve Board's Survey of Consumer Finances (SCF) for 1995, 1998, 2001, 2004, 2007, 2010, and 2013.[39] Using the SCF and other sources, DOE then developed a distribution of rates for each type of debt and asset by income group to represent the rates that may apply in the year in which amended standards would take effect. DOE assigned each sample household a specific discount rate drawn from one of the distributions. The average rate across all types of household debt and equity and income groups, weighted by the shares of each class, is 4.4 percent. See chapter 8, section 8.2.3 of the final rule TSD for further details on the development of consumer discount rates.

8. Efficiency Distribution in the No-New-Standards Case

To accurately estimate the share of consumers that would be affected by a standard at a particular efficiency level, DOE's LCC analysis considered the projected distribution of product efficiencies in the no-new-standards case (*i.e.,* the case without new energy

[33] Edison Electric Institute. Typical Bills and Average Rates Report. Winter 2014 published April 2014, Summer 2014 published October 2014. Available at: *http://www.eei.org/resourcesandmedia/products/Pages/Products.aspx.*

[34] U. S. Department of Energy, Energy Information Administration. Form EIA–861 Annual Electric Power Industry Database. *http://www.eia.doe.gov/cneaf/electricity/page/eia861.html.*

[35] The Life Expectancy/Replacement Picture. *Appliance Magazine,* September, 2005. Vol. 62, No. 9.

[36] Kubo, T., S. Nadel, and H. Sachs. Opportunities for New Appliance and Equipment Efficiency Standards: Energy and Economic Savings Beyond Current Standards Programs, September, 2001. Washington, DC: American Council for an Energy Efficient Economy (ACEEE). Report Number A016. <*http://aceee.org/research-report/a016*>.

[37] Northeast Energy Star Lighting and Appliance. *Dehumidifiers.* Accessed June 26, 2006. <*http://www.myenergystar.com/Dehumidifiers.aspx*>

[38] DOE-Energy Efficiency and Renewable Energy, Energy Conservation Program for Consumer Products, Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment, Residential Clothes Dryers and Room Air Conditioners (2011) (Available at: *http://www.regulations.gov/#!documentDetail;D=EERE-2007-BT-STD-0010-0053*).

[39] Note that two older versions of the SCF are also available (1989 and 1992). These surveys were not used in this analysis because they do not provide all of the necessary types of data (*e.g.,* credit card interest rates). DOE determines that the 15-year span covered by the six surveys included is sufficiently representative of recent debt and equity shares and interest rates.

efficiency standards). DOE refers to this distribution of product efficiencies as a no-new-standards case efficiency distribution.

To estimate the efficiency distribution of dehumidifiers for 2019, DOE analyzed its Compliance Certification Database for dehumidifiers. To project the efficiency trend between 2019 and 2048, DOE used a 0.25 percent annual increase in shipment-weighted efficiency, as discussed in section IV.H. See chapter 8 of the final rule TSD for further information on the derivation of the efficiency distributions.

9. Payback Period Analysis

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

The inputs to the PBP calculation for each efficiency level are the change in total installed cost of the product and the change in the first-year annual operating expenditures relative to the baseline. The PBP calculation uses the same inputs as the LCC analysis, except that discount rates are not needed.

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

G. Shipments Analysis

DOE uses forecasts of annual product shipments to calculate the national impacts of potential amended energy conservation standards on energy use, NPV, and future manufacturer cash flows.[40] The shipments model takes an accounting approach, tracking market shares of each product class and the vintage of units in the stock. Stock accounting uses product shipments as inputs to estimate the age distribution of in-service product stocks for all years. The age distribution of in-service product stocks is a key input to calculations of both the NES and NPV, because operating costs for any year depend on the age distribution of the stock.

To determine shipments to the replacement market, DOE estimated a stock of dehumidifiers by vintage by integrating historical shipments starting from 1972 for portable dehumidifiers and from 2004 for whole-home dehumidifiers. Over time, some units are retired and removed from the stock, triggering the shipment of a replacement unit. Depending on the vintage, a certain percentage of each type of unit will fail and need to be replaced. DOE based the retirement function on a probability distribution for the product lifetime that was developed in the LCC analysis. The shipments model assumes that no units are retired below a minimum product lifetime and that all units are retired before exceeding a maximum product lifetime.

To calibrate the estimated shipments with the historical data, DOE introduced into the model a market segment identified as existing households without dehumidifiers, also referred to as first-time owners. Based on the calibration, DOE estimated that 0.35 percent of existing households without a dehumidifier would annually purchase this product over the analysis period, 2019–2048.

For the final rule analysis, DOE applied price and efficiency elasticity parameters to estimate the effect of new standards on dehumidifier shipments. DOE estimated the price and efficiency elasticity parameters from a regression analysis that incorporated shipments, purchase price, and efficiency data specific to several residential appliances during 1989–2009. Based on evidence that the price elasticity of demand is significantly different over the short run and long run for other consumer goods (*i.e.,* automobiles), DOE assumed that these elasticities decline over time. DOE estimated shipments in each standards case using the price and efficiency elasticity along with the change in the product price and operating costs between a standards case and the no-new-standards case. For details on the shipments analysis, see chapter 9 of the final rule TSD.

H. National Impact Analysis

The NIA assesses the national energy savings (NES) and the national net present value (NPV) from a national perspective of total consumer costs and savings that would be expected to result from new or amended standards at specific efficiency levels.[41] (''Consumer'' in this context refers to consumers of the product being regulated.) DOE calculates the NES and NPV based on projections of annual product shipments, along with the annual energy consumption and total installed cost data from the energy use and LCC analyses.[42] For the present analysis, DOE forecasted the energy savings, operating cost savings, product costs, and NPV of consumer benefits over the lifetime of dehumidifiers sold from 2019 through 2048.

DOE evaluates the impacts of new and amended standards by comparing a case without such standards with standards-case projections. The no-new-standards case characterizes energy use and consumer costs for each product class in the absence of new or amended energy conservation standards. For this projection, DOE considers historical trends in efficiency and various forces that are likely to affect the mix of efficiencies over time. DOE compares the no-new-standards case with projections characterizing the market for each product class if DOE adopted new or amended standards at specific energy efficiency levels (*i.e.,* the TSLs or standards cases) for that class. For the standards cases, DOE considers how a given standard would likely affect the market shares of products with efficiencies greater than the standard.

[40] DOE uses data on manufacturer shipments as a proxy for national sales, as aggregate data on sales are lacking. In general one would expect a close correspondence between shipments and sales.

[41] The NIA accounts for impacts in the 50 states and U.S. territories.

[42] For the NIA, DOE adjusts the installed cost data from the LCC analysis to exclude sales tax, which is a transfer.

DOE uses a spreadsheet model to calculate the energy savings and the national consumer costs and savings from each TSL. Interested parties can review DOE's analyses by changing various input quantities within the spreadsheet. The NIA spreadsheet model uses typical values (as opposed to probability distributions) as inputs.

Table IV.19 summarizes the inputs and methods DOE used for the NIA analysis for the final rule. Discussion of these inputs and methods follows the table. See chapter 10 of the final rule TSD for further details.

TABLE IV.19—SUMMARY OF INPUTS AND METHODS FOR THE NATIONAL IMPACT ANALYSIS

Inputs	Method
Shipments	Annual shipments from shipments model.
Compliance Date of Standard	2019.
Efficiency Trends	No-New-Standards case: Shipment-Weighted Integrated Energy Factor (SWIEF) determined in 2019 for each of the considered products classes. Annual growth rate of 0.25 percent assumed for determining SWIEF between 2019 and 2048. Standard cases: Roll-up and shift scenario for 2019.
Annual Energy Consumption per Unit.	Annual weighted-average values are a function of energy use at each TSL.
Total Installed Cost per Unit	Annual weighted-average values are a function of cost at each TSL. Incorporates forecast of future product prices based on historical data.
Annual Energy Cost per Unit	Annual weighted-average values as a function of the annual energy consumption per unit and energy prices.
Repair and Maintenance Cost per Unit.	Annual values do not change with efficiency level.
Energy Prices	*AEO 2015* forecasts (to 2040) and extrapolation through 2048.
Energy Site-to-Primary and FFC Conversion.	A time-series conversion factor derived from *AEO 2015.*
Discount Rate	Three and seven percent real.
Present Year	Future costs and savings are discounted to 2015.

1. Product Efficiency Trends

A key component of the NIA is the trend in energy efficiency projected for the no-new-standards case and each of the standards cases. Section IV.8 of this document describes how DOE developed an energy efficiency distribution for the no-new-standards case (which yields a shipment-weighted average efficiency) for each of the considered product classes for the first year of the forecast period. To project the trend in efficiency for dehumidifiers over the entire shipments projection period, DOE employed shipments-weighted integrated energy factors (SWIEF) as a starting point for 2014 and assumed a 0.25 percent annual increase in shipment-weighted efficiency between 2014 and 2048. The approach is further described in chapter 10 of the final rule TSD.

For the standards cases, DOE used a ''roll-up'' scenario to establish the shipment-weighted efficiency for the year that standards are assumed to become effective (2019). In this scenario, the market of products in the no-new-standards case that do not meet the standard under consideration would ''roll up'' to meet the new standard level, and the market share of products above the standard would remain unchanged. For its projected efficiencies of TSLs, in addition to a ''roll-up'' scenario, DOE developed a shift scenario. In the shift scenario DOE developed growth trends for each trial standard level that maintained the same per-unit average total installed cost difference for the year 2019 between the no-new-standards case and each standards case over the entire projection period (2019–2048).

2. National Energy Savings

In 2011, in response to the recommendations of a committee on ''Point-of-Use and Full-Fuel-Cycle Measurement Approaches to Energy Efficiency Standards'' appointed by the National Academy of Sciences, DOE announced its intention to use FFC measures of energy use and greenhouse gas and other emissions in the national impact analyses and emissions analyses included in future energy conservation standards rulemakings. 76 FR 51281 (Aug. 18, 2011). After evaluating the approaches discussed in the August 18, 2011 notice, DOE published a statement of amended policy in which DOE explained its determination that EIA's National Energy Modeling System (NEMS) is the most appropriate tool for its FFC analysis and its intention to use NEMS for that purpose. 77 FR 49701 (August 17, 2012). NEMS is a public domain, multi-sector, partial equilibrium model of the U.S. energy sector [43] that EIA uses to prepare its *Annual Energy Outlook.* The approach used for deriving FFC measures of energy use and emissions is described in appendix 10C of the final rule TSD.

Aprilaire commented that DOE should separately show energy savings of whole-home dehumidifiers and portable dehumidifiers and stated that DOE has not shown that whole-home dehumidifier regulation will meet the requirement of ''substantial'' energy savings nor has DOE shown it meets the term used in the public meeting as ''non-trivial.'' (Aprilaire, No. 38 at p. 5) DOE shows energy savings for each product class in the National Impact Analysis. However when analyzing whether standards meet the EPCA requirement of ''significant'' energy savings, DOE considers the product type as a whole.

3. Net Present Value Analysis

The inputs for determining the NPV of the total costs and benefits experienced by consumers are: (1) Total annual installed cost; (2) total annual savings in operating costs; and (3) a discount factor to calculate the present value of costs and savings. DOE calculates net savings each year as the difference between the no-new-standards case and each standards case in terms of total savings in operating costs versus total increases in installed costs. DOE calculates operating cost savings over the lifetime of each product shipped during the forecast period.

As discussed in section IV.F.1 of this document, DOE developed dehumidifier

[43] For more information on NEMS, refer to *The National Energy Modeling System: An Overview,* DOE/EIA–0581 (98) (Feb.1998) (Available at: *http://www.eia.gov/oiaf/aeo/overview/*).

price trends based on historical Producer Price Index (PPI) data. Within the portable and whole-home product groups, DOE applied the same trends to forecast prices for each product class at each considered efficiency level. By 2048, which is the end date of the forecast period, the average dehumidifier price is forecasted to drop 37 percent relative to 2013. DOE's projection of product prices for dehumidifiers is described in further detail in appendix 10C of the final rule TSD.

To evaluate the effect of uncertainty regarding price trends, DOE examined the effect of various product price forecasts on the consumer NPV for the considered TSLs for dehumidifiers. In addition to the default price trend, DOE considered separate product price sensitivity cases for portable dehumidifiers and whole-home dehumidifiers. For portable dehumidifiers, DOE considered a case for a low price decline based on estimating an experience curve using PPI data for ''small electric household appliances'' from 1990 to 2009. A case for high price decline was based on the price forecast of the ''furniture and appliances'' series from *AEO 2015.* For whole-home dehumidifiers, a case for a low price decline was based on an exponential fit to the PPI from 1978 to 2014 for ''air-conditioning, refrigeration, and forced air heating equipment.'' The high price decline was based on the price forecast of the ''furniture and appliances'' series from *AEO 2015.* The approach used to forecast the price trends and the results of the sensitivity cases are described in appendix 10C of the final rule TSD.

The operating cost savings are energy cost savings, which are calculated using the estimated energy savings in each year and the projected price of the appropriate form of energy. To estimate energy prices in future years, DOE multiplied the average and marginal energy prices by the forecast of annual national-average residential energy price changes in the reference case from *AEO 2015,* which has an end year of 2040. To estimate price trends after 2040, DOE used the average annual rate of change in prices from 2020 to 2040. As part of the NIA, DOE also analyzed scenarios that used inputs from the *AEO 2015* Low Economic Growth and High Economic Growth cases. Those cases have higher and lower energy price trends compared to the Reference case. NIA results based on these cases are presented in appendix 10C of the final rule TSD.

In calculating the NPV, DOE multiplies the net savings in future years by a discount factor to determine their present value. For this final rule, DOE estimated the NPV of consumer benefits using both a 3-percent and a 7-percent real discount rate. DOE uses these discount rates in accordance with guidance provided by the Office of Management and Budget (OMB) to Federal agencies on the development of regulatory analysis.[44] The discount rates for the determination of NPV are in contrast to the discount rates used in the LCC analysis, which are designed to reflect a consumer's perspective. The 7-percent real value is an estimate of the average before-tax rate of return to private capital in the U.S. economy. The 3-percent real value represents the ''social rate of time preference,'' which is the rate at which society discounts future consumption flows to their present value.

I. Consumer Subgroup Analysis

In analyzing the potential impact of new or amended standards on consumers, DOE evaluates the impact on identifiable subgroups of consumers that may be disproportionately affected by a national standard. DOE evaluates impacts on particular subgroups of consumers by analyzing the LCC impacts and PBP for those particular consumers from alternative standard levels. For this final rule, DOE analyzed the impacts of the considered standard levels on low-income households and senior-only households. Chapter 11 in the final rule TSD describes the consumer subgroup analysis.

J. Manufacturer Impact Analysis

1. Overview

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

The quantitative part of the MIA primarily relies on the Government Regulatory Impact Model (GRIM), an industry cash flow model with inputs specific to this rulemaking. The key GRIM inputs include data on the industry cost structure, unit production costs, product shipments, manufacturer markups, and investments in R&D and manufacturing capital required to produce compliant products. The key GRIM outputs are the INPV, which is the sum of industry annual cash flows over the analysis period, discounted using the industry-weighted average cost of capital, and the impact to domestic manufacturing employment. The model uses standard accounting principles to estimate the impacts of more-stringent energy conservation standards on a given industry by comparing changes in INPV and domestic manufacturing employment between a no-new-standards case and the various TSLs. To capture the uncertainty relating to manufacturer pricing strategy following amended standards, the GRIM estimates a range of possible impacts under different markup scenarios.

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

DOE conducted the MIA for this rulemaking in three phases. In Phase 1 of the MIA, DOE conducted detailed interviews with manufacturers and prepared a profile of the dehumidifier manufacturing industry. During manufacturer interviews, DOE discussed engineering, manufacturing, and financial topics in order to identify concerns and to inform and validate assumptions used in the GRIM. See appendix 5A and 5B of the final rule TSD for a copy of the interview guides. See section IV.J.4 for a description of the key issues raised by manufacturers during the interviews.

Based on these manufacturer interviews, the market and technology assessment, and publicly available information, DOE derived financial inputs for the GRIM (*e.g.,* revenues; materials, labor, overhead, and depreciation expenses; selling, general, and administrative expenses (SG&A); and R&D expenses). The public sources

[44] United States Office of Management and Budget, ''Circular A–4: Regulatory Analysis,'' Section E (Sept. 17, 2003) (Available at: *www.whitehouse.gov/omb/memoranda/m03-21.html.http://www.whitehouse.gov/omb/circulars_a004_a-4/*).

of information DOE used in developing its characterization of the dehumidifier manufacturing industry, include company filings of form SEC 10–K filings,[45] corporate annual reports, the U.S. Census Bureau's Economic Census,[46] and Hoover's reports.[47]

In Phase 2 of the MIA, DOE prepared an industry cash-flow analysis to quantify the potential impacts of amended energy conservation standards. The GRIM uses several factors to determine a series of annual cash flows starting with the announcement of the standard and extending over a 30-year period following the compliance date of the standard. These factors include annual expected revenues, costs of sales, SG&A and R&D expenses, taxes, and capital expenditures (derived during Phase 1). In general, energy conservation standards can affect manufacturer cash flow in three distinct ways: (1) Create a need for increased investment; (2) raise production costs per unit; and (3) alter revenue due to higher per-unit prices and changes in sales volumes.

In Phase 3 of the MIA, DOE evaluated subgroups of manufacturers that may be disproportionately impacted by amended standards or that may not be accurately represented by the average cost assumptions used to develop the industry cash flow analysis. Such manufacturer subgroups always include small business manufacturers, but may also include low-volume manufacturers (LVMs), niche players, and/or manufacturers exhibiting a cost structure that largely differs from the industry average. DOE identified one dehumidifier manufacturer subgroup for which average cost assumptions may not hold: Small businesses.

To identify small businesses for this analysis, DOE applied the size standards published by the Small Business Administration (SBA) to determine whether a company is considered a small business. *See* 13 CFR part 121. To be categorized as a small business manufacturer of dehumidifiers under North American Industry Classification System (NAICS) codes 333415 (''Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing'') or 335210 (''Small Electrical Appliance Manufacturing''), a dehumidifier manufacturer and its affiliates may employ a maximum of 1,250 employees or 1,500 employees, respectively. These thresholds include all employees in a business' parent company and any other subsidiaries. Using these classifications in conjunction with a search of industry databases and the SBA member directory, DOE identified five manufacturers of dehumidifiers that qualify as small businesses, all of which are manufacturers of whole-home dehumidifiers and high-capacity portable dehumidifiers.

The dehumidifier manufacturer subgroup analysis is discussed in greater detail in chapter 12 of the final rule TSD and in section V.B.2.d of this document.

In Phase 3, DOE also analyzed impacts of amended energy conservation standards for dehumidifiers on manufacturing capacity, direct employment, and cumulative regulatory burdens. Section V.B.2 discusses the findings of these analyses.

2. Government Regulatory Impact Model (GRIM)

DOE uses the GRIM to quantify the changes in industry cash flows resulting from amended energy conservation standards. The GRIM uses manufacturer costs, markups, shipments, and industry financial information to arrive at a series of no-new-standards-case annual cash flows absent new or amended standards, beginning with the present year, 2016, and continuing through 2048. The GRIM then models changes in costs, investments, shipments, and manufacturer margins that may result from new or amended energy conservation standards and compares these results against those in the no-new-standards-case forecast of annual cash flows. The primary quantitative output of the GRIM is the INPV, which DOE calculates by summing the stream of annual discounted cash flows over the full analysis period. For manufacturers of dehumidifiers, DOE used a real discount rate of 8.43 percent, the weighted-average cost of capital derived from industry financials and modified based on feedback received during confidential interviews with manufacturers.

The GRIM calculates cash flows using standard accounting principles and compares changes in INPV between the no-new-standards case and the various TSLs. The difference in INPV between the no-new-standards case and a standards case represents the financial impact of the amended standard on manufacturers at that particular TSL. As discussed previously, DOE collected the necessary information to develop key GRIM inputs from a number of sources, including publicly available data and interviews with manufacturers (described in section IV.J.4 of this document). The GRIM results are shown in section V.B.2.a of this document. Additional details about the GRIM can be found in chapter 12 of the final rule TSD.

a. Government Regulatory Impact Model Key Inputs

Manufacturer Production Costs

Manufacturing a higher efficiency product is typically more expensive than manufacturing a baseline product due to the use of more complex and typically more costly components. The changes in the MPCs of the analyzed products can affect the revenues, gross margins, and cash flow of the industry, making product cost data key GRIM inputs for DOE's analysis. For each efficiency level for each product class, DOE used the MPCs developed in the engineering analysis, as described in section IV.C.2 of this document and further detailed in chapter 5 of the final rule TSD. Additionally, DOE used information from its teardown analysis, described in section IV.C of this final rule, to disaggregate the MPCs into material and labor costs. These cost breakdowns and equipment markups were validated with manufacturers during interviews.

No-New-Standards-Case Shipments Forecast

The GRIM estimates manufacturer revenues based on total unit shipment forecasts and the distribution of shipments by efficiency level. Changes in sales volumes and efficiency mix over time can significantly affect manufacturer finances. For this analysis, the GRIM used the NIA's annual shipment forecasts derived from the shipments analysis from 2016 (the base year) to 2048 (the end of the analysis period). See chapter 9 of the final rule TSD for additional details on the shipments analysis.

Standards-Case Shipments Forecast

For each standards case, the GRIM assumes a small, constant percentage shift in shipments to higher efficiency levels, reflecting the idea that some efficiency improvements will occur independent of amended standards. The GRIM also assumes all remaining shipments of products below the projected minimum standard levels would roll up (*i.e.,* be added) to the standard efficiency levels in response to

[45] U.S. Securities and Exchange Commission, Annual 10–K Reports (Various Years) (Available at: *http://www.sec.gov/edgar/searchedgar/companysearch.html*).

[46] U.S. Census Bureau, Annual Survey of Manufacturers: General Statistics: Statistics for Industry Groups and Industries (2011) (Available at: *http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t*).

[47] Hoovers Inc. Company Profiles. Various Companies. *www.hoovers.com.*

an increase in energy conservation standards. The GRIM also assumes that demand for higher-efficiency products (that are above the minimally compliant level) is a function of price, and is independent of the standard level.

Product and Capital Conversion Costs

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

Stranded Assets

If new or amended energy conservation standards require investment in new manufacturing capital, there also exists the possibility that they will render existing manufacturing capital obsolete. If the obsolete manufacturing capital is not fully depreciated at the time new or amended standards go into effect, these assets would be stranded and the manufacturer would have to write-down the residual value that had not yet been depreciated.

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

In general, DOE assumes that all conversion-related investments occur between the year the final rule is published and the year by which manufacturers must comply with the new or amended standards. The investment figures used in the GRIM can be found in section V.B.2 of this document. For additional information on the estimated product conversion and capital conversion costs, see chapter 12 of the final rule TSD.

b. Government Regulatory Impact Model Scenarios

No-New-Standards-Case Markup

As discussed in section IV.D of this final rule, MSPs include direct manufacturing production costs (*i.e.,* labor, material, overhead, and depreciation estimated in DOE's MPCs) and all non-production costs (*i.e.,* SG&A, R&D, and interest), along with profit. To calculate the MSPs in the GRIM, DOE applied manufacturer markups to the MPCs estimated in the engineering analysis. Based on publicly available financial information for manufacturers of dehumidifiers and comments from manufacturer interviews, DOE assumed the industry average no-new-standards-case markup on production costs to be 1.45. This markup takes into account the two-tiered sourcing structure of the majority of the portable dehumidifier segment, detailed below, in addition to the traditional one-tiered structure of the domestically-produced whole-home (and similarly constructed high-capacity portable) dehumidifier segment.

Lower-capacity portable dehumidifiers (product classes 1 and 2) and some high-capacity dehumidifiers (product class 3) are manufactured under contract by an overseas original equipment manufacturer (OEM). The engineering analysis, as detailed in chapter 5 of the final rule TSD, estimates the cost of manufacturing at the OEM. This production cost is marked up once by the OEM to the company contracting its manufacturer and again by the contracting company who imports the product and sells it to retailers. For imported portable dehumidifiers, the industry average baseline markup breaks down as follows:

TABLE IV.20—INDUSTRY-AVERAGE BASELINE MARKUPS

OEM to Contracting Company Markup	1.20
Contracting Company to First Customer Markup	1.21
Overall OEM to First Customer Markup	1.45

Markup Scenarios

Modifying the aforementioned no-new-standards-case markups in the standards case yields different sets of impacts on manufacturers. For the MIA, DOE modeled two standards-case markup scenarios to represent the uncertainty regarding the potential impacts on prices and profitability for manufacturers following the implementation of amended energy conservation standards: (1) A preservation of gross margin [48] (percentage) scenario; and (2) a preservation of per-unit operating profits scenario. These scenarios lead to different markups values that, when applied to the MPCs, result in varying revenue and cash flow impacts.

The preservation of gross margin as a percentage of revenues markup scenario assumes that the baseline markup of 1.45 is maintained for all products in the standards case. Typically, this scenario represents the upper bound of industry profitability as manufacturers are able to fully pass through additional costs due to standards to their customers under this scenario.

The preservation of per-unit operating profits markup scenario is similar to the preservation of gross margin as a percentage of revenues markup scenario with the exception that in the standards case, minimally compliant products lose a fraction of the baseline markup. Typically, this scenario represents the lower bound profitability and a more substantial impact on the industry as manufacturers accept a lower margin in an attempt to offer price competitive entry level products while maintaining the same level of absolute operating profits, on a per-unit basis, that they saw prior to amended standards. Under this scenario, gross margin as a percentage decreases in the standards case.

3. Discussion of Comments

Manufacturers and trade organizations provided several comments on the potential impact of amended energy conservation standards on manufacturers. These comments are outlined below. DOE considered these comments when updating the analysis for this final rule.

AHAM cautioned that DOE not overlook the considerable capital and product conversion expenditures that manufacturers must face in redesigning significant component systems to meet TSL 3 with the new test procedure, appendix X1. AHAM commented that DOE should revise its analysis based on

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

additional data from AHAM and manufacturer interviews, which may show that TSL 3 is no longer justified. (AHAM, No. 39 at p. 6) Additionally, AHAM commented that DOE should consider marketing costs necessary to explain to the public the change in capacities of units. (AHAM, No. 39 at p. 3)

DOE recognizes that the revised test procedure resulted in changes in capacity and efficiency. 80 FR 45802 (July 31, 2015). To ensure that the conversion cost estimates provided by manufacturers were reflective of the conversion costs dehumidifier manufacturers will face as a result of amended energy conservation standards, DOE conducted another round of manufacturer interviews following the June 2015 NOPR publication. DOE solicited information on all conversion costs during these interviews and was particularly interested in understanding the product conversion costs necessary for marketing, training, consumer education, and labeling that would help buyers of these products understand the new ranges of capacity and efficiency. (See the final rule TSD appendix 12A for the list of topics included in post-NOPR manufacturer interviews.) Based on feedback from these interviews, DOE has revised its conversion cost estimates, where applicable, for this final rule. See section V.B.2 of this final rule and chapter 12 of the final rule TSD for details on the revised industry conversion costs.

Aprilaire and Therma-Stor provided comments describing the potential impacts on the high-capacity portable dehumidifier and whole-home dehumidifier market segments. Aprilaire commented that it does not support DOE regulating the whole-home dehumidifier industry at this time, as it believes the small American-based businesses would face high, disproportionate impacts. (Aprilaire, No. 34 at p. 1) Additionally, Aprilaire commented that any decrease in market size and jobs for whole-home dehumidifiers would have a disproportionate effect on employment in the United States, and the job market specifically in Wisconsin. (Aprilaire, No. 34 at p. 5) Therma-Stor, also a small manufacturer located in Wisconsin, commented that if the June 2015 NOPR proposal goes into effect unchanged, it could put them and other domestic manufacturers out of business. Therma-Stor stated that it expects to reduce its employment headcount by one-half under the June 2015 NOPR proposal, which it stated was biased against manufacturers of high-capacity portable dehumidifiers and whole-home dehumidifiers. (Therma-Stor, No. 38 at p. 3)

DOE acknowledges that amended energy conservation standards for dehumidifiers could disproportionately impact small domestic manufacturers. As mentioned above, as a result of these and other comments submitted in response to the June 2015 NOPR, DOE solicited additional information from small and large dehumidifier manufacturers on the expected financial burdens related to compliance with the standard levels considered in the NOPR. Based on new feedback, for this final rule, DOE has updated the MIA, including its analysis of small business impacts and discussions of potential impacts on domestic production employment and manufacturing capacity. DOE based its selection of efficiency levels in this final rule on its updated analysis. See section V.B.2 of this final rule for DOE's updated analysis of INPV impacts, and direct employment and manufacturing capacity impacts. See section VII.B of this final rule for a discussion of disproportionate impacts on small domestic dehumidifier manufacturers.

Regarding the baseline and incremental efficiency levels analyzed in the June 2015 NOPR, Therma-Stor commented that DOE's determination that low-capacity portable dehumidifiers cannot be designed with efficiency enhancements to establish a minimum efficiency level two to three times less than high capacity portable dehumidifiers and whole-home dehumidifiers leads to an unfair and anti-competitive bias in favor of the manufacturers and importers of low-capacity portable dehumidifiers. (Therma-Stor, No. 38 at p. 2) Aprilaire commented that the whole-home dehumidifier industry has been analyzed at only two efficiency levels and asked why DOE did not analyze other efficiency levels, which may have less of an impact on the small businesses and the whole-home dehumidifier industry. (Aprilaire, Public Meeting Transcript, No. 35 at p. 83)

As described in section IV.C.1 of this final rule, DOE analyzed a representative sample of products in each product class to determine an appropriate baseline efficiency level and subsequent improved efficiency levels. For high-capacity portable dehumidifiers (50.01 pints/day or greater), DOE has updated the analysis and included an additional efficiency level for this product class to reflect products currently available on the market. Based on product testing and teardowns, DOE included only one gap fill efficiency level for whole-home dehumidifiers with a case volume less than 8.0 cubic feet and two gap fill efficiency levels for whole-home dehumidifiers with case volumes greater than 8.0 cubic feet. Based on the new feedback from interested parties, DOE has updated the MIA in this final rule, including its analysis of small, domestic business impacts, and its analysis of potential impacts on domestic production employment and manufacturing capacity. This updated analysis has directly impacted the selection of standard efficiency levels in this final rule. See section V.B.2 of this final rule for DOE's updated analysis of INPV impacts, and direct employment and manufacturing capacity impacts.

4. Manufacturer Interviews

As a result of public comments received from interested parties following the publication of the June 2015 NOPR and DOE's amended test procedure,[49] DOE conducted additional confidential interviews with manufacturers. During interviews, DOE asked manufacturers to describe their recommendations relating to updates to the June 2015 NOPR analyses, particularly those that would be affected by the new dehumidifier test procedure. Specifically, DOE solicited feedback on product classes, efficiency levels, and industry conversion costs. Technical data obtained during these interviews informed updates to the engineering analysis for this final rule, where applicable. See sections IV.A.1 and IV.C.1 of this document for information about the changes to product classes and efficiency levels for this final rule.

The following sections describe the issues identified by manufacturers relating to DOE's June 2015 NOPR analyses. These concerns are also presented in chapter 12 of the final rule TSD.

Unavailability of Products

Most manufacturers interviewed expressed concern that the proposed dehumidifier standards were too aggressive and could result in the unavailability of products of certain capacities. In particular, manufacturers stated that the efficiency levels proposed in the June 2015 NOPR for high-capacity portable dehumidifiers and whole-home dehumidifiers are too stringent relative to those for lower-capacity dehumidifiers. Manufacturers stated that this would reduce the

[49] Section IV.C.1.a describes the updated engineering analysis based on the test procedure in appendix X1.

competitiveness of high-capacity portable dehumidifiers and whole-home dehumidifiers, making them uneconomical to produce. Relatedly, other manufacturers noted that they would not enter the high-capacity portable dehumidifier market in the future because the high standard efficiency levels for these products would make it difficult to meet their price targets. Public comments relating to the impact of this rulemaking on the availability of certain product types are discussed in sections IV.J.3 and V.C of this final rule.

Impacts on Small Business

Similarly, manufacturers expressed concerns that small business manufacturers currently producing high-capacity portable dehumidifiers and whole-home dehumidifiers may have to exit the market if the standards proposed in the June 2015 NOPR become final. This would negatively impact domestic manufacturing employment and capacity in the dehumidifier market.

In addition to the prohibitive capital costs associated with compliance with the standard levels proposed in the June 2015 NOPR, small manufacturers of whole-home dehumidifiers cited the re-education of distributors as a source of substantial financial burden resulting from the new test procedure and amended standards for whole-home products. Public comments relating to small business impacts are addressed in section IV.J.3 of this final rule.

Consumer Confusion

Finally, manufacturers expressed concerns regarding the potential confusion faced by consumers as a result of new product capacity ratings under the appendix X1 test procedure. Manufacturers believe this confusion will be particularly detrimental in the short-term, when consumers will have a selection of both newly rated products and the existing inventory of products rated using the appendix X test procedure. One manufacturer commented that it would like DOE to develop a standardized label for dehumidifiers to help educate consumers on the new ratings. Public comments relating to consumer confusion and labeling are discussed in section IV.J.3 of this final rule. Additionally, as stated in section II.A of this final rule, the FTC is primarily responsible for the labeling of consumer products.

K. Emissions Analysis

The emissions analysis consists of two components. The first component estimates the effect of potential energy conservation standards on power sector and site (where applicable) combustion emissions of CO_2, NO_X, SO_2, and Hg. The second component estimates the impacts of potential standards on emissions of two additional greenhouse gases, CH_4 and N_2O, as well as the reductions to emissions of all species due to ''upstream'' activities in the fuel production chain. These upstream activities comprise extraction, processing, and transporting fuels to the site of combustion. The associated emissions are referred to as upstream emissions.

The analysis of power sector emissions uses marginal emissions factors that were derived from data in *AEO 2015,* as described in section IV.M. The methodology is described in chapter 13 and 15 of the final rule TSD.

Combustion emissions of CH_4 and N_2O are estimated using emissions intensity factors published by the EPA, GHG Emissions Factors Hub.[50] The FFC upstream emissions are estimated based on the methodology described in chapter 15 of the final rule TSD. The upstream emissions include both emissions from fuel combustion during extraction, processing, and transportation of fuel, and ''fugitive'' emissions (direct leakage to the atmosphere) of CH_4 and CO_2.

The emissions intensity factors are expressed in terms of physical units per MWh or MMBtu of site energy savings. Total emissions reductions are estimated using the energy savings calculated in the national impact analysis.

For CH_4 and N_2O, DOE calculated emissions reduction in tons and also in terms of units of carbon dioxide equivalent (CO_2eq). Gases are converted to CO_2eq by multiplying each ton of gas by the gas' global warming potential (GWP) over a 100-year time horizon. Based on the Fifth Assessment Report of the Intergovernmental Panel on Climate Change,[51] DOE used GWP values of 28 for CH_4 and 265 for N_2O.

The *AEO* incorporates the projected impacts of existing air quality regulations on emissions. *AEO 2015* generally represents current legislation and environmental regulations, including recent government actions, for which implementing regulations were available as of October 31, 2014. DOE's estimation of impacts accounts for the presence of the emissions control programs discussed in the following paragraphs.

SO_2 emissions from affected electric generating units (EGUs) are subject to nationwide and regional emissions cap-and-trade programs. Title IV of the Clean Air Act sets an annual emissions cap on SO_2 for affected EGUs in the 48 contiguous States and the District of Columbia (DC). (42 U.S.C. 7651 *et seq.*) SO_2 emissions from 28 eastern States and DC were also limited under the Clean Air Interstate Rule (CAIR). 70 FR 25162 (May 12, 2005). CAIR created an allowance-based trading program that operates along with the Title IV program. In 2008, CAIR was remanded to EPA by the U.S. Court of Appeals for the District of Columbia Circuit, but it remained in effect.[52] In 2011, EPA issued a replacement for CAIR, the Cross-State Air Pollution Rule (CSAPR). 76 FR 48208 (August 8, 2011). On August 21, 2012, the DC Circuit issued a decision to vacate CSAPR,[53] and the court ordered EPA to continue administering CAIR. On April 29, 2014, the U.S. Supreme Court reversed the judgment of the DC Circuit and remanded the case for further proceedings consistent with the Supreme Court's opinion.[54] On October 23, 2014, the DC Circuit lifted the stay of CSAPR.[55] Pursuant to this action, CSAPR went into effect (and CAIR ceased to be in effect) as of January 1, 2015.

EIA was not able to incorporate CSAPR into *AEO 2015,* so it assumes implementation of CAIR. Although DOE's analysis used emissions factors that assume that CAIR, not CSAPR, is the regulation in force, the difference between CAIR and CSAPR is not significant for the purpose of DOE's analysis of emissions impacts from energy conservation standards.

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

[50] Available at: *http://www2.epa.gov/climateleadership/center-corporate-climate-leadership-ghg-emission-factors-hub.*

[51] IPCC, 2013: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. Chapter 8.

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

[53] See *EME Homer City Generation, LP* v. *EPA,* 696 F.3d 7, 38 (D.C. Cir. 2012), *cert. granted,* 81 U.S.L.W. 3567, 81 U.S.L.W. 3696, 81 U.S.L.W. 3702 (U.S. June 24, 2013) (No. 12–1182).

[54] *See EPA* v. *EME Homer City Generation,* 134 S.Ct. 1584, 1610 (U.S. 2014). The Supreme Court held in part that EPA's methodology for quantifying emissions that must be eliminated in certain States due to their impacts in other downwind States was based on a permissible, workable, and equitable interpretation of the Clean Air Act provision that provides statutory authority for CSAPR.

[55] See *Georgia* v. *EPA,* Order (D.C. Cir. filed October 23, 2014) (No. 11–1302).

enforced through the use of emissions allowances and tradable permits. Under existing EPA regulations, any excess SO_2 emissions allowances resulting from the lower electricity demand caused by the adoption of an efficiency standard could be used to permit offsetting increases in SO_2 emissions by any regulated EGU. In past rulemakings, DOE recognized that there was uncertainty about the effects of efficiency standards on SO_2 emissions covered by the existing cap-and-trade system, but it concluded that negligible reductions in power sector SO_2 emissions would occur as a result of standards.

Beginning in 2016, however, SO_2 emissions will fall as a result of the Mercury and Air Toxics Standards (MATS) for power plants. 77 FR 9304 (Feb. 16, 2012). In the MATS rule, EPA established a standard for hydrogen chloride as a surrogate for acid gas hazardous air pollutants (HAP), and also established a standard for SO_2 (a non-HAP acid gas) as an alternative equivalent surrogate standard for acid gas HAP. The same controls are used to reduce HAP and non-HAP acid gas; thus, SO_2 emissions will be reduced as a result of the control technologies installed on coal-fired power plants to comply with the MATS requirements for acid gas. *AEO 2015* assumes that, in order to continue operating, coal plants must have either flue gas desulfurization or dry sorbent injection systems installed by 2016. Both technologies, which are used to reduce acid gas emissions, also reduce SO_2 emissions. Under the MATS, emissions will be far below the cap established by CAIR, so it is unlikely that excess SO_2 emissions allowances resulting from the lower electricity demand would be needed or used to permit offsetting increases in SO_2 emissions by any regulated EGU.[56] Therefore, DOE believes that energy conservation standards will generally reduce SO_2 emissions in 2016 and beyond.

CAIR established a cap on NO_X emissions in 28 eastern States and the District of Columbia.[57] Energy conservation standards are expected to have little effect on NO_X emissions in those States covered by CAIR because excess NO_X emissions allowances resulting from the lower electricity demand could be used to permit offsetting increases in NO_X emissions from other facilities. However, standards would be expected to reduce NO_X emissions in the States not affected by the caps, so DOE estimated NO_X emissions reductions from the standards considered in this final rule for these States.

The MATS limit mercury emissions from power plants, but they do not include emissions caps and, as such, DOE's energy conservation standards would likely reduce Hg emissions. DOE estimated mercury emissions reduction using emissions factors based on *AEO 2015,* which incorporates the MATS.

L. Monetizing Carbon Dioxide and Other Emissions Impacts

As part of the development of this rule, DOE considered the estimated monetary benefits from the reduced emissions of CO_2 and NO_X that are expected to result from each of the TSLs considered. In order to make this calculation analogous to the calculation of the NPV of consumer benefit, DOE considered the reduced emissions expected to result over the lifetime of products shipped in the forecast period for each TSL. This section summarizes the basis for the monetary values used for CO_2 and NO_X emissions and presents the values considered in this final rule.

For this final rule, DOE relied on a set of values for the social cost of carbon (SCC) that was developed by a Federal interagency process. The basis for these values is summarized in the next section, and a more detailed description of the methodologies used is provided as an appendix to chapter 14 of the final rule TSD.

1. Social Cost of Carbon

The SCC is an estimate of the monetized damages associated with an incremental increase in carbon emissions in a given year. It is intended to include (but is not limited to) climate-change-related changes in net agricultural productivity, human health, property damages from increased flood risk, and the value of ecosystem services. Estimates of the SCC are provided in dollars per metric ton of CO_2. A domestic SCC value is meant to reflect the value of damages in the United States resulting from a unit change in CO_2 emissions, while a global SCC value is meant to reflect the value of damages worldwide.

Under section 1(b)(6) of Executive Order 12866, ''Regulatory Planning and Review,'' 58 FR 51735 (Oct. 4, 1993), agencies must, to the extent permitted by law, ''assess both the costs and the benefits of the intended regulation and, recognizing that some costs and benefits are difficult to quantify, propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs.'' The purpose of the SCC estimates presented here is to allow agencies to incorporate the monetized social benefits of reducing CO_2 emissions into cost-benefit analyses of regulatory actions. The estimates are presented with an acknowledgement of the many uncertainties involved and with a clear understanding that they should be updated over time to reflect increasing knowledge of the science and economics of climate impacts.

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

a. Monetizing Carbon Dioxide Emissions

When attempting to assess the incremental economic impacts of CO_2 emissions, the analyst faces a number of challenges. A report from the National Research Council [58] points out that any assessment will suffer from uncertainty, speculation, and lack of information about: (1) Future emissions of GHGs; (2) the effects of past and future emissions on the climate system; (3) the impact of changes in climate on the physical and biological environment; and (4) the translation of these environmental impacts into economic damages. As a result, any effort to quantify and

[56] DOE notes that the Supreme Court remanded EPA's 2012 rule regarding national emission standards for hazardous air pollutants from certain electric utility steam generating units. See *Michigan* v. *EPA* (Case No. 14–46, 2015). DOE has tentatively determined that the remand of the MATS rule does not change the assumptions regarding the impact of energy efficiency standards on SO_2 emissions. Further, while the remand of the MATS rule may have an impact on the overall amount of mercury emitted by power plants, it does not change the impact of the energy efficiency standards on mercury emissions. DOE will continue to monitor developments related to this case and respond to them as appropriate.

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

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

monetize the harms associated with climate change will raise questions of science, economics, and ethics and should be viewed as provisional.

Despite the limits of both quantification and monetization, SCC estimates can be useful in estimating the social benefits of reducing CO_2 emissions. The agency can estimate the benefits from reduced (or costs from increased) emissions in any future year by multiplying the change in emissions in that year by the SCC values appropriate for that year. The NPV of the benefits can then be calculated by multiplying each of these future benefits by an appropriate discount factor and summing across all affected years.

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

b. Development of Social Cost of Carbon Values

In 2009, an interagency process was initiated to offer a preliminary assessment of how best to quantify the benefits from reducing carbon dioxide emissions. To ensure consistency in how benefits are evaluated across Federal agencies, the Administration sought to develop a transparent and defensible method, specifically designed for the rulemaking process, to quantify avoided climate change damages from reduced CO_2 emissions. The interagency group did not undertake any original analysis. Instead, it combined SCC estimates from the existing literature to use as interim values until a more comprehensive analysis could be conducted. The outcome of the preliminary assessment by the interagency group was a set of five interim values: Global SCC estimates for 2007 (in 2006$) of $55, $33, $19, $10, and $5 per metric ton of CO_2. These interim values represented the first sustained interagency effort within the U.S. government to develop an SCC for use in regulatory analysis. The results of this preliminary effort were presented in several proposed and final rules.

c. Current Approach and Key Assumptions

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

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

In 2010, the interagency group selected four sets of SCC values for use in regulatory analyses. Three sets of values are based on the average SCC from the three integrated assessment models, at discount rates of 2.5, 3, and 5 percent. The fourth set, which represents the 95th percentile SCC estimate across all three models at a 3-percent discount rate, was included to represent higher-than-expected impacts from climate change further out in the tails of the SCC distribution. The values grow in real terms over time. Additionally, the interagency group determined that a range of values from 7 percent to 23 percent should be used to adjust the global SCC to calculate domestic effects,[59] although preference is given to consideration of the global benefits of reducing CO_2 emissions. Table IV.21 presents the values in the 2010 interagency group report,[60] which is reproduced in appendix 14A of the final rule TSD.

TABLE IV.21—ANNUAL SCC VALUES FROM 2010 INTERAGENCY REPORT, 2010–2050

[2007$ per metric ton CO_2]

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

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

[60] *Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866.* Interagency Working Group on Social Cost of Carbon, United States Government (February 2010) (Available at: *www.whitehouse.gov/sites/default/files/omb/inforeg/for-agencies/Social-Cost-of-Carbon-for-RIA.pdf*).

The SCC values used for this document were generated using the most recent versions of the three integrated assessment models that have been published in the peer-reviewed literature, as described in the 2013 update from the interagency working group (revised July 2015).[61] Table IV.22 shows the updated sets of SCC estimates from the latest interagency update in 5-year increments from 2010 to 2050. The full set of annual SCC estimates between 2010 and 2050 is reported in appendix 14B of the final rule TSD. The central value that emerges is the average SCC across models at the 3-percent discount rate. However, for purposes of capturing the uncertainties involved in regulatory impact analysis, the interagency group emphasizes the importance of including all four sets of SCC values.

TABLE IV.22—ANNUAL SCC VALUES FROM 2013 INTERAGENCY UPDATE (REVISED JULY 2015), 2010–2050

[2007$ per metric ton CO_2]

Year	Discount Rate			
	5%	3%	2.5%	3%
	Average	Average	Average	95th percentile
2010	10	31	50	86
2015	11	36	56	105
2020	12	42	62	123
2025	14	46	68	138
2030	16	50	73	152
2035	18	55	78	168
2040	21	60	84	183
2045	23	64	89	197
2050	26	69	95	212

It is important to recognize that a number of key uncertainties remain, and that current SCC estimates should be treated as provisional and revisable because they will evolve with improved scientific and economic understanding. The interagency group also recognizes that the existing models are imperfect and incomplete. The National Research Council report mentioned previously points out that there is tension between the goal of producing quantified estimates of the economic damages from an incremental ton of carbon and the limits of existing efforts to model these effects. There are a number of analytical challenges that are being addressed by the research community, including research programs housed in many of the Federal agencies participating in the interagency process to estimate the SCC. The interagency group intends to periodically review and reconsider those estimates to reflect increasing knowledge of the science and economics of climate impacts, as well as improvements in modeling.[62]

In summary, in considering the potential global benefits resulting from reduced CO_2 emissions, DOE used the values from the 2013 interagency report (revised July 2015), adjusted to 2014$ using the implicit price deflator for gross domestic product (GDP) from the Bureau of Economic Analysis. For each of the four sets of SCC cases specified, the values for emissions in 2015 were $12.2, $40.0, $62.3, and $117 per metric ton avoided (values expressed in 2014$). DOE derived values after 2050 based on the trend in 2010–2050 in each of the four cases.

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

2. Social Cost of Other Air Pollutants

As noted previously, DOE has estimated how the considered energy conservation standards would decrease power sector NO_X emissions in those 22 States not affected by the CAIR.

DOE estimated the monetized value of NO_X emissions reductions using benefit per ton estimates from the Regulatory Impact Analysis *for the Clean Power Plan Final Rule*, published in August 2015 by EPA's Office of Air Quality Planning and Standards.[63] The report includes high and low values for NO_X (as $PM_{2.5}$) for 2020, 2025, and 2030 discounted at 3 percent and 7 percent; [64] these values are presented in chapter 14 of the final rule TSD. DOE assigned values for 2021–2024 and 2026–2029 using, respectively, the values for 2020 and 2025. DOE assigned values after 2030 using the value for 2030. DOE developed values specific to the end-use category for dehumidifiers using a method described in appendix 14C.

DOE multiplied the emissions reduction (tons) in each year by the associated $/ton values, and then discounted each series using discount rates of 3-percent and 7-percent as appropriate. DOE will continue to evaluate the monetization of avoided NO_X emissions and will make any appropriate updates in energy conservation standards rulemakings.

DOE is evaluating appropriate monetization of avoided SO_2 and Hg emissions in energy conservation standards rulemakings. DOE has not

[61] *Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866*, Interagency Working Group on Social Cost of Carbon, United States Government (May 2013; revised July 2015) (Available at: *http://www.whitehouse.gov/sites/default/files/omb/inforeg/scc-tsd-final-july-2015.pdf*).

[62] In November 2013, OMB announced a new opportunity for public comment on the interagency technical support document underlying the revised SCC estimates. 78 FR 70586. In July 2015 OMB published a detailed summary and formal response to the many comments that were received. *https://www.whitehouse.gov/blog/2015/07/02/estimating-benefits-carbon-dioxide-emissions-reductions*. It also stated its intention to seek independent expert advice on opportunities to improve the estimates, including many of the approaches suggested by commenters.

[63] Available at: *http://www.epa.gov/cleanpowerplan/clean-power-plan-final-rule-regulatory-impact-analysis*. See Tables 4A–3, 4A–4, and 4A–5 in the report.

[64] For the monetized NO_X benefits associated with $PM_{2.5}$, the related benefits (derived from benefit-per-ton values) are primarily based on an estimate of premature mortality derived from the ACS study (Krewski et al., 2009), which is the lower of the two EPA central tendencies. Using the lower value is more conservative when making the policy decision concerning whether a particular standard level is economically justified. If the benefit-per-ton estimates were based on the Six Cities study (Lepuele *et al.*, 2012), the values would be nearly two-and-a-half times larger. (See chapter 14 of the final rule TSD for further description of the studies mentioned in this preamble.)

included monetization of those emissions in the current analysis.

AHAM commented that monetization of avoided CO_2 emissions should include a more comprehensive analysis to understand the total environmental impact. It stated that any CO_2 analysis should include CO_2 emissions that are caused indirectly, as well as directly, from a standards change, such as increased carbon emissions required to manufacture a given standard level, the increased transportation and related emissions required for a given standard level, and reduced carbon emissions from peak load reductions. (AHAM, No. 39 at p. 7)

In response, DOE notes that EPCA directs DOE to consider the total projected amount of energy, or as applicable, water, savings likely to result directly from the imposition of the standard when determining whether a standard is economically justified. (42 U.S.C. 6295(o)(2)(B)(i)(III)) DOE interprets this to include energy used in the generation, transmission, and distribution of fuels used by appliances or equipment. In addition, DOE is using the FFC measure, which includes the energy consumed in extracting, processing, and transporting primary fuels. DOE's current accounting of primary energy savings and the FFC measure are directly linked to the energy used by appliances or equipment. DOE believes that energy used in manufacturing or transporting appliances or equipment falls outside the boundaries of ''directly'' as intended by EPCA. Thus, DOE did not consider such energy use and air emissions in the NIA or in the emissions analysis. DOE's analysis does account for impacts on CO_2 emissions from electricity load reduction.

The U.S. Chamber of Commerce objected to the continued use of the SCC in the cost-benefit analysis performed. AHAM stated that DOE should wait for comments on the 2013 interagency report to be resolved before it relies on the 2013 estimates, and, until that time DOE should rely on the 2010 estimates as it has done in rulemakings prior to May 2013. (U.S. Chamber of Commerce, No. 37 at p. 4; AHAM, No. 39 at p. 7)

The 2013 report provides an update of the SCC estimates based solely on the latest peer-reviewed version of the models, replacing model versions that were developed up to ten years ago in a rapidly evolving field. It does not revisit other assumptions with regard to the discount rate, reference case socioeconomic and emission scenarios, or equilibrium climate sensitivity. Improvements in the way damages are modeled are confined to those that have been incorporated into the latest versions of the models by the developers themselves in the peer-reviewed literature. Given the above, using the 2010 estimates would be inconsistent with DOE's objective of using the best available information in its analyses. As noted previously, OMB published a detailed summary and formal response to the many comments that were received on the 2013 interagency report.

M. Utility Impact Analysis

The utility impact analysis estimates several effects on the electric power generation industry that would result from the adoption of new or amended energy conservation standards. The utility impact analysis estimates the changes in installed electrical capacity and generation that would result for each TSL. The analysis is based on published output from the NEMS associated with *AEO 2015.* NEMS produces the *AEO* Reference case, as well as a number of side cases that estimate the economy-wide impacts of changes to energy supply and demand. DOE uses published side cases to estimate the marginal impacts of reduced energy demand on the utility sector. These marginal factors are estimated based on the changes to electricity sector generation, installed capacity, fuel consumption and emissions in the *AEO* Reference case and various side cases. Details of the methodology are provided in the appendices to chapters 13 and 15 of the final rule TSD.

The output of this analysis is a set of time-dependent coefficients that capture the change in electricity generation, primary fuel consumption, installed capacity and power sector emissions due to a unit reduction in demand for a given end use. These coefficients are multiplied by the stream of electricity savings calculated in the NIA to provide estimates of selected utility impacts of new or amended energy conservation standards.

N. Employment Impact Analysis

DOE considers employment impacts in the domestic economy as one factor in selecting a standard. Employment impacts from new or amended energy conservation standards include both direct and indirect impacts. Direct employment impacts are any changes in the number of employees of manufacturers of the products subject to standards, their suppliers, and related service firms. The MIA addresses those impacts. Indirect employment impacts are changes in national employment that occur due to the shift in expenditures and capital investment caused by the purchase and operation of more-efficient appliances. Indirect employment impacts from standards consist of the net jobs created or eliminated in the national economy, other than in the manufacturing sector being regulated, caused by: (1) Reduced spending by end users on energy; (2) reduced spending on new energy supply by the utility industry; (3) increased consumer spending on new products to which the new standards apply; and (4) the effects of those three factors throughout the economy.

One method for assessing the possible effects on the demand for labor of such shifts in economic activity is to compare sector employment statistics developed by the Labor Department's Bureau of Labor Statistics (BLS).[65] BLS regularly publishes its estimates of the number of jobs per million dollars of economic activity in different sectors of the economy, as well as the jobs created elsewhere in the economy by this same economic activity. Data from BLS indicate that expenditures in the utility sector generally create fewer jobs (both directly and indirectly) than expenditures in other sectors of the economy.[66] There are many reasons for these differences, including wage differences and the fact that the utility sector is more capital-intensive and less labor-intensive than other sectors. Energy conservation standards have the effect of reducing consumer utility bills. Because reduced consumer expenditures for energy likely lead to increased expenditures in other sectors of the economy, the general effect of efficiency standards is to shift economic activity from a less labor-intensive sector (*i.e.*, the utility sector) to more labor-intensive sectors (*e.g.*, the retail and service sectors). Thus, the BLS data suggest that net national employment may increase due to shifts in economic activity resulting from energy conservation standards.

DOE estimated indirect national employment impacts for the standard levels considered in this final rule using an input/output model of the U.S. economy called Impact of Sector Energy Technologies version 3.1.1 (ImSET).[67]

[65] Data on industry employment, hours, labor compensation, value of production, and the implicit price deflator for output for these industries are available upon request by calling the Division of Industry Productivity Studies (202–691–5618) or by sending a request by email to *dipsweb@bls.gov*.

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

[67] J.M. Roop, M.J. Scott, and R.W. Schultz, *ImSET 3.1: Impact of Sector Energy Technologies*, PNNL–18412, Pacific Northwest National Laboratory

ImSET is a special-purpose version of the ''U.S. Benchmark National Input-Output'' (I–O) model, which was designed to estimate the national employment and income effects of energy-saving technologies. The ImSET software includes a computer-based I–O model having structural coefficients that characterize economic flows among 187 sectors most relevant to industrial, commercial, and residential building energy use.

DOE notes that ImSET is not a general equilibrium forecasting model, and understands the uncertainties involved in projecting employment impacts, especially changes in the later years of the analysis. Because ImSET does not incorporate price changes, the employment effects predicted by ImSET may over-estimate actual job impacts over the long run for this rule. Therefore, DOE generated results for near-term timeframes, where these uncertainties are reduced. For more details on the employment impact analysis, see chapter 16 of the final rule TSD.

V. Analytical Results and Conclusions

The following section addresses the results from DOE's analyses with respect to the considered energy conservation standards for dehumidifiers. It addresses the TSLs examined by DOE, the projected impacts of each of these levels if adopted as energy conservation standards for dehumidifiers, and the standards levels that DOE is adopting in this final rule. Additional details regarding DOE's analyses are contained in the final rule TSD supporting this document.

A. Trial Standard Levels

DOE analyzed the benefits and burdens of four TSLs for dehumidifiers. These TSLs were developed by combining specific efficiency levels for each of the five product classes analyzed by DOE. DOE presents the results for the TSLs in this document, while the results for all efficiency levels that DOE analyzed are in the final rule TSD. Table V.1 presents the TSLs and the corresponding efficiency levels for dehumidifiers. TSL 4 represents the max-tech energy efficiency for all product classes. TSL 3 consists of the efficiency levels below the max-tech level for all product classes. The efficiency level for TSL 2 for product classes 1, 2, and 3 is one below the max-tech level, the same level as TSL3. The efficiency level for TSL 2 for product classes 4 and 5 is the baseline. TSL 1 consists of Efficiency Level 2 for product classes 1, 2, and 3 and the baseline for product classes 4 and 5.

TABLE V.1—TRIAL STANDARD LEVELS FOR DEHUMIDIFIERS

TSL	PC1		PC2		PC3		PC4		PC5	
	≤25.00 pints/day		25.01–50.00 pints/day		≥50.01 pints/day		≤8.0 ft^3		>8.0 ft^3	
	EL	AEU (kWh/yr)	EL	AEU (kWh/yr)	EL	AEU (kWh/yr)	EL	AEU (kWh/yr)	EL	AEU (kWh/yr)
	0	505	0	808	0	867	0	809	0	967
1	2	460	2	688	2	778	0	809	0	967
2	3	422	3	603	3	665	0	809	0	967
3	3	422	3	603	3	665	1	681	2	660
4	4	351	4	534	4	509	2	565	3	519

B. Economic Justification and Energy Savings

1. Economic Impacts on Individual Consumers

DOE analyzed the economic impacts on dehumidifier consumers by looking at the effects potential amended standards at each TSL would have on the LCC and PBP. DOE also examined the impacts of potential standards on consumer subgroups. These analyses are discussed below.

a. Life-Cycle Cost and Payback Period

In general, higher-efficiency products affect consumers in two ways: (1) Purchase price increases, and (2) annual operating costs decrease. Inputs used for calculating the LCC and PBP include total installed costs (*i.e.*, product price plus installation costs), and operating costs (*i.e.*, annual energy use, energy prices, energy price trends, repair costs, and maintenance costs). The LCC calculation also uses product lifetime and a discount rate. Chapter 8 of the final rule TSD provides detailed information on the LCC and PBP analyses.

Table V.2 through Table V.3 show the LCC and PBP results for the TSL efficiency levels considered for each product class. In the first of each pair of tables, the simple payback is measured relative to the baseline product. In the second table, the impacts are measured relative to the efficiency distribution in the no-new-standards case in the compliance year (see section IV.F.8 of this document). Because some consumers purchase products with higher efficiency in the no-new-standards case, the average savings are less than the difference between the average LCC of Efficiency Level 0 (baseline) and the average LCC at each TSL. The savings refer only to consumers who are affected by a standard at a given TSL. Those who already purchase a product with efficiency at or above a given TSL are not affected. Consumers for whom the LCC increases at a given TSL experience a net cost.

(2009) (Available at: *www.pnl.gov/main/publications/external/technical_reports/PNNL-18412.pdf*.)

TABLE V.2—AVERAGE LCC AND PBP RESULTS BY EFFICIENCY LEVEL FOR DEHUMIDIFIER PC1

[≤25.00 pints/day]

TSL	EL	Average costs (2014$)				Simple payback (years)	Average lifetime (years)
		Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	0	208	78	736	944		11
1	2	210	71	674	884	0.4	11
2, 3	3	214	66	622	836	0.5	11
4	4	238	56	525	763	1.3	11

Note: The results for each TSL are calculated assuming that all consumers use products at that efficiency level. The PBP is measured relative to the baseline (EL 0) product.

TABLE V.3—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR DEHUMIDIFIER PC1

[≤25.00 pints/day]

TSL	EL	Life-cycle cost savings	
		Average LCC savings* (2014$)	Percent of consumers that experience net cost (%)
1	2	60	0
2, 3	3	107	0.1
4	4	110	11.5

*The savings represent the average LCC for affected consumers.

TABLE V.4—AVERAGE LCC AND PBP RESULTS BY EFFICIENCY LEVEL FOR DEHUMIDIFIER PC2

[25.01–50.00 pints/day]

TSL	EL	Average costs (2014$)				Simple PBP (years)	Average lifetime (years)
		Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	0	252	124	1,173	1,425		11
1	2	255	107	1,010	1,265	0.2	11
2, 3	3	264	95	895	1,158	0.4	11
4	4	286	85	800	1,086	0.9	11

Note: The results for each TSL are calculated assuming that all consumers use products at that efficiency level. The PBP is measured relative to the baseline product.

TABLE V.5—AVERAGE LCC SAVINGS RELATIVE TO THE BASE-CASE EFFICIENCY DISTRIBUTION FOR DEHUMIDIFIER PC2

[25.01–50.00 pints/day]

TSL	EL	Life-cycle cost savings	
		Average LCC savings* (2014$)	Percent of consumers that experience net cost (%)
1	2	157	0
2,3	3	119	0.7
4	4	191	5.1

*The savings represent the average LCC for affected consumers.

TABLE V.6—AVERAGE LCC AND PBP RESULTS BY EFFICIENCY LEVEL FOR DEHUMIDIFIER PC3

[>50.00 pints/day]

TSL	EL	Average costs (2014$)				Simple PBP (years)	Average lifetime (years)
		Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	0	1,302	134	1,269	2,571	.....	11
1	2	1,407	121	1,147	2,554	8.2	11
2,3	3	1,433	105	994	2,427	4.5	11
4	4	1,673	83	782	2,455	7.2	11

Note: The results for each TSL are calculated assuming that all consumers use products at that efficiency level. The PBP is measured relative to the baseline product.

TABLE V.7—AVERAGE LCC SAVINGS RELATIVE TO THE BASE-CASE EFFICIENCY DISTRIBUTION FOR DEHUMIDIFIER PC3

[>50.00 pints/day]

TSL	EL	Life-cycle cost savings	
		Average LCC savings* (2014$)	Percent of consumers that experience net cost (%)
1	2	17	44.9
2,3	3	142	28.7
4	4	96	54.3

*The savings represent the average LCC for affected consumers.

TABLE V.8—AVERAGE LCC AND PBP RESULTS BY EFFICIENCY LEVEL FOR DEHUMIDIFIER PC4

[≤8.0 ft^3]

TSL	EL	Average costs (2014$)				Simple PBP (years)	Average lifetime (years)
		Installed cost	First year's operating cost	Lifetime operating cost	LCC		
1,2	0	1,733	129	1,893	3,626	.....	19
3	1	1,769	110	1,613	3,382	1.9	19
4	2	1,977	93	1,361	3,339	6.8	19

Note: The results for each TSL are calculated assuming that all consumers use products at that efficiency level. The PBP is measured relative to the baseline product.

TABLE V.9—AVERAGE LCC SAVINGS RELATIVE TO THE BASE-CASE EFFICIENCY DISTRIBUTION FOR DEHUMIDIFIER PC4

[≤8.0 ft^3]

TSL	EL	Life-cycle cost savings	
		Average LCC savings* (2014$)	Percent of consumers that experience net cost (%)
1,2	0		
3	1	242	9.9
4	2	242	42.6

*The savings represent the average LCC for affected consumers.

TABLE V.10—AVERAGE LCC AND PBP RESULTS BY EFFICIENCY LEVEL FOR DEHUMIDIFIER PC5

[>8.0 ft^3]

TSL	EL	Average costs (2014$)				Simple PBP (years)	Average lifetime (years)
		Installed cost	First year's operating cost	Lifetime operating cost	LCC		
1,2	0	2,233	153	2,250	4,483	.....	19

TABLE V.10—AVERAGE LCC AND PBP RESULTS BY EFFICIENCY LEVEL FOR DEHUMIDIFIER PC5—Continued

[>8.0 ft³]

TSL	EL	Average costs (2014$)				Simple PBP (years)	Average lifetime (years)
		Installed cost	First year's operating cost	Lifetime operating cost	LCC		
3	2	2,325	108	1,581	3,906	2.0	19
4	3	2,617	87	1,273	3,890	5.8	19

Note: The results for each TSL are calculated assuming that all consumers use products at that efficiency level. The PBP is measured relative to the baseline product.

TABLE V.11—AVERAGE LCC SAVINGS RELATIVE TO THE BASE-CASE EFFICIENCY DISTRIBUTION FOR DEHUMIDIFIER PC5

[>8.0 ft³]

TSL	EL	Life-cycle cost savings	
		Average LCC savings * (2014$)	Percent of consumers that experience net cost (%)
1,2	1	.....	.....
3	2	479	10.8
4	3	386	43.4

* The savings represent the average LCC for affected consumers.

b. Consumer Subgroup Analysis

As described in section IV.I of this document, DOE estimated the impact of the considered TSLs on low-income households and senior-only households. Table V.12 through Table V.16 compare the average LCC savings at each efficiency level for the two consumer subgroups, along with the average LCC savings for the entire sample. In most cases, the average LCC savings and PBP for low-income households and senior-only households at the considered efficiency levels are not substantially different from the average for all households. Chapter 11 of the final rule TSD presents the complete LCC and PBP results for the two subgroups.

TABLE V.12—DEHUMIDIFIER PC1 (>25.00 PINTS/DAY): COMPARISON OF IMPACTS FOR CONSUMER SUBGROUPS AND ALL HOUSEHOLDS

TSL	Average life-cycle cost savings (2014$)			Simple payback period (years)		
	Low-income households	Senior-only households	All households	Low-income households	Senior-only households	All households
1	55	48	60	0.4	0.5	0.4
2,3	99	86	107	0.6	0.7	0.5
4	101	85	110	1.4	1.6	1.3

TABLE V.13—DEHUMIDIFIER PC2 (25.01–50.00 PINTS/DAY): COMPARISON OF IMPACTS FOR CONSUMER SUBGROUPS AND ALL HOUSEHOLDS

TSL	Average life-cycle cost savings (2014$)			Simple payback period (years)		
	Low-income households	Senior-only households	All households	Low-income households	Senior-only households	All households
1	149	127	157	0.2	0.2	0.2
2,3	112	97	119	0.4	0.5	0.4
4	178	151	191	0.9	1.1	0.9

TABLE V.14—DEHUMIDIFIER PC3 (>50.00 PINTS/DAY): COMPARISON OF IMPACTS FOR CONSUMER SUBGROUPS AND ALL HOUSEHOLDS

TSL	Average life-cycle cost savings (2014$)			Simple payback period (years)		
	Low-income households	Senior-only households	All households	Low-income households	Senior-only households	All households
1	9	(6)	17	8.6	9.9	8.2
2,3	126	95	142	4.7	5.5	4.5
4	69	17	96	7.5	8.7	7.2

TABLE V.15—DEHUMIDIFIER PC4 (>8.0 FT^3): COMPARISON OF IMPACTS FOR CONSUMER SUBGROUPS AND ALL HOUSEHOLDS

TSL	Average life-cycle cost savings (2014$)			Simple payback period (years)		
	Low-income households	Senior-only households	All households	Low-income households	Senior-only households	All households
1,2						
3	135	251	242	2.7	1.8	1.9
4	64	259	242	9.6	6.5	6.8

TABLE V.16—DEHUMIDIFIER PC5 (>8.0 FT^3): COMPARISON OF IMPACTS FOR CONSUMER SUBGROUPS AND ALL HOUSEHOLDS

TSL	Average life-cycle cost savings (2014$)			Simple payback period (years)		
	Low-income households	Senior-only households	All households	Low-income households	Senior-only households	All households
1,2						
3	261	496	479	2.9	2.0	2.0
4	105	409	386	8.3	5.6	5.8

c. Rebuttable Presumption Payback

As discussed in this preamble, EPCA provides a rebuttable presumption that an energy conservation standard is economically justified if the increased purchase cost for a product that meets the standard is less than three times the value of the first-year energy savings resulting from the standard. In calculating a rebuttable presumption PBP for the considered standard levels, DOE used discrete values and, as required by EPCA, based the energy use calculation on the DOE test procedure for dehumidifiers in appendix X1. In contrast, the PBPs presented in section V.B.1.a were calculated using distributions for input values, with energy use based on field studies and RECS data.

Table V.17 presents the rebuttable-presumption PBPs for the considered TSLs.[68] While DOE examined the rebuttable-presumption criterion, it further considered whether the standard levels considered for the NOPR are economically justified through a more detailed analysis of the economic impacts of those levels pursuant to 42 U.S.C. 6295(o)(2)(B)(i). The results of that analysis serve as the basis for DOE to evaluate the economic justification for a potential standard level (thereby supporting or rebutting the results of any preliminary determination of economic justification).

TABLE V.17—DEHUMIDIFIERS: REBUTTABLE PAYBACK PERIOD (YEARS)

Product class	Trial standard level			
	1	2	3	4
PC1 (≤25.00 pints/day)	0.5	0.6	0.6	1.6
PC2 (25.00–50.00 pints/day)	0.2	0.5	0.5	1.0
PC3 (≥50.01 pints/day)	8.7	4.8	4.8	7.7
PC4 (≤8.0 ft^3)			2.2	7.8
PC5 (>8.0 ft^3)			2.3	6.7

[68] The PBPs in Table V.17 differ from those shown in Tables V.2, V.4, V.6, V.8 and V.10 because the rebuttable PBPs are calculated with energy use based on the DOE test procedure, whereas the PBPs in the earlier tables are calculated with energy use based on field studies and RECS data.

2. Economic Impacts on Manufacturers

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

a. Industry Cash Flow Analysis Results

The following tables illustrate the estimated financial impacts (represented by changes in INPV) of amended energy conservation standards on manufacturers of dehumidifiers, as well as the conversion costs that DOE estimates manufacturers would incur for each product class at each TSL. To evaluate the range of cash-flow impacts on the dehumidifier manufacturing industry, DOE used two different markup scenarios to model the range of anticipated market responses to amended energy conservation standards.

To assess the lower (less severe) end of the range of potential impacts, DOE modeled a preservation of gross margin percentage markup scenario, in which a flat markup of 1.45 (*i.e.,* the baseline manufacturer markup) is applied across all efficiency levels. In this scenario, DOE assumed that a manufacturer's absolute dollar markup would increase as production costs increase in the amended energy conservation standards case. Manufacturers have indicated that it is optimistic to assume that they would be able to maintain the same gross margin markup as their production costs increase in response to a new or amended energy conservation standard, particularly at higher TSLs.

To assess the higher (more severe) end of the range of potential impacts, DOE modeled the preservation of per-unit operating profit markup scenario, which assumes that manufacturers would not be able to preserve the same overall gross margin, but instead would cut their markup for minimally compliant products to maintain a cost competitive product offering while maintaining the same overall level of operating profit in absolute dollars as in the no-new-standards case. The two tables below show the range of potential INPV impacts for manufacturers of dehumidifiers. Table V.18 reflects the lower bound of impacts (higher profitability) and Table V.19 represents the upper bound of impacts (lower profitability).

Each scenario results in a unique set of cash flows and corresponding industry values at each TSL. In the following discussion, the INPV results refer to the sum of discounted cash flows through 2048, the difference in INPV between the no-new-standards case and each standards case, and the total industry conversion costs required for each standards case.

TABLE V.18—MANUFACTURER IMPACT ANALYSIS UNDER THE PRESERVATION OF GROSS MARGIN PERCENTAGE MARKUP SCENARIO FOR ANALYSIS PERIOD

[2016–2048]

	Units	No-new-standards case	Trial standard level			
			1	2	3	4
INPV	2014$ Millions	179.5	176.5	145.5	140.7	126.9
Change in INPV	2014$ Millions		(3.0)	(34.0)	(38.7)	(52.6)
	(%)		(1.7%)	(18.9%)	(21.6%)	(29.3%)
Free Cash Flow (2018)	2014$ Millions	15.0	13.2	(4.2)	(6.7)	(19.7)
Change in Free Cash Flow (2018)	(%)		(12.4%)	(128.3%)	(144.9%)	(231.4%)
Product Conversion Costs	2014$ Millions		3.0	29.9	35.4	55.2
Capital Conversion Costs	2014$ Millions		2.1	22.6	24.5	39.1
Total Conversion Costs	2014$ Millions		5.1	52.5	59.8	94.3

Parentheses indicate negative (−) values.

TABLE V.19—MANUFACTURER IMPACT ANALYSIS UNDER THE PRESERVATION OF PER-UNIT OPERATING PROFIT MARKUP SCENARIO FOR ANALYSIS PERIOD

[2016–2048]

	Units	No-new-standards case	Trial standard level			
			1	2	3	4
INPV	2014$ Millions	179.5	175.8	142.0	137.1	106.8
Change in INPV	2014$ Millions		(3.6)	(37.5)	(42.4)	(72.7)
	(%)		(2.0%)	(20.9%)	(23.6%)	(40.5%)
Free Cash Flow (2018)	2014$ Millions	15.0	13.2	(4.2)	(6.7)	(19.7)
Decrease in Free Cash Flow (2018)	(%)		(12.4%)	(128.3%)	(144.9%)	(231.4%)
Product Conversion Costs	2014$ Millions		3.0	29.9	35.4	55.2
Capital Conversion Costs	2014$ Millions		2.1	22.6	24.5	39.1
Total Conversion Costs	2014$ Millions		5.1	52.5	59.8	94.3

Parentheses indicate negative (−) values.

Beyond impacts on INPV, DOE includes a comparison of free cash flow between the no-new-standards case and the standards case at each TSL in the year before amended standards take effect to provide perspective on the short-run cash flow impacts in the discussion of the results below.

At TSL 1, DOE estimates the impact on INPV for manufacturers of dehumidifiers to range from −$3.6 million to −$3.0 million, or a change in INPV of −2.0 percent to −1.7 percent under the preservation of per-unit operating profit markup scenario and

preservation of gross margin percentage markup scenario, respectively. At this TSL, industry free cash flow is estimated to decrease by approximately 12.4 percent to $13.2 million, compared to the no-new-standards-case value of $15.0 million in 2018, the year before the projected compliance date.

At TSL 1, the industry as a whole is expected to incur $3.0 million in product conversion costs attributed to upfront research, development, testing, and certification, as well as $2.1 million in investments in property, plant and equipment (PP&E) necessary to manufacture redesigned platforms. Industry conversion cost burden at TSL 1 would be felt by manufacturers of both lower-capacity and high-capacity portable dehumidifiers, although 83 percent of conversion costs relate to higher-capacity portable dehumidifier platform redesigns. At TSL 1, approximately 1 percent of portable platforms will require complete platform redesigns to reach the improved efficiency, which involve moving to a new case size to accommodate larger heat exchangers. These changes require upfront capital investments for new tooling to manufacturing production lines, among other changes. Additionally, it is assumed that manufacturers of high-capacity portable dehumidifiers, the majority of which are small business manufacturers, will have to outsource testing of their products to third-party testing facilities, contributing to greater product conversion costs. In contrast, the large manufacturers of portable dehumidifiers are assumed to have in-house testing capabilities, which significantly reduce the cost of testing. DOE confirmed these assumptions regarding testing burdens during manufacturer interviews.

At TSL 2, DOE estimates the impact on INPV for dehumidifier manufacturers to range from −$37.5 million to −$34.0 million, or a change in INPV of −20.9 percent to −18.9 percent under the preservation of per-unit operating profit markup scenario and the preservation of gross margin percentage markup scenario, respectively. At this TSL, industry free cash flow is estimated to decrease by approximately 128.3 percent to −$4.2 million, compared to the no-new-standards-case free cash flow of $15.0 million in 2018, the year before the projected compliance date.

At TSL 2, the industry as a whole is expected to incur $29.9 million in product conversion costs associated with upfront research, development, testing, and certification, as well as $22.6 million in investments in PP&E to manufacture products requiring platform redesigns. At TSL 2, the industry conversion cost burden will be felt by manufacturers of both low-capacity and high-capacity portable dehumidifiers, as approximately 50 percent of portable dehumidifier platforms will require complete platform redesigns. Platform redesigns at TSL 2 will include moving to a new case size to accommodate larger heat exchangers, and will necessitate upfront capital investments for new tooling. Because lower-capacity portable units represent approximately 98.5 percent of the market, conversion costs associated with this segment have a significant impact on total industry conversion costs for TSL 2.

At TSL 3, DOE estimates the impact on INPV for dehumidifier manufacturers to range from −$42.4 million to −$38.7 million, or a change in INPV of −23.6 percent to −21.6 percent under the preservation of per-unit operating profit markup scenario and the preservation of gross margin percentage markup scenario, respectively. At this TSL, industry free cash flow is estimated to decrease by approximately 144.9 percent to −$6.7 million, compared to the no-new-standards-case free cash flow of $15.0 million in 2018, the year before the projected compliance date.

At TSL 3, the industry as a whole is expected to spend $35.4 million in product conversion costs associated with upfront research, development, testing, and certification, as well as $24.5 million in investments in PP&E to manufacture redesigned platforms. While conversion costs remain constant for manufacturers of portable dehumidifiers between TSLs 2 and 3, the conversion costs for manufacturers of whole-home dehumidifiers increase substantially at TSL 3, as nearly 80 percent of these products will require total platform redesigns. As with the portable dehumidifier market segment, platform redesigns for whole-home units will consist of moving products to a new case size to accommodate larger heat exchangers, and in turn will require capital investments in new tooling for larger cases. This upfront investment is in addition to higher R&D and testing expenditures. Despite increased conversion costs associated with the whole-home segment, because lower-capacity portable units represent approximately 98.5 percent of the market, conversion costs associated with this segment have a significant impact on total industry conversion costs for TSL 3.

At TSL 4, DOE estimates the impact on INPV for manufacturers of dehumidifiers to range from −$72.7 million to −$52.6 million, or a change in INPV of −40.5 percent to −29.3 percent the preservation of per-unit operating profit markup scenario and the preservation of gross margin percentage markup scenario, respectively. At this TSL, industry free cash flow is estimated to decrease by approximately 231.4 percent to −$19.7 million, compared to the no-new-standards-case free cash flow of $15.0 million in 2018, the year before the projected compliance date.

At TSL 4, the industry as a whole is expected to spend $55.2 million in product conversion costs associated with upfront research, development, testing, and certification, as well as $40.5 million in investments in PP&E for platform redesigns. At TSL 4, approximately 63 percent of dehumidifier platforms will require complete redesigns in the form of larger chassis. Again, since lower-capacity portable units represent approximately 98.5 percent of the market, conversion costs associated with this segment have a significant impact on total industry conversion costs for TSL 4.

b. Impacts on Direct Employment

DOE used the GRIM to estimate the domestic labor expenditures and number of domestic production workers in the no-new-standards case and at each TSL from 2016 to 2048. DOE used statistical data from the U.S. Census Bureau's 2013 *Annual Survey of Manufactures,* the results of the engineering analysis, and interviews with manufacturers to determine the inputs necessary to calculate industry-wide labor expenditures and domestic employment levels at each TSL. Labor expenditures for the manufacture of a product are a function of the labor intensity of the product, the sales volume, and an assumption that wages in real terms remain constant. The total labor expenditures in each year are calculated by multiplying the MPCs by the labor percentage of MPCs. DOE estimates that all whole-home dehumidifiers and 50 percent of high-capacity portable dehumidifiers are produced domestically. This represents approximately 1 percent of dehumidifiers sold in the United States.

The total labor expenditures in the GRIM were then converted to domestic production employment levels by dividing production labor expenditures by the annual payment per production worker (production worker hours times the labor rate found in the U.S. Census Bureau's 2013 Annual Survey of Manufactures). The production worker estimates in this section only cover workers up to the line-supervisor level who are directly involved in fabricating

and assembling a product within an original equipment manufacturer (OEM) facility. Workers performing services that are closely associated with production operations, such as materials handling tasks using forklifts, are also included as production labor. DOE's estimates only account for production workers who manufacture the specific products covered by this rulemaking.

Because production employment expenditures are assumed to be a fixed percentage of cost of goods sold and the MPCs typically increase with more efficient products, labor tracks the increased prices in the GRIM. As efficiency of dehumidifiers increase, so does the complexity of the products, generally requiring more labor to produce. Based on industry feedback, DOE believes that manufacturers that use domestic production currently will continue to produce the same scope of covered products in domestic production facilities. DOE does not expect production to shift to lower labor cost countries. However, in public comments submitted in response to the NOPR and in manufacturer interviews, stakeholders provided feedback indicating that amended energy conservation standards could have a negative impact on domestic production employment, depending on the standard level.

Using the GRIM, DOE estimates that in the absence of amended energy conservation standards, there would be 88 domestic production workers in the dehumidifier industry. As noted previously, DOE estimates that 1 percent of dehumidifier units sold in the United States are manufactured domestically. Table V.20 shows the range of the impacts of potential amended energy conservation standards on U.S. production workers of dehumidifiers. A complete description of the assumptions used to generate these upper and lower bounds can be found in chapter 12 of the final rule TSD.

TABLE V.20—CHANGE IN TOTAL NUMBER OF DOMESTIC PRODUCTION EMPLOYEES IN 2019 IN THE DEHUMIDIFIER INDUSTRY

	No-new-standards case *	TSL 1	TSL 2	TSL 3	TSL 4
Change in Total Number of Domestic Production Workers in 2019.**	.....	0 to 1	0 to 1	(44) to 2	(88) to 11

* No-new-standards case estimates 88 domestic production workers in the dehumidifier industry in 2019.
** Parentheses indicate negative values.

The upper end of the range estimates the maximum increase in the number of production workers in the dehumidifier industry after implementation of an emended energy conservation standard. It assumes that manufacturers would continue to produce the same scope of covered products within the United States and would require some additional labor to produce more efficient products.

The lower end of the range represents the maximum decrease in total number of U.S. production workers that could result from an amended energy conservation standard and is based on direct feedback from interested parties. Feedback from manufacturers during interviews indicated that some domestic small businesses in the dehumidifier industry (specifically in the high-capacity portable dehumidifier and whole-home dehumidifier segments) may be forced to reduce employment, shift production abroad, or exit the dehumidifier market as a result of amended energy conservation standards. This lower bound of direct employment impacts reflects the worst-case scenario of impacts.

This conclusion is independent of any conclusions regarding indirect employment impacts in the broader U.S. economy, which are documented in Chapter 16 of the TSD.

c. Impacts on Manufacturing Capacity

As noted previously, the majority of dehumidifiers sold in the United States are not produced domestically. However, in response to standard levels analyzed in the June 2015 NOPR, domestic manufacturers of high-capacity portable dehumidifiers and whole-home dehumidifiers commented that production of these products could shift to lower-cost countries or halt altogether as a result of amended energy conservation standards, depending on the level selected. This could lead to a permanently lower production capacity within the dehumidifier industry.

d. Impacts on Subgroups of Manufacturers

Small manufacturers, niche equipment manufacturers, and manufacturers exhibiting a cost structure substantially different from the industry average could be affected disproportionately. Using average cost assumptions to develop an industry cash-flow estimate is inadequate to assess differential impacts among manufacturer subgroups.

For dehumidifier equipment, DOE identified and evaluated the impact of amended energy conservation standards on one subgroup: Small manufacturers. The SBA defines a ''small business'' as having 1,250 employees or less for NAICS 333415 (''Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing'') or 1,500 employees or less for NAICS 335210 (''Small Electrical Appliance Manufacturing''). Based on this definition, DOE identified five manufacturers in the dehumidifier equipment industry that are small businesses.

For a discussion of the impacts on the small manufacturer subgroup, see the Regulatory Flexibility Analysis in section VII.B of this final rule and chapter 12 of the final rule TSD.

e. Cumulative Regulatory Burden

One aspect of assessing manufacturer burden involves looking at the cumulative impact of multiple DOE standards and the regulatory actions of other Federal agencies and States that affect the manufacturers of a covered product or equipment. DOE believes that a standard level is not economically justified if it contributes to an unacceptable cumulative regulatory burden. While any one regulation may not impose a significant burden on manufacturers, the combined effects of several existing or impending regulations may have serious consequences for some manufacturers, groups of manufacturers, or an entire industry. Multiple regulations affecting the same manufacturer can strain profits and lead companies to abandon product lines or markets with lower expected

future returns than competing products. In addition to DOE's energy conservation regulations for dehumidifiers, several other existing and pending regulations apply to these products and other equipment produced by the same manufacturers. DOE looks at these regulations that could affect dehumidifier manufacturers that will take effect approximately 3 years before or after the 2019 compliance date of amended energy conservation standards for dehumidifiers. Additionally, DOE will evaluate its approach to assessing cumulative regulatory burden for use in future rulemakings to ensure that it is effectively capturing the overlapping impacts of its regulations. In particular, DOE will assess whether looking at rules where any portion of the compliance period potentially overlaps with the compliance period for the subject rulemaking would yield a more accurate reflection of cumulative regulatory burden. For example, DOE recognizes that if it were to undertake a rulemaking to amend the standards for room air conditioners pursuant to the 6-year look back requirement under 42 U.S.C. 6295(m), any future room air conditioner rule could have a cumulative impact on manufacturers of dehumidifiers during the compliance period for these dehumidifiers standards.

The compliance years and expected industry conversion costs of energy conservation standards that may also impact dehumidifier manufacturers are indicated in Table V.21. For each rule, the table also contains the number of affected dehumidifier original equipment manufacturers (OEMs). DOE excludes companies that import and relabel dehumidifiers from this count, as DOE's analysis indicates that OEMs bear the majority of the economic burden for a given rule. Only 50 percent of the companies selling dehumidifiers in the United States are OEMs (12 of 24). None of the OEMs identified in this table are domestic in terms of ownership or manufacturing site.

TABLE V.21—OTHER FEDERAL ENERGY CONSERVATION STANDARDS AFFECTING DEHUMIDIFIER OEMS

DOE Regulation	Number of manufacturers *	Estimated INPV *** (No new standards case)	Estimated total industry conversion costs	Compliance date	Number of affected dehumidifier OEMs
Microwave Ovens, 78 FR 36316 (June 17, 2013).	12	1,386.5 Million (2011$).	43.1 Million (2011$)	2016	1
Residential Clothes Washers, 77 FR 32308 (May 31, 2012).	16	2,586.0 Million (2010$).	418.5 Million (2010$)	2018	2
Ceiling Fans, 81 FR 1688, (January 13, 2016).	31	1,308.7 Million (2014$).	9.4 Million (2014$) ...	** 2019	1
Furnace Fans, 79 FR 38129 (July 3, 2014)	37	349.6 Million (2013$)	40.6 Million (2013$)	2019	2
Portable Air Conditioners Pre-publication NOPR issued on April 27, 2016.	29	725.5 Million (2014$)	302.8 Million (2014$)	** 2021	4

* The number of manufacturers listed in the final rule for the energy conservation standard that is contributing to cumulative regulatory burden.
** The dates listed are an approximation. The exact dates are pending final DOE action.
*** The industry net present value (INPV) is the sum of the discounted cash flows to the industry from the base year through the end of the analysis period of the rulemaking (typically 30 years).

In addition to other Federal energy conservation standards, manufacturers cited third-party certification programs (*e.g.,* UL safety standards certification for dehumidifiers) as a source of cumulative regulatory burden for dehumidifier manufacturers. For more details, see chapter 12 of the final rule TSD.

3. National Impact Analysis

a. Significance of Energy Savings

To estimate the energy savings attributable to potential standards for dehumidifiers, DOE compared the energy consumption of those products under the base case to their anticipated energy consumption under each TSL. Table V.22 presents DOE's projections of the national energy savings for each TSL considered for dehumidifiers shipped in the 2019–2048 period. The savings were calculated using the approach described in section IV.H.1 of this document.

TABLE V.22—DEHUMIDIFIERS: CUMULATIVE NATIONAL ENERGY SAVINGS

[Shipments in 2019–2048]

Savings	Trial standard level			
	1	2	3	4
Primary Energy Savings (*quads*)	0.07	0.29	0.30	0.79
FFC Energy Savings (*quads*)	0.07	0.30	0.31	0.82

OMB Circular A–4 [69] requires agencies to present analytical results, including separate schedules of the monetized benefits and costs that show the type and timing of benefits and costs. Circular A–4 also directs agencies to consider the variability of key elements underlying the estimates of benefits and costs. For this rulemaking, DOE undertook a sensitivity analysis using 9, rather than 30, years of product shipments. The choice of a 9-year period is a proxy for the timeline in EPCA for the review of certain energy conservation standards and potential revision of, and compliance with, such revised standards.[70] The review

[69] U.S. Office of Management and Budget, ''Circular A–4: Regulatory Analysis'' (Sept. 17, 2003) (Available at: *http://www.whitehouse.gov/omb/circulars_a004_a-4/*).

[70] Under 42 U.S.C. 6295(m)(1), no later than 6 years after DOE issues a final rule establishing or amending an energy conservation standard, DOE must publish a notice of determination that

Continued

timeframe established in EPCA is generally not synchronized with the product lifetime, product manufacturing cycles, or other factors specific to dehumidifiers. Thus, such results are presented for informational purposes only and are not indicative of any change in DOE's analytical methodology. The NES sensitivity analysis results based on a 9-year analytical period are presented in Table V.23. The impacts are counted over the lifetime of dehumidifiers purchased in 2019–2027.

TABLE V.23—DEHUMIDIFIERS: CUMULATIVE NATIONAL ENERGY SAVINGS FOR PRODUCTS SHIPPED IN 2019–2027

Savings	Trial standard level			
	1	2	3	4
Primary Energy Savings (*quads*)	0.02	0.09	0.10	0.23
FFC Energy Savings (*quads*)	0.02	0.10	0.10	0.25

b. Net Present Value of Consumer Costs and Benefits

DOE estimated the cumulative NPV of the total costs and savings for consumers that would result from the standard levels considered for dehumidifiers. In accordance with the OMB's guidelines on regulatory analysis,[71] DOE calculated NPV using both a 7-percent and a 3-percent real discount rate. Table V.24 shows the consumer NPV results for each TSL DOE considered for dehumidifiers. The impacts are counted over the lifetime of products purchased in 2019–2048.

TABLE V.24—DEHUMIDIFIERS: CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR PRODUCTS SHIPPED IN 2019–2048

Discount rate	Trial standard level (Billion 2014$)			
	1	2	3	4
3 percent	0.61	2.71	2.77	6.74
7 percent	0.28	1.28	1.30	3.04

The NPV results based on the aforementioned 9-year analytical period are presented in Table V.25. The impacts are counted over the lifetime of products purchased in 2019–2027. As mentioned previously, such results are presented for informational purposes only and are not indicative of any change in DOE's analytical methodology or decision criteria.

TABLE V.25—DEHUMIDIFIERS: CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR PRODUCTS SHIPPED IN 2019–2027

Discount rate	Trial standard level (Billion 2014$)			
	1	2	3	4
3 percent	0.22	1.05	1.07	2.41
7 percent	0.14	0.65	0.66	1.47

The above results reflect the use of a default trend to estimate the change in price for dehumidifiers over the analysis period (see section IV.F.1 of this document). DOE also conducted a sensitivity analysis that considered one scenario with a lower rate of price decline than the reference case and one scenario with a higher rate of price decline than the reference case. The results of these alternative cases are presented in appendix 10C of the final rule TSD. In the high price decline case, the NPV of consumer benefits is higher than in the default case. In the low price decline case, the NPV of consumer benefits is lower than in the default case.

c. Indirect Impacts on Employment

DOE expects energy conservation standards for dehumidifiers to reduce energy bills for consumers of those products, with the resulting net savings being redirected to other forms of economic activity. These expected shifts in spending and economic activity could affect the demand for labor. As described in section IV.N of this document, DOE used an input/output model of the U.S. economy to estimate indirect employment impacts of the TSLs that DOE considered in this rulemaking. DOE understands that there are uncertainties involved in projecting employment impacts, especially changes in the later years of the analysis. Therefore, DOE generated results for near-term timeframes (2019–2048), where these uncertainties are reduced.

standards for the product do not need to be amended or a NOPR that includes new proposed standards. The 9-year analytical period includes this 6-year period and an additional 3 years to issue the final rule and allow time for industry compliance.

[71] U.S. Office of Management and Budget, ''Circular A–4: Regulatory Analysis,'' Section E, (September 17, 2003) (Available at: *http://www.whitehouse.gov/omb/circulars_a004_a-4/*).

The results suggest that the adopted standards are likely to have a negligible impact on the net demand for labor in the economy. The net change in jobs is so small that it would be imperceptible in national labor statistics and might be offset by other, unanticipated effects on employment. Chapter 16 of the final rule TSD presents detailed results regarding anticipated indirect employment impacts.

4. Impact on Utility or Performance of Products

Based on testing conducted in support of this rule, discussed in section IV.C of this document, DOE has concluded that the standards adopted in this final rule would not reduce the utility or performance of the dehumidifiers under consideration in this rulemaking. Manufacturers of these products currently offer units that meet or exceed the adopted standards.

5. Impact of Any Lessening of Competition

As discussed in section e, the Attorney General of the United States (Attorney General) determines the impact, if any, of any lessening of competition likely to result from a proposed standard and to transmit such determination in writing to the Secretary within 60 days of the publication of a proposed rule, together with an analysis of the nature and extent of the impact. To assist the Attorney General in making such determination, DOE provided the Department of Justice (DOJ) with copies of the NOPR and the TSD for review. In its assessment letter responding to DOE, DOJ concluded that the proposed energy conservation standards for dehumidifiers are unlikely to have a significant adverse impact on competition. DOE is publishing the Attorney General's assessment at the end of this final rule.

6. Need of the Nation To Conserve Energy

Enhanced energy efficiency, where economically justified, improves the nation's energy security, strengthens the economy, and reduces the environmental impacts (costs) of energy production. Reduced electricity demand due to energy conservation standards is also likely to reduce the cost of maintaining the reliability of the electricity system, particularly during peak-load periods. As a measure of this reduced demand, chapter 15 in the final rule TSD presents the estimated reduction in generating capacity, relative to the no-new-standards case, for the TSLs that DOE considered in this rulemaking.

Energy conservation resulting from amended standards for dehumidifiers is expected to yield environmental benefits in the form of reduced emissions of air pollutants and greenhouse gases. Table V.26 provides DOE's estimate of cumulative emissions reductions expected to result from the TSLs considered in this rulemaking. The table includes both power sector emissions and upstream emissions. The emissions were calculated using the multipliers discussed in section IV.K. DOE reports annual emissions reductions for each TSL in chapter 13 of the final rule TSD.

TABLE V.26—CUMULATIVE EMISSIONS REDUCTION FOR DEHUMIDIFIERS SHIPPED IN 2019–2048

	Trial standard level			
	1	2	3	4
Power Sector Emissions				
CO_2 (*million metric tons*)	4.0	17.7	18.1	47.5
SO_2 (*thousand tons*)	2.4	10.8	11.1	29.0
NO_X (*thousand tons*)	4.4	19.3	19.7	52.0
Hg (*tons*)	0.01	0.04	0.04	0.11
CH_4 (*thousand tons*)	0.4	1.5	1.6	4.1
N_2O (thousand tons)	0.05	0.22	0.22	0.59
Upstream Emissions				
CO_2 (*million metric tons*)	0.2	1.0	1.0	2.6
SO_2 (*thousand tons*)	0.0	0.2	0.2	0.5
NO_X (*thousand tons*)	3.2	13.8	14.1	37.4
Hg (*tons*)	0.0	0.0	0.0	0.0
CH_4 (*thousand tons*)	17.4	76.4	78.1	206.6
N_2O (thousand tons)	0.00	0.01	0.01	0.02
Total FFC Emissions				
CO_2 (*million metric tons*)	4.2	18.6	19.0	50.1
SO_2 (*thousand tons*)	2.5	11.0	11.3	29.5
NO_X (*thousand tons*)	7.5	33.1	33.9	89.4
Hg (*tons*)	0.01	0.04	0.04	0.11
CH_4 (*thousand tons*)	17.8	77.9	79.7	210.7
CH_4 (thousand *tons* CO_2*eq*)*	498	2,182	2,231	5,900
N_2O (thousand tons)	0.05	0.23	0.23	0.61
N_2O (*thousand tons* CO_2*eq*)*	13.7	60.5	61.8	162.2

* CO_2eq is the quantity of CO_2 that would have the same global warming potential (GWP).

As part of the analysis for this rule, DOE estimated monetary benefits likely to result from the reduced emissions of CO_2 and NO_X that DOE estimated for each of the considered TSLs for dehumidifiers. As discussed in section IV.K of this document, for CO_2, DOE used the most recent values for the SCC developed by an interagency process. The four sets of SCC values for CO_2 emissions reductions in 2015 resulting from that process (expressed in 2014$) are represented by $12.2/metric ton (the average value from a distribution that uses a 5-percent discount rate), $40.0/

metric ton (the average value from a distribution that uses a 3-percent discount rate), $62.3/metric ton (the average value from a distribution that uses a 2.5-percent discount rate), and $117/metric ton (the 95th-percentile value from a distribution that uses a 3-percent discount rate). The values for later years are higher due to increasing damages (public health, economic and environmental) as the projected magnitude of climate change increases.

Table V.27 presents the global value of CO_2 emissions reductions at each TSL. For each of the four cases, DOE calculated a present value of the stream of annual values using the same discount rate as was used in the studies upon which the dollar-per-ton values are based. DOE calculated domestic values as a range from 7 percent to 23 percent of the global values; these results are presented in chapter 14 of the final rule TSD.

TABLE V.27—ESTIMATES OF GLOBAL PRESENT VALUE OF CO_2 EMISSIONS REDUCTION FOR PRODUCTS SHIPPED IN 2019–2048

TSL	SCC case * (million 2014$)			
	5% discount rate, average	3% discount rate, average	2.5% discount rate, average	3% discount rate, 95th percentile
Power Sector Emissions				
1	29.2	131.0	207.2	398.6
2	129.7	580.0	916.2	1,763
3	132.6	592.9	936.6	1,802
4	343.9	1,547	2,447	4,705
Upstream Emissions				
1	1.6	7.1	11.3	21.7
2	7.0	31.4	49.7	95.6
3	7.1	32.1	50.8	97.7
4	18.5	84.2	133.4	256.3
Total FFC Emissions				
1	30.8	138.2	218.5	420.3
2	136.7	611.4	965.9	1,859
3	139.7	625.0	987.4	1,900
4	362.4	1,631	2,580	4,961

* For each of the four cases, the corresponding SCC value for emissions in 2015 is $12.2, $40.0, $62.3, and $117 per metric ton (2014$). The values are for CO_2 only (*i.e.,* not CO_{2eq} of other greenhouse gases).

DOE is well aware that scientific and economic knowledge about the contribution of CO_2 and other GHG emissions to changes in the future global climate and the potential resulting damages to the world economy continues to evolve rapidly. Thus, any value placed on reduced CO_2 emissions in this rulemaking is subject to change. DOE, together with other Federal agencies, will continue to review various methodologies for estimating the monetary value of reductions in CO_2 and other GHG emissions. This ongoing review will consider the comments on this subject that are part of the public record for this and other rulemakings, as well as other methodological assumptions and issues. However, consistent with DOE's legal obligations, and taking into account the uncertainty involved with this particular issue, DOE has included in this rule the most recent values and analyses resulting from the interagency review process.

DOE also estimated the cumulative monetary value of the economic benefits associated with NO_X emissions reductions anticipated to result from the considered TSLs for dehumidifiers. The dollar-per-ton values that DOE used are discussed in section IV.L of this document. Table V.28 presents the cumulative present value for NO_X emissions for each TSL calculated using 7-percent and 3-percent discount rates. This table presents values that use the low dollar-per-ton values, which reflect DOE's primary estimate. Results that reflect the range of NO_X dollar-per-ton values are presented in Table V.29.

TABLE V.28—ESTIMATES OF PRESENT VALUE OF NO_X EMISSIONS REDUCTION FOR DEHUMIDIFIERS SHIPPED IN 2019–2048 *

TSL	Million 2014$	
	3% discount rate	7% discount rate
Power Sector Emissions		
1	8.7	3.9
2	38.9	17.6
3	39.7	18.0
4	102.9	45.7
Upstream Emissions		
1	6.2	2.7
2	27.7	12.2
3	28.3	12.5
4	73.6	31.8
Total FFC Emissions		
1	15.0	6.6
2	66.6	29.8
3	68.0	30.4
4	176.5	77.4

* Results are based on the low benefit-per-ton values.

7. Other Factors

The Secretary of Energy, in determining whether a standard is economically justified, may consider

any other factors that the Secretary deems to be relevant. (42 U.S.C. 6295(o)(2)(B)(i)(VII)) No other factors were considered in this analysis.

8. Summary of National Economic Impacts

The NPV of the monetized benefits associated with emissions reductions can be viewed as a complement to the NPV of the consumer savings calculated for each TSL considered in this rulemaking. Table V.29 presents the NPV values that result from adding the estimates of the potential economic benefits resulting from reduced CO_2 and NO_X emissions in each of four valuation scenarios to the NPV of consumer savings calculated for each TSL considered in this rulemaking, at both a 7-percent and 3-percent discount rate. The CO_2 values used in the columns of each table correspond to the four sets of SCC values discussed above.

TABLE V.29—NET PRESENT VALUE OF CONSUMER SAVINGS COMBINED WITH PRESENT VALUE OF MONETIZED BENEFITS FROM CO_2 AND NO_X EMISSIONS REDUCTIONS

TSL	Consumer NPV at 3% discount rate added with: (Billion 2014$)			
	SCC case $12.2/metric ton and 3% low NO_X value	SCC case $40.0/metric ton and 3% low NO_X value	SCC case $62.3/metric ton and 3% low NO_X value	SCC case $117/metric ton and 3% low NO_X value
1	0.7	0.8	0.8	1.0
2	2.9	3.4	3.7	4.6
3	3.0	3.5	3.8	4.7
4	7.3	8.5	9.5	11.9

TSL	Consumer NPV at 7% discount rate added with: (billion 2014$)			
	SCC Case $12.2/metric ton and 7% low NO_X value	SCC Case $40.0/metric ton and 7% low NO_X value	SCC Case $62.3/metric ton and 7% low NO_X value	SCC Case $117/metric ton and 7% low NO_X value
1	0.3	0.4	0.5	0.7
2	1.4	1.9	2.3	3.2
3	1.5	2.0	2.3	3.2
4	3.5	4.7	5.7	8.1

Note: The SCC case values represent the global SCC in 2015, in 2014$, for each case.

In considering the above results, two issues are relevant. First, the national operating cost savings are domestic U.S. monetary savings that occur as a result of market transactions, while the value of CO_2 reductions is based on a global value. Second, the assessments of operating cost savings and the SCC are performed with different methods that use different time frames for analysis. The national operating cost savings is measured for the lifetime of products shipped in 2019 to 2048. Because CO_2 emissions have a very long residence time in the atmosphere,[72] the SCC values in future years reflect future climate-related impacts that continue beyond 2100.

C. Conclusion

When considering standards, the new or amended energy conservation standards that DOE adopts for any type (or class) of covered product must be designed to achieve the maximum improvement in energy efficiency that the Secretary determines is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A)) In determining whether a standard is economically justified, the Secretary must determine whether the benefits of the standard exceed its burdens by, to the greatest extent practicable, considering the seven statutory factors discussed previously. (42 U.S.C. 6295(o)(2)(B)(i)). The new or amended standard must also result in significant conservation of energy. (42 U.S.C. 6295(o)(3)(B))

In the June 2015 NOPR, DOE proposed energy conservation standards for dehumidifiers at TSL 3, as constructed for that analysis. The minimum IEFs corresponding to TSL 3 from the June 2015 NOPR are shown in Table V.30. 80 FR 31645, 31696 (June 3, 2015).

TABLE V.30—NOPR PROPOSED AMENDED ENERGY CONSERVATION STANDARDS FOR DEHUMIDIFIERS

Portable dehumidifier product capacity (pints/day)	Minimum integrated energy factor (L/kWh)
30.00 or less	1.30
30.01–45.00	1.60
45.01 or more	2.80
Whole-home dehumidifier product case volume (cubic feet)	
8.0 or less	2.09
More than 8.0	3.52

Aprilaire encouraged DOE to analyze portable dehumidifiers and whole-home dehumidifiers as separate markets with separate regulations and test procedures and to suspend proposed regulations on the whole-home dehumidifier market. Aprilaire suggested that in lieu of proposing whole-home dehumidifier standards, that DOE use the Build America program to better understand the market and applications. (Aprilaire, No. 34 at pp. 1, 3) Further, Aprilaire commented that because whole-home

[72] The atmospheric lifetime of CO_2 is estimated of the order of 30–95 years. Jacobson, MZ, ''Correction to 'Control of fossil-fuel particulate black carbon and organic matter, possibly the most effective method of slowing global warming,'' *J. Geophys. Res.* 110. pp. D14105 (2005).

dehumidifiers are a subsystem of energy control in the home, regulating that market may have a detrimental effect on the overall goal of reducing energy use in the home. (Aprilaire, Public Meeting Transcript, No. 35 at pp. 94–95) In this final rule, DOE considered multiple TSLs representing both energy conservation standards at the baseline efficiency level and higher efficiency levels for whole-home dehumidifiers. Section V.C.1 of this document describes how DOE selected the energy conservation standards established in this final rule.

Therma-Stor recommended a single minimum efficiency level be established for all portable dehumidifiers and a single minimum efficiency level be established for whole-home dehumidifiers based upon the test procedure in appendix X1. (Therma-Stor, No. 38 at pp. 2–3) As discussed in section IV.A.1 of this document, DOE separated both portable dehumidifiers and whole-home dehumidifiers into multiple product classes to ensure that consumer utility is maintained under any amended energy conservation standards. Section IV.C.1 of this final rule explains the efficiency levels DOE analyzed for each of the product classes. In that discussion, DOE explains how different IEF values define each efficiency level for the different product classes. In constructing TSLs for this final rule, DOE selected efficiency levels for each individual product class. Accordingly, DOE considered different minimum efficiency levels for the individual product classes in each TSL.

Therma-Stor commented that only two of its seven whole-home dehumidifier models exceed the proposed minimum efficiency level from the June 2015 NOPR. Therma-Stor cautioned that the proposed regulation would reduce the number of efficient high-capacity portable dehumidifier and whole-home dehumidifier choices available to consumers who would instead purchase one, or multiple, inefficient low-capacity portable dehumidifiers. (Therma-Stor, No. 38 at pp. 2–3) In this final rule analysis, DOE updated its estimates of manufacturer impacts at the different analyzed efficiency levels. (See section IV.J of this document.) DOE considered these impacts for each TSL when determining appropriate standards for dehumidifiers. Section V.C.1 of this document details the benefits and burdens of each TSL considered in this final rule.

Therma-Stor stated that the test procedure for whole-home dehumidifiers in appendix X1 specifies an external static pressure which increases the necessary fan power beyond that specified for portable dehumidifiers. Therefore, Therma-Stor expressed concern that, although there are no whole-home dehumidifiers currently in the market that are more efficient than a similar-capacity portable dehumidifier, the proposed efficiency level for ''large'' whole-home dehumidifiers is 26 percent higher than the level proposed for high-capacity portable dehumidifiers. (Therma-Stor, No. 38 at pp. 2–3) Although whole-home dehumidifiers are tested with a ducted setup that imposes an external static pressure on the unit, which increases power consumption, the higher ambient test temperature increases overall dehumidification capacity compared to a portable dehumidifier. As a result, a whole-home dehumidifier would typically have a higher rated IEF than a portable dehumidifier with similar components.

ASAP and the Joint Commenters supported the proposed levels for high-capacity portable dehumidifiers and whole-home dehumidifiers, while they urged DOE to consider adopting TSL 4 in the final rule for the two portable dehumidifier product classes with capacities less than or equal to 45 pints/day. (ASAP, Public Meeting Transcript, No. 35 at pp. 9–10; Joint Commenters, No. 40 at pp. 1–4) The Joint Commenters stated that multiple market and policy changes will likely increase the demand for high-efficiency compressors for room air conditioners, which would increase the availability of high-efficiency compressors for dehumidifiers. The Joint Commenters commented that impacts on manufacturers would be substantially reduced by maintaining the proposed TSL 3 for high-capacity portable dehumidifiers and whole-home dehumidifiers while adopting the proposed TSL 4 for portable dehumidifiers with capacities ≤45 pints/day. They stated that adopting the proposed TSL 3 for high-capacity portable dehumidifiers and whole-home dehumidifiers would limit impacts on small domestic manufacturers and eliminate DOE's concern regarding the availability of high-efficiency compressors for high-capacity portable dehumidifiers and whole-home dehumidifiers. (Joint Commenters, No. 40 at pp. 1, 3–4)

AHAM disagreed with adopting the proposed TSL 4 instead of the proposed TSL 3 for portable dehumidifiers less than 45 pints per day. AHAM noted that TSL 4 is the max-tech level for which no units are currently on the market, and stated that selecting TSL 4 may contribute to the potential unavailability of products at certain capacities across that product class. To meet TSL 4, AHAM suggested that manufacturers would have to incorporate the highest efficiency compressors, but few are available; therefore, several dehumidifier platforms could be unable to meet the max-tech IEF. (AHAM, No. 39 at p. 6)

DOE reviewed the comments submitted by ASAP, the Joint Commenters, and AHAM that directly addressed the proposed standards and TSLs analyzed in the June 2015 NOPR. In this final rule, DOE reassessed the benefits and burdens of the TSLs, including newly constructed TSLs for this final rule analysis, while considering all comments received, as detailed below.

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

To aid the reader as DOE discusses the benefits and/or burdens of each TSL, tables in this section present a summary of the results of DOE's quantitative analysis for each TSL. In addition to the quantitative results presented in the tables, DOE also considers other burdens and benefits that affect economic justification. These include the impacts on identifiable subgroups of consumers who may be disproportionately affected by a national standard and impacts on employment.

DOE also notes that the economics literature provides a wide-ranging discussion of how consumers trade off upfront costs and energy savings in the absence of government intervention. Much of this literature attempts to explain why consumers appear to undervalue energy efficiency improvements. There is evidence that consumers undervalue future energy savings as a result of: (1) A lack of information; (2) a lack of sufficient salience of the long-term or aggregate benefits; (3) a lack of sufficient savings to warrant delaying or altering purchases; (4) excessive focus on the short term, in the form of inconsistent weighting of future energy cost savings relative to available returns on other investments; (5) computational or other difficulties associated with the evaluation of relevant tradeoffs; and (6) a divergence in incentives (for example,

between renters and owners, or builders and purchasers). Having less than perfect foresight and a high degree of uncertainty about the future, consumers may trade off these types of investments at a higher than expected rate between current consumption and uncertain future energy cost savings.

In DOE's current regulatory analysis, potential changes in the benefits and costs of a regulation due to changes in consumer purchase decisions are included in two ways. First, if consumers forego the purchase of a product in the standards case, this decreases sales for product manufacturers, and the impact on manufacturers attributed to lost revenue is included in the MIA. Second, DOE accounts for energy savings attributable only to products actually used by consumers in the standards case; if a regulatory option decreases the number of products purchased by consumers, this decreases the potential energy savings from an energy conservation standard. DOE provides estimates of shipments and changes in the volume of product purchases in chapter 9 of the final rule TSD. However, DOE's current analysis does not explicitly control for heterogeneity in consumer preferences, preferences across subcategories of products or specific features, or consumer price sensitivity variation according to household income.[73]

While DOE is not prepared at present to provide a fuller quantifiable framework for estimating the benefits and costs of changes in consumer purchase decisions due to an energy conservation standard, DOE is committed to developing a framework that can support empirical quantitative tools for improved assessment of the consumer welfare impacts of appliance standards. DOE has posted a paper that discusses the issue of consumer welfare impacts of appliance energy conservation standards, and potential enhancements to the methodology by which these impacts are defined and estimated in the regulatory process.[74] DOE welcomes comments on how to more fully assess the potential impact of energy conservation standards on consumer choice and how to quantify this impact in its regulatory analysis in future rulemakings.

1. Benefits and Burdens of TSLs Considered for Dehumidifier Standards

Table V.31 and Table V.32 summarize the quantitative impacts estimated for each TSL for dehumidifiers. The efficiency levels contained in each TSL are described in section V.A of this document.

TABLE V.31—DEHUMIDIFIER TRIAL STANDARD LEVELS: NATIONAL IMPACTS

Category	TSL 1	TSL 2	TSL 3	TSL 4
Cumulative FFC Energy Savings (quads)				
	0.07	0.30	0.31	0.82.
NPV of Customer Benefits (2014$ billion)				
3% discount rate	0.61	2.71	2.77	6.74.
7% discount rate	0.28	1.28	1.30	3.04.
Cumulative FFC Emissions Reduction				
CO_2 (*million metric tons)*	4.2	18.6	19.0	50.1.
NO_X (*thousand tons)*	7.5	33.1	33.9	89.4.
Hg (*tons)*	0.01	0.04	0.04	0.11.
N_2O (*thousand tons)*	0.05	0.23	0.23	0.61.
N_2O (*thousand tons CO_2eq*)*	13.7	60.5	61.8	162.2.
CH_4 (*thousand tons)*	17.8	77.9	79.7	210.7.
CH_4 (*thousand tons CO_2eq*)*	498	2,182	2,231	5,900.
SO_2 (*thousand tons)*	2.5	11.0	11.3	29.5.
Value of Emissions Reduction				
CO_2 (*2014$ million)***	31 to 420	137 to 1,859	140 to 1,900	362 to 4,961.
NO_X—3% discount rate (*2014$ million)*	15.0 to 34.2	66.6 to 151.8	68.0 to 155.1	176.5 to 402.3.
NO_X—7% discount rate (*2014$ million)*	6.6 to 14.9	29.8 to 67.1	30.4 to 68.6	77.4 to 174.6.

Parentheses indicate negative (−) values.
* CO_2eq is the quantity of CO_2 that would have the same GWP.
** Range of the economic value of CO_2 reductions is based on estimates of the global benefit of reduced CO_2 emissions.

TABLE V.32—DEHUMIDIFIER TRIAL STANDARD LEVELS: MANUFACTURER AND CONSUMER IMPACTS

Category	TSL 1	TSL 2	TSL 3	TSL 4
Manufacturer Impacts				
Industry NPV (2014$ millions) (*No-New-Standards INPV = 179.5*).	175.8 to 176.5	142.0 to 145.5	137.1 to 140.7	106.8 to 126.9.
Industry NPV *(% change*)	(2.0%) to (1.7%)	(20.9%) to (18.9%)	(23.6%) to (21.6%)	(40.5%) to (29.3%).

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

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

TABLE V.32—DEHUMIDIFIER TRIAL STANDARD LEVELS: MANUFACTURER AND CONSUMER IMPACTS—Continued

Category	TSL 1	TSL 2	TSL 3	TSL 4
Consumer Average LCC Savings (2014$)				
PC1 (≤25.00 pints/day)	60	107	107	110.
PC2 (25.01–50.00 pints/day)	157	119	119	191.
PC3 (>50.00 pints/day)	17	142	142	96.
PC4 (≤8.0 ft^3)			242	242.
PC5 (≤8.0 ft^3)			479	386.
Consumer Simple PBP (years)				
PC1 (≤25.00 pints/day)	0.4	0.5	0.5	1.3.
PC2 (25.01–50.00 pints/day)	0.2	0.4	0.4	0.9.
PC3 (>50.00 pints/day)	8.2	4.5	4.5	7.2.
PC4 (≤8.0 ft^3)			1.9	6.8.
PC5 (≤8.0 ft^3)			2.0	5.8.
% of Consumers That Experience Net Cost				
PC1 (≤25.00 pints/day)	0	0.1	0.1	11.5.
PC2 (25.01–50.00 pints/day)	0	0.7	0.7	5.1.
PC3 (>50.00 pints/day)	44.9	28.7	28.7	54.3.
PC4 (≤8.0 ft^3)			9.9	42.6.
PC5 (≤8.0 ft^3)			10.8	43.4.

Parentheses indicate negative (−) values.

DOE first considered TSL 4, which represents the max-tech efficiency levels. TSL 4 would save 0.82 quads of energy, an amount DOE considers significant. Under TSL 4, the NPV of consumer benefit would be $3.04 billion using a discount rate of 7 percent, and $6.74 billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 4 are 50.1 Mt of CO_2, 89.4 thousand tons of NO_X, 29.5 thousand tons of SO_2, 0.11 ton of Hg, 0.61 thousand tons of N_2O, and 210.7 thousand tons of CH_4. The estimated monetary value of the CO_2 emissions reductions at TSL 4 ranges from $362 million to $4,961 million.

At TSL 4, the average LCC impact is a savings of $110 for PC1, $191 for PC2, $96 for PC3, $242 for PC4, and $386 for PC5. The simple PBP is 1.3 years for PC1, 0.9 years for PC2, 7.2 years for PC3, 6.8 years for PC4, and 5.8 years for PC5. The fraction of consumers experiencing a net LCC cost is 11.5 percent for PC1, 5.1 percent for PC2, 54.3 percent for PC3, 42.6 percent for PC4, and 43.4 percent for PC5.

At TSL 4, the projected change in INPV ranges from a decrease of $72.7 million to a decrease of $52.6 million. If the high end of the range of impacts is reached, TSL 4 could result in a net loss of up to 40.5 percent in INPV for manufacturers. Products that meet the efficiency standards specified by this TSL are estimated to represent less than 2 percent of current annual shipments. As such, manufacturers would have to redesign nearly all products by the expected 2019 projected compliance date to meet demand. Redesigning all units to meet the current max-tech efficiency levels would require considerable capital and product conversion expenditures. At TSL 4, the capital conversion costs total as much as $39.1 million, 3.8 times the industry annual ordinary capital expenditure in 2018 (the year leading up to amended standards). DOE estimates that complete platform redesigns would cost the industry $55.2 million in product conversion costs. These conversion costs largely relate to the extensive research programs required to develop new products that meet the efficiency standards at TSL 4. These costs are equivalent to 10.9 times the industry annual budget for research and development. As such, the conversion costs associated with the changes in products and manufacturing facilities required at TSL 4 would require significant use of manufacturers' financial reserves (manufacturer capital pools), impacting other areas of business that compete for these resources and significantly reducing INPV. In addition, manufacturers could face a substantial impact on profitability at TSL 4. Because manufacturers are more likely to reduce their margins to maintain a price-competitive product at higher TSLs, especially in the lower-capacity portable dehumidifier segment, DOE expects that TSL 4 would yield impacts closer to the high end of the range of INPV impacts. If the high end of the range of impacts is reached, as DOE expects, TSL 4 could result in a net loss to manufacturers of 40.5 percent of INPV. Additionally, TSL 4 could result in a net loss to whole-home dehumidifier manufacturers of 174.7 percent of INPV, or cause some domestic manufacturers to exit the whole-home dehumidifier market altogether.

Beyond the direct financial impact on manufacturers, TSL 4 may also contribute to the potential unavailability of products at certain capacities across the five product classes. To meet TSL 4, all products would be required to incorporate the highest efficiency compressors; however, manufacturers indicated that few such compressors are available in the range of compressor capacities suitable for dehumidifiers, and it is unlikely that substantially more would become available if standards at TSL 4 were adopted. In addition, the specific compressor capacities available at any given time are driven largely by the markets for other products with higher shipments (*e.g.,* room air conditioners), and thus dehumidifier manufacturers may be constrained in their design choices. Because DOE assumed manufacturers would optimize all components at TSL 4, including the use of high-efficiency compressors as well as larger heat exchangers and permanent-magnet blower motors, DOE expects that those dehumidifier platforms for which a suitable high efficiency compressor is not available would be unable to meet the max-tech efficiency levels associated with TSL 4. While this would likely not eliminate entire product classes from the market,

it has the potential to eliminate dehumidifiers of certain capacities within a given product class. The potential for this impact on manufacturers of high-capacity portable dehumidifiers and whole-home dehumidifiers is exacerbated by this segment's low production volumes, which limits manufacturers' ability to influence the availability of higher efficiency components from their vendors.

Therefore, the Secretary concludes that at TSL 4 for dehumidifiers, the benefits of energy savings, positive NPV of consumer benefits, emission reductions, and the estimated monetary value of the CO_2 emissions reductions would be outweighed by the economic burden on some consumers, the potential impact on product availability, and the impacts on manufacturers, including significantly negative impacts on small domestic manufacturers of high-capacity portable and whole-home dehumidifiers. Consequently, the Secretary has concluded that TSL 4 is not economically justified.

DOE then considered TSL 3, which would save an estimated 0.31 quads of energy, an amount DOE considers significant. Under TSL 3, the NPV of consumer benefit would be $1.30 billion using a discount rate of 7 percent, and $2.77 billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 3 are 19.0 Mt of CO_2, 33.9 thousand tons of NO_X, 11.3 thousand tons of SO_2, 0.04 tons of Hg, 0.23 thousand tons of N_2O, and 79.7 thousand tons of CH_4. The estimated monetary value of the CO_2 emissions reductions at TSL 3 ranges from $140 million to $1,900 million.

At TSL 3, the average LCC impact is a savings of $107 for PC1, $119 for PC2, $142 for PC3, $242 for PC4, and $479 for PC5. The simple PBP is 0.5 years for PC1, 0.4 and PC2, 4.5 years for PC3, 1.9 years for PC4, and 2.0 years for PC5. The fraction of consumers experiencing a net LCC cost is 0.1 percent for PC1, 0.7 percent for PC2, 28.7 percent for PC3, 9.9 percent for PC4, and 10.8 percent for PC5.

At TSL 3, the projected change in INPV ranges from a decrease of $42.4 million to a decrease of $38.7 million. If the high end of the range of impacts is reached, TSL 3 could result in a net loss of up to 23.6 percent in INPV for manufacturers, with high disproportionate impacts to small, domestic manufacturers of whole-home and high-capacity portable dehumidifiers. The capital conversion costs required by whole-home dehumidifier manufacturers (which includes four small, domestic manufacturers and one larger foreign manufacturer) in order to comply with TSL 3 are estimated to be $1.8 million, 5.4 times the whole-home dehumidifier industry annual ordinary capital expenditure in 2018 (the year leading up to amended standards). DOE estimates that complete platform redesigns would cost the industry $5.5 million in product conversion costs, equivalent to 32.7 times the whole-home dehumidifier industry annual budget for research and development. As a result, TSL 3 could result in a net loss to whole-home dehumidifier industry of 101.4 percent of INPV or cause some domestic manufacturers to exit the whole-home dehumidifier market altogether. Additionally, the manufacturers with the greatest share of the whole-home dehumidifier market are small and domestic and also produce high-capacity portable dehumidifiers. Accordingly, these manufacturers will incur the added burden of compliance with EL 3 for their high-capacity portable dehumidifiers as well as with standards above the baseline for their whole-home dehumidifiers. In aggregate, as detailed in section VII.B of this document, at TSL 3, the typical small manufacturer may incur $2.3 million in capital and product conversion costs in order to maintain existing product lines for both portable and whole-home dehumidifiers. This equates to approximately 56.1 percent of the typical small manufacturer's annual revenue and 945.1 percent of its annual operating profit.

Although some portable dehumidifiers may require higher efficiency compressors, the efficiency levels specified at TSL 3 offer manufacturers multiple design pathways to meet the standard. This in turn would allow manufacturers to maintain product offerings should a high efficiency compressor be unavailable at a given compressor capacity. In addition, a wide variety of units are already available that meet the efficiency levels for portable dehumidifiers specified at TSL 3.

The Secretary concludes that at TSL 3 for dehumidifiers, the benefits of energy savings, positive NPV of consumer benefits, emission reductions, and the estimated monetary value of the CO_2 emissions reductions would be outweighed by the significantly negative impacts on small domestic manufacturers of high-capacity portable and whole-home dehumidifiers. Consequently, the Secretary has concluded that TSL 3 is not economically justified.

DOE then considered TSL 2, which would save an estimated 0.30 quads of energy, an amount DOE considers significant. Under TSL 3, the NPV of consumer benefit would be $1.28 billion using a discount rate of 7 percent, and $2.71 billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 2 are 18.6 Mt of CO_2, 33.1 thousand tons of NO_X, 11.0 thousand tons of SO_2, 0.04 tons of Hg, 0.23 thousand tons of N_2O, and 77.9 thousand tons of CH_4. The estimated monetary value of the CO_2 emissions reductions at TSL 3 ranges from $137 million to $1,859 million.

At TSL 2, the average LCC impact is a savings of $107 for PC1, $119 for PC2, $142 for PC3, $0 for PC4, and $0 for PC5. The simple PBP is 0.5 years for PC1, 0.4 and PC2, 4.5 years for PC3, and zero years for PC4 and PC5. The fraction of consumers experiencing a net LCC cost is 0.1 percent for PC1, 0.7 percent for PC2, 28.7 percent for PC3, and zero percent for PC4 and PC5 because TSL 2 is set at the baseline efficiency level for PC4 and PC5.

At TSL 2, the projected change in INPV ranges from a decrease of $37.5 million to a decrease of $34.0 million. If the high end of the range of impacts is reached, TSL 2 could result in a net loss of up to 20.9 percent in INPV for manufacturers. In contrast to TSL 3 and TSL 4, TSL 2 would not result in disproportionate impacts to the whole-home dehumidifier industry because TSL 2 corresponds to the baseline efficiency level for the whole-home product classes. Products that meet the efficiency standards specified at this TSL level represent 39 percent of shipments of all dehumidifiers in 2018 (the year leading up to amended standards). In order to bring the remaining products into compliance with TSL 2, the portable dehumidifier industry may incur capital and product conversion costs of $22.6 million and $29.9 million, respectively. Although, at TSL 2, three out of the five small, domestic manufacturers will incur some costs associated with redesigning high-capacity portable products, only one of these five manufacturers limits its product offerings in the dehumidifier market to the high-capacity portable segment, with most of its products comprising commercial units that are not covered products under this rulemaking. The other two small, domestic manufacturers that produce high-capacity portable products also manufacture whole-home dehumidifiers, and thus their impacts at TSL 2 will be significantly lower than at TSL 3 and TSL 4. TSL 2 will result

in little to no adverse impacts for whole-home dehumidifier manufacturing, including the two small, domestic manufacturers that focus exclusively on these dehumidifiers. For these reasons, TSL 2 will minimize disproportionate impacts to small, domestic dehumidifier manufacturers relative to TSL 3 and TSL 4.

Although some dehumidifiers may require higher efficiency compressors, the efficiency levels specified at TSL 2 offer manufacturers multiple design pathways to meet the standard. This allows manufacturers to maintain product offerings should a high efficiency compressor be unavailable at a given compressor capacity. In addition, units are already available that meet the efficiency levels specified at TSL 2.

The Secretary concludes that at TSL 2 for dehumidifiers, the benefits of energy savings, positive NPV of consumer benefits, emission reductions, estimated monetary value of the CO_2 emissions reductions, and positive average LCC savings would outweigh the negative impacts on some consumers and on manufacturers, including the conversion costs that could result in a reduction in INPV for manufacturers of portable dehumidifiers.

After carefully considering the analysis and the benefits and burdens of TSL 2, the Secretary concludes that this TSL will offer the maximum improvement in energy efficiency that is technologically feasible and economically justified, and will result in significant conservation of energy without eliminating or making unavailable any product classes or portions of product classes. Therefore, DOE is establishing amended energy conservation standards for dehumidifiers at TSL 2, as indicated in Table V.33.

TABLE V.33—AMENDED ENERGY CONSERVATION STANDARDS FOR DEHUMIDIFIERS

Portable dehumidifier product capacity (pints/day)	Minimum integrated energy factor (L/kWh)
25.00 or less	1.30
25.01–50.00	1.60
50.01 or more	2.80
Whole-home dehumidifier product case volume (cubic feet)	
8.0 or less	1.77
More than 8.0	2.41

2. Summary of Annualized Benefits and Costs of the Adopted Standards

The benefits and costs of the proposed standards can also be expressed in terms of annualized values. The annualized net benefit is the sum of: (1) The annualized national economic value of the benefits from operating products that meet the proposed standards (consisting primarily of operating cost savings from using less energy, minus increases in product purchase costs, which is another way of representing consumer NPV), and (2) the monetary value of the benefits of CO_2 and NO_X emission reductions.[75]

Table V.34 shows the annualized values for dehumidifiers under TSL 3, expressed in 2014$. The results under the primary estimate are as follows. Using a 7-percent discount rate for benefits and costs other than CO_2 reductions, for which DOE used a 3-percent discount rate along with the SCC series corresponding to a value of $40.5/ton in 2015 (in 2014$), the estimated cost of the proposed standards for dehumidifiers is $11 million per year in increased equipment costs, while the estimated annualized benefits are $136 million per year in reduced equipment operating costs, $34 million per year in CO_2 reductions, and $2.9 million per year in reduced NO_X emissions. In this case, the net benefit amounts to $163 million per year.

Using a 3-percent discount rate for all benefits and costs and the SCC series corresponding to a value of $40.5/ton in 2015 (in 2014$), the estimated cost of the proposed standards for dehumidifiers in today's rule is $10 million per year in increased equipment costs, while the benefits are $162 million per year in reduced operating costs, $34 million per year in CO_2 reductions, and $3.7 million per year in reduced NO_X emissions. In this case, the net benefit amounts to $189 million per year.

TABLE V.34—ANNUALIZED BENEFITS AND COSTS OF PROPOSED AMENDED STANDARDS (TSL 3) FOR DEHUMIDIFIERS SOLD IN 2019–2048

	Discount rate	Million 2014$/year		
		Primary estimate *	Low net benefits estimate *	High net benefits estimate *
Benefits				
Consumer Operating Cost Savings	7%	136	131	141.
	3%	162	154	169.
CO_2 Reduction at $12.2/t **	5%	10	10	11.
CO_2 Reduction at $40.0/t **	3%	34	34	35.
CO_2 Reduction at $62.3/t **	2.5%	50	49	51.
CO_2 Reduction at $117/t **	3%	104	102	106.
NO_X Reduction †	7%	2.9	2.9	6.7.
	3%	3.7	3.7	8.6.
Total Benefits ††	7% plus CO_2 range	150 to 243	144 to 236	159 to 254.
	7%	173	167	183.

[75] To convert the time-series of costs and benefits into annualized values, DOE calculated a present value in 2014, the year used for discounting the NPV of total consumer costs and savings. For the benefits, DOE calculated a present value associated with each year's shipments in the year in which the shipments occur (2020, 2030, *etc.*), and then discounted the present value from each year to 2014. The calculation uses discount rates of 3 and 7 percent for all costs and benefits except for the value of CO_2 reductions, for which DOE used case-specific discount rates, as shown in Table V.22. Using the present value, DOE then calculated the fixed annual payment over a 30-year period, starting in the compliance year that yields the same present value.

TABLE V.34—ANNUALIZED BENEFITS AND COSTS OF PROPOSED AMENDED STANDARDS (TSL 3) FOR DEHUMIDIFIERS SOLD IN 2019–2048—Continued

	Discount rate	Million 2014$/year		
		Primary estimate *	Low net benefits estimate *	High net benefits estimate *
	3% plus CO_2 range ...	176 to 269	168 to 260	188 to 284.
	3%	200	192	213.
Costs				
Consumer Incremental Product Costs	7%	11	11	10.
	3%	10	12	10.
Total Net Benefits				
Total ††	7% plus CO_2 range ...	139 to 232	132 to 224	148 to 244.
	7%	163	156	173.
	3% plus CO_2 range ...	165 to 259	157 to 248	178 to 274.
	3%	189	180	203.

* This table presents the costs and benefits associated with dehumidifiers shipped in 2019–2048. These results include benefits to consumers which accrue after 2048 from the products purchased in 2019–2048. The costs account for the incremental variable and fixed costs incurred by manufacturers due to the standard, some of which may be incurred in preparation for the rule.

** The CO_2 values represent global monetized values of the SCC, in 2014$, in 2015 under several scenarios of the updated SCC values. The first three cases use the averages of SCC distributions calculated using 5%, 3%, and 2.5% discount rates, respectively. The fourth case represents the 95th percentile of the SCC distribution calculated using a 3% discount rate. The SCC time series incorporate an escalation factor.

† The $/ton values used for NO_X are described in section 0. DOE estimated the monetized value of NO_X emissions reductions using benefit per ton estimates from the *Regulatory Impact Analysis for the Clean Power Plan Final Rule,* published in August 2015 by EPA's Office of Air Quality Planning and Standards. (Available at: *http://www.epa.gov/cleanpowerplan/clean-power-plan-final-rule-regulatory-impact-analysis*.) See section IV.L.2 for further discussion. Note that the agency is primarily using a national benefit-per-ton estimate for NO_X emitted from the Electricity Generating Unit sector based on an estimate of premature mortality derived from the ACS study (Krewski *et al.,* 2009). If the benefit-per-ton estimates were based on the Six Cities study (Lepuele *et al.,* 2011), the values would be nearly two-and-a-half times larger.

†† Total Benefits for both the 3% and 7% cases are derived using the series corresponding to average SCC with 3-percent discount rate ($40.0/t case).

VI. Certification Reporting and Enforcement Requirements

In the July 2015 Test Procedure Final Rule, DOE amended the sampling plan and certification reporting requirements for dehumidifiers in 10 CFR 429.36 to clarify how manufacturers must make representations of capacity, and for whole-home dehumidifiers, the case volume of a basic model. DOE also amended the certification reporting requirements to specify the product-specific information that must be reported for each basic model. 80 FR 45801, 45819 (July 31, 2015).

In this final rule, DOE further amends section 10 CFR 429.36(a) to provide rounding instructions for the reported IEF and to require that products capable of operating as both a portable and whole-home dehumidifier be rated and certified under both configurations, and section 10 CFR 429.36(b)(2) to detail the specific reporting requirements when testing according to appendix X and appendix X1.

In the July 2015 Test Procedure Final Rule, DOE amended the enforcement requirements for dehumidifiers in 10 CFR 429.134(f). *Id.* In this final rule, DOE amends the enforcement provisions to update the referenced efficiency metric to also include IEF.

VII. Procedural Issues and Regulatory Review

A. Review Under Executive Orders 12866 and 13563

Section 1(b)(1) of Executive Order 12866, ''Regulatory Planning and Review,'' 58 FR 51735 (Oct. 4, 1993), requires each agency to identify the problem that it intends to address, including, where applicable, the failures of private markets or public institutions that warrant new agency action, as well as to assess the significance of that problem. The problems that the adopted standards for dehumidifiers are intended to address are as follows:

(1) Insufficient information and the high costs of gathering and analyzing relevant information leads some consumers to miss opportunities to make cost-effective investments in energy efficiency.

(2) In some cases the benefits of more efficient equipment are not realized due to misaligned incentives between purchasers and users. An example of such a case is when the equipment purchase decision is made by a building contractor or building owner who does not pay the energy costs.

(3) There are external benefits resulting from improved energy efficiency of appliances that are not captured by the users of such equipment. These benefits include externalities related to public health, environmental protection and national energy security that are not reflected in energy prices, such as reduced emissions of air pollutants and greenhouse gases that impact human health and global warming. DOE attempts to qualify some of the external benefits through use of social cost of carbon values.

The Administrator of the Office of Information and Regulatory Affairs (OIRA) in the OMB has determined that the proposed regulatory action is a significant regulatory action under section (3)(f) of Executive Order 12866. Accordingly, pursuant to section 6(a)(3)(B) of the Order, DOE has provided to OIRA: (i) The text of the draft regulatory action, together with a reasonably detailed description of the need for the regulatory action and an explanation of how the regulatory action will meet that need; and (ii) An assessment of the potential costs and benefits of the regulatory action, including an explanation of the manner in which the regulatory action is consistent with a statutory mandate. DOE has included these documents in the rulemaking record.

In addition, the Administrator of OIRA has determined that the proposed regulatory action is an ''economically'' significant regulatory action under section (3)(f)(1) of Executive Order 12866. Accordingly, pursuant to section 6(a)(3)(C) of the Order, DOE has provided to OIRA an assessment, including the underlying analysis, of benefits and costs anticipated from the regulatory action, together with, to the extent feasible, a quantification of those costs; and an assessment, including the underlying analysis, of costs and benefits of potentially effective and reasonably feasible alternatives to the planned regulation, and an explanation why the planned regulatory action is preferable to the identified potential alternatives. These assessments can be found in the technical support document for this rulemaking.

DOE has also reviewed this regulation pursuant to Executive Order 13563, issued on January 18, 2011. (76 FR 3281, Jan. 21, 2011) Executive Order 13563 is supplemental to and explicitly reaffirms the principles, structures, and definitions governing regulatory review established in Executive Order 12866. To the extent permitted by law, agencies are required by Executive Order 13563 to: (1) Propose or adopt a regulation only upon a reasoned determination that its benefits justify its costs (recognizing that some benefits and costs are difficult to quantify); (2) tailor regulations to impose the least burden on society, consistent with obtaining regulatory objectives, taking into account, among other things, and to the extent practicable, the costs of cumulative regulations; (3) select, in choosing among alternative regulatory approaches, those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity); (4) to the extent feasible, specify performance objectives, rather than specifying the behavior or manner of compliance that regulated entities must adopt; and (5) identify and assess available alternatives to direct regulation, including providing economic incentives to encourage the desired behavior, such as user fees or marketable permits, or providing information upon which choices can be made by the public.

DOE emphasizes as well that Executive Order 13563 requires agencies to use the best available techniques to quantify anticipated present and future benefits and costs as accurately as possible. In its guidance, OIRA has emphasized that such techniques may include identifying changing future compliance costs that might result from technological innovation or anticipated behavioral changes. For the reasons stated in the preamble, DOE believes that this final rule is consistent with these principles, including the requirement that, to the extent permitted by law, benefits justify costs and that net benefits are maximized.

B. Review Under the Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) requires preparation of a final regulatory flexibility analysis (FRFA) for any final rule where the agency was first required by law to publish a proposed rule for public comment. As required by Executive Order 13272, ''Proper Consideration of Small Entities in Agency Rulemaking,'' 67 FR 53461 (Aug. 16, 2002), DOE published procedures and policies on February 19, 2003, to ensure that the potential impacts of its rules on small entities are properly considered during the rulemaking process. 68 FR 7990. DOE has made its procedures and policies available on the Office of the General Counsel's Web site (*http://energy.gov/gc/office-general-counsel*). DOE has prepared the following FRFA for the products that are the subject of this rulemaking.

1. Statement of the Need for, and Objectives of, the Rule

The need for, and objectives of this final rule are stated elsewhere in the preamble and not repeated here.

2. Significant Issues Raised by Public Comment

Significant issues raised by public comment in response to the initial regulatory flexibility analysis and the economic impacts of the rule are provided in section IV.J.3 and not repeated here. As discussed in section IV.J.3, based on those comments, DOE updated its analysis of manufacturer impacts, including small business impacts, for this final rule. The standard levels adopted in this final rule were selected based on updated engineering and economic analyses.

3. Response to Comments From the Small Business Administration's Chief Counsel for Advocacy

The SBA's Chief Counsel for Advocacy did not submit comments on this rulemaking.

4. Description and Estimated Number of Small Entities Regulated

a. Methodology for Estimating the Number of Small Entities

For the manufacturers of dehumidifiers, the SBA has set a size threshold, which defines those entities classified as ''small businesses'' for the purposes of the Regulatory Flexibility Act. DOE used the SBA's small business size standards to determine whether any small entities would be subject to the requirements of the rule. *See* 13 CFR part 121. The size standards are listed by North American Industry Classification System (NAICS) code and industry description and are available at: *www.sba.gov/sites/default/files/files/Size_Standards_Table.pdf*. Manufacturing of whole-home dehumidifiers is classified under NAICS codes 333415: Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing, whereas manufacturing of portable dehumidifiers is classified under 335210: Small Electrical Appliance Manufacturing. The SBA sets a threshold of 1,250 employees or less and 1,500 employees or less for an entity to be considered as a small business in these industry categories, respectively.

To estimate the number of companies that could be small business manufacturers of products covered by this rulemaking, DOE conducted a market survey using available public information to identify potential small manufacturers. DOE's research included searches of public databases (*e.g.,* DOE's Compliance Certification Database,[76] the SBA Database[77]), individual company Web sites, and market research tools (*e.g.,* Hoovers Web site[78]) to create a list of companies that manufacture or sell products covered by this rulemaking. DOE also asked stakeholders and industry representatives if they were aware of any other small manufacturers during manufacturer interviews and at DOE public meetings. DOE reviewed publicly available data and contacted select companies on its list, as necessary, to determine whether they met the SBA's definition of a small business manufacturer of covered dehumidifiers. DOE screened out companies that do not manufacture products covered by this rulemaking, do not meet the

[76] See *http://www.regulations.doe.gov/certification-data/*.

[77] See *http://dsbs.sba.gov/dsbs/search/dsp_dsbs.cfm*.

[78] See *http://www.hoovers.com/*.

definition of a ''small business,'' or are foreign owned and operated.

DOE initially identified 25 manufacturers of dehumidifier products sold in the United States. DOE then determined that of the 25 companies, 20 were either large manufacturers, exclusively import products manufactured overseas, or are foreign owned and operated. DOE identified the remaining five manufacturers as domestic manufacturers that meet the SBA's definition of a ''small business'' and manufacture products covered by this rulemaking.

The five domestic small business manufacturers of dehumidifiers identified account for a small fraction of total industry shipments. In 2015, 98.5 percent of dehumidifiers sold in the United States were small portable units (belonging to product classes 1 and 2) and were made by large, diversified manufacturers. The remaining 1.5 percent of the market consists of high-capacity portable and whole-home dehumidifiers, which are primarily manufactured by small business manufacturers. It is estimated that small, domestic manufacturers account for 50 percent of high-capacity portable U.S. shipments and the overwhelming majority of whole-home dehumidifier U.S. shipments. The two small, domestic manufacturers that account for the greatest share of the combined high-capacity portable and whole-home market segments manufacture both high-capacity portable and whole-home products. Of the remaining small, domestic manufacturers, one produces only high-capacity portable dehumidifiers and two produce only whole-home dehumidifiers.

b. Manufacturer Participation

Before issuing this final rule, DOE attempted to contact all the small business manufacturers of dehumidifiers identified. Two of these small business manufacturers responded to DOE and consented to being interviewed as part of the manufacturing impact analysis. DOE also obtained information about small business impacts while interviewing large manufacturers.

c. Comparison of Large and Small Entities

Several factors may contribute to a disproportionate burden on small business manufacturers from amended energy conservation standards for dehumidifiers relative to their larger counterparts. One way in which small manufacturers could be at a disadvantage is that they may be disproportionately affected by product and capital conversion costs. Product redesign, testing, and certification costs tend to be fixed per basic model and do not scale with sales volume. Both large and small business manufacturers must make investments in R&D to redesign their products, but small businesses lack the sales volumes to sufficiently recoup these upfront investments without substantially marking up their products. Similarly, upfront capital investments in new manufacturing capital for platform redesigns, as well as depreciated manufacturing capital, can be spread across a lower volume of shipments for small business manufacturers.

In addition, because small business manufacturers typically have fewer engineers than large manufacturers, they must allocate a greater portion of their available human resources to meet an amended regulatory standard. Because engineers may need to spend more time redesigning and testing existing models as a result of the amended standard, they may have less time to develop new products.

Furthermore, smaller manufacturers may lack the purchasing power of larger manufacturers. For example, because fan motor suppliers give volume discounts to manufacturers based on the number of motors they purchase, larger manufacturers may have a pricing advantage because they make higher volume purchases. This purchasing power difference between high-volume and low-volume orders applies to other dehumidifier components as well, including compressors and heat exchangers. DOE expects that certain larger manufacturers of lower-capacity portable dehumidifiers may even manufacture heat exchangers in-house. Additionally, because small business manufacturers produce higher-capacity dehumidifiers, they typically require larger and/or custom-made components (*e.g.,* larger compressors and heat exchangers), compared to the lower-capacity portable dehumidifier manufacturers that account for the majority of the dehumidifier market. Because of the low-volume nature of the high-capacity portable dehumidifier and whole-home dehumidifier market, certain technological improvements to components may be developed only for lower-capacity portable products, or with significant lag time for application in high-capacity portable dehumidifier and whole-home dehumidifier products.

In terms of cumulative regulatory burden faced by small domestic dehumidifier manufacturers, the small manufacturers with the greatest dehumidifier market share are more specialized and concentrated in dehumidifier manufacturing and, thus, manufacture a smaller range of products than larger companies. The other products that some of the small manufacturers also produce include humidifiers, air purifiers and desiccant wheels. None of these are currently regulated by DOE.

However, one small manufacturer (with low market share among small dehumidifier manufacturers) also produces residential furnaces. This small manufacturer produces only whole-home dehumidifiers and would not be burdened by the whole-home standard level established in this document.

In terms of access to the capital required to cover the conversion costs associated with reaching the proposed standards, small business manufacturers would likely need to take on additional debt, whereas larger diversified manufacturers of small portable products would be better equipped to fund purchases with existing cash flow from operations. Additionally, since the recession of 2007 and 2008, small business lending has dropped substantially due to a combination of tightened lending standards, increasing collateral requirements and reduced focus on small business credit markets. Thus, small businesses generally have less access to capital than larger companies.

5. Description and Estimate of Compliance Requirements

DOE derived industry conversion costs using a top-down approach described in section IV.J.2.a. Using product platform counts by product class and manufacturer, DOE estimated the distribution of industry conversion costs between small manufacturers and large manufacturers. Using its count of manufacturers, DOE calculated capital conversion costs (Table VII.1) and product conversion costs (Table VII.2) for an average small manufacturer versus an average large manufacturer. To provide context on the size of the conversion costs relative to the size of the businesses, DOE presents the conversion costs relative to annual revenue and annual operating profit at each TSL for the average small manufacturer (Table VII.3) and the average large manufacturer (Table VII.4). The current annual revenue and annual operating profit estimates are derived from the GRIM's industry revenue calculations and the market share breakdowns of small versus large manufacturers.

TABLE VII.1—COMPARISON OF TYPICAL SMALL AND LARGE MANUFACTURER'S CAPITAL CONVERSION COSTS

Trial standard level	Capital conversion costs for typical small manufacturer (2014 $M)	Capital conversion costs for typical large manufacturer (2014 $M)
TSL 1	$0.2	$0.1
TSL 2	0.2	1.3
TSL 3	0.6	1.3
TSL 4	0.8	2.1

TABLE VII.2—COMPARISON OF TYPICAL SMALL AND LARGE MANUFACTURER'S PRODUCT CONVERSION COSTS

Trial standard level	Product conversion costs for typical small manufacturer (2014 $M)	Product conversion costs for typical large manufacturer (2014 $M)
TSL 1	$0.5	$0.0
TSL 2	0.8	1.5
TSL 3	1.7	1.5
TSL 4	2.4	2.5

TABLE VII.3—IMPACTS OF CONVERSION COSTS ON A TYPICAL SMALL MANUFACTURER

Trial standard level	Capital conversion costs (2014 $M)	Product conversion costs (2014 $M)	Conversion costs/ annual revenue (%)	Conversion costs/ annual operating profit (%)	Conversion costs/ conversion period revenue * (%)	Conversion costs/ conversion period operating profit * (%)
TSL 1	$0.2	$0.5	15.3	258.1	5.1	86.0
TSL 2	0.2	0.8	24.9	419.1	8.3	139.7
TSL 3	0.6	1.9	56.1	945.1	18.7	315.0
TSL 4	0.8	2.5	78.0	1313.8	26.0	437.9

* **Note:** The conversion period, the time between the final rule publication year and the compliance year for this rulemaking, is 3 years. Annual Revenues, and Operating Profit figures are for 2015.

TABLE VII.4—IMPACTS OF CONVERSION COSTS ON A TYPICAL LARGE MANUFACTURER

Trial standard level	Capital conversion costs (2014 $M)	Product conversion costs (2014 $M)	Conversion costs/ annual revenue (%)	Conversion costs/ annual operating profit (%)	Conversion costs/ conversion period revenue * (%)	Conversion costs/ conversion period operating profit * (%)
TSL 1	$0.1	$0.0	0.0	0.6	0.0	0.2
TSL 2	1.3	1.5	0.8	13.1	0.3	4.4
TSL 3	1.3	1.5	0.8	13.1	0.3	4.4
TSL 4	2.1	2.5	1.3	21.4	0.4	7.1

* **Note:** The conversion period, the time between the final rule publication year and the compliance year for this rulemaking, is 3 years. Annual Revenues, and Operating Profit figures are for 2015.

At the established standard level (TSL 2), DOE estimates total conversion costs associated with amended energy conservation standards for an average small manufacturer to be $1.01 million, which is approximately 24.9 percent of annual revenue and 419.1 percent of annual operating profit. This suggests that an average small manufacturer would need to reinvest roughly 139.7 percent of its operating profit per year over the conversion period to comply with standards. At this TSL, the standard level for whole-home dehumidifiers is the baseline. Accordingly three of the five small, domestic manufacturers may incur costs associated only with the high-capacity portable segment of their business.

The total conversion costs associated with new and amended energy conservation standards for an average large manufacturer is $2.79 million, which is approximately 0.8 percent of annual revenue and 13.1 percent of annual operating profit. This suggests that an average large manufacturer would need to reinvest roughly 4.4 percent of its operating profit per year over the 3-year conversion period.

6. Significant Alternatives to the Rule

The discussion in the previous section analyzes impacts on small businesses that would result from the adopted standards, represented by TSL 2. In reviewing alternatives to the adopted standards, DOE examined an energy conservation standard set at both higher and lower efficiency levels.

As discussed in section V. C., DOE's analysis shows that TSL 3 achieves

approximately 3 percent higher energy savings than TSL 2. TSL 4 achieves approximately 173 percent higher savings than TSL 2. However, as discussed in section V.C., DOE rejected these TSLs in part due to the negative INPV results and substantial small business impacts. The estimated conversion costs for small business manufacturers are significantly higher at TSL 3 and TSL 4 than at TSL 2. To comply with TSL 3, the average small manufacturer must make $2.27 million in conversion cost investments, which is $1.26 million more than at TSL 2. At TSL 3, the projected change in INPV also ranges from a decrease of $42.4 million to a decrease of $38.7 million. If the high end of the range of impacts is reached, TSL 3 could result in a net loss of up to 23.6 percent in INPV for manufacturers, with high disproportionate impacts to whole-home dehumidifier manufacturers, the majority of which are small, domestic companies. The capital conversion costs required by whole-home dehumidifier manufacturers to comply with TSL 3 are estimated to be $1.8 million, 5.4 times the whole-home dehumidifier industry annual ordinary capital expenditure in 2018 (the year leading up to amended standards). DOE estimates that complete platform redesigns would cost the industry $5.5 million in product conversion costs, equivalent to 32.7 times the whole-home dehumidifier industry annual budget for research and development. As a result, TSL 3 could result in a net loss to whole-home dehumidifier manufacturers of 101.4 percent of INPV (compared to no impacts at TSL 2) or cause some domestic manufacturers to exit the whole-home dehumidifier market altogether. To comply with TSL 4, the average small manufacturer must make $3.15 million in conversion cost investments, which is $2.15 million more than at TSL 2. INPV losses and impacts to the industry, and particularly to small manufacturers, would be even more significant than at TSL 3. DOE's analysis also shows that while TSL 1 would reduce the impacts on small business manufacturers ($0.62 million conversion costs for the typical small manufacturers), it would come at the expense of a reduction in energy savings. TSL 1 achieves 77-percent lower energy savings compared to the energy savings at TSL 2.

DOE has concluded that establishing standards at TSL 2 balances the benefits of the energy savings at TSL 2 with the potential burdens placed on dehumidifier manufacturers, including small business manufacturers. As required by EPCA, DOE adopts in this final rule the energy conservation standards that achieve the maximum improvement in energy efficiency that is technologically feasible and economically justified. Accordingly, DOE is not adopting one of the other TSLs considered in the analysis, or the other policy alternatives examined as part of the regulatory impacts analysis and included in chapter 17 of the final rule TSD.

Additional compliance flexibilities may be available through other means. For example, individual manufacturers may petition for a waiver of the applicable test procedure. (See 10 CFR 431.401) Further, EPCA provides that a manufacturer whose annual gross revenue from all of its operations does not exceed $8 million may apply for an exemption from all or part of an energy conservation standard for a period not longer than 24 months after the effective date of a final rule establishing the standard. Additionally, Section 504 of the Department of Energy Organization Act, 42 U.S.C. 7194, provides authority for the Secretary to adjust a rule issued under EPCA in order to prevent ''special hardship, inequity, or unfair distribution of burdens'' that may be imposed on that manufacturer as a result of such rule. Manufacturers should refer to 10 CFR part 430, subpart E, and part 1003 for additional details.

C. Review Under the Paperwork Reduction Act

Manufacturers of dehumidifiers must certify to DOE that their products comply with any applicable energy conservation standards. In certifying compliance, manufacturers must test their products according to the DOE test procedures for dehumidifiers, including any amendments adopted for those test procedures. DOE has established regulations for the certification and recordkeeping requirements for all covered consumer products and commercial equipment, including dehumidifiers. *See generally* 10 CFR part 429. The collection-of-information requirement for the certification and recordkeeping is subject to review and approval by OMB under the Paperwork Reduction Act (PRA). This requirement has been approved by OMB under OMB control number 1910–1400. Public reporting burden for the certification is estimated to average 30 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

Notwithstanding any other provision of the law, no person is required to respond to, nor shall any person be subject to a penalty for failure to comply with, a collection of information subject to the requirements of the PRA, unless that collection of information displays a currently valid OMB Control Number.

D. Review Under the National Environmental Policy Act of 1969

Pursuant to the National Environmental Policy Act (NEPA) of 1969, DOE has determined that the rule fits within the category of actions included in Categorical Exclusion (CX) B5.1 and otherwise meets the requirements for application of a CX. See 10 CFR part 1021, App. B, B5.1(b); 1021.410(b) and App. B, B(1)–(5). The rule fits within this category of actions because it is a rulemaking that establishes energy conservation standards for consumer products or industrial equipment, and for which none of the exceptions identified in CX B5.1(b) apply. Therefore, DOE has made a CX determination for this rulemaking, and DOE does not need to prepare an Environmental Assessment or Environmental Impact Statement for this rule. DOE's CX determination for this rule is available at *http://energy.gov/nepa/categorical-exclusion-cx-determinations-cx*.

E. Review Under Executive Order 13132

Executive Order 13132, ''Federalism.'' 64 FR 43255 (Aug. 10, 1999) imposes certain requirements on Federal agencies formulating and implementing policies or regulations that preempt State law or that have Federalism implications. The Executive Order requires agencies to examine the constitutional and statutory authority supporting any action that would limit the policymaking discretion of the States and to carefully assess the necessity for such actions. The Executive Order also requires agencies to have an accountable process to ensure meaningful and timely input by State and local officials in the development of regulatory policies that have Federalism implications. On March 14, 2000, DOE published a statement of policy describing the intergovernmental consultation process it will follow in the development of such regulations. 65 FR 13735. DOE has examined this rule and has determined that it would not have a substantial direct effect on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. EPCA governs and

prescribes Federal preemption of State regulations as to energy conservation for the products that are the subject of this final rule. States can petition DOE for exemption from such preemption to the extent, and based on criteria, set forth in EPCA. (42 U.S.C. 6297) Therefore, no further action is required by Executive Order 13132.

F. Review Under Executive Order 12988

With respect to the review of existing regulations and the promulgation of new regulations, section 3(a) of Executive Order 12988, ''Civil Justice Reform,'' imposes on Federal agencies the general duty to adhere to the following requirements: (1) Eliminate drafting errors and ambiguity; (2) write regulations to minimize litigation; (3) provide a clear legal standard for affected conduct rather than a general standard; and (4) promote simplification and burden reduction. 61 FR 4729 (Feb. 7, 1996). Regarding the review required by section 3(a), section 3(b) of Executive Order 12988 specifically requires that Executive agencies make every reasonable effort to ensure that the regulation: (1) Clearly specifies the preemptive effect, if any; (2) clearly specifies any effect on existing Federal law or regulation; (3) provides a clear legal standard for affected conduct while promoting simplification and burden reduction; (4) specifies the retroactive effect, if any; (5) adequately defines key terms; and (6) addresses other important issues affecting clarity and general draftsmanship under any guidelines issued by the Attorney General. Section 3(c) of Executive Order 12988 requires Executive agencies to review regulations in light of applicable standards in section 3(a) and section 3(b) to determine whether they are met or it is unreasonable to meet one or more of them. DOE has completed the required review and determined that, to the extent permitted by law, this final rule meets the relevant standards of Executive Order 12988.

G. Review Under the Unfunded Mandates Reform Act of 1995

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA) requires each Federal agency to assess the effects of Federal regulatory actions on State, local, and Tribal governments and the private sector. Public Law 104–4, sec. 201 (codified at 2 U.S.C. 1531). For a regulatory action likely to result in a rule that may cause the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector of $100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish a written statement that estimates the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a), (b)) The UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal governments on a ''significant intergovernmental mandate,'' and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect them. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. 62 FR 12820. DOE's policy statement is also available at *http://energy.gov/sites/prod/files/gcprod/documents/umra_97.pdf*.

DOE has concluded that this final rule does not require expenditures of $100 million or more in any one year on the private sector. The final rule is likely to result in expenditures of $100 million or more, but there is no requirement that mandates that result. Such expenditures may include: (1) Investment in research and development and in capital expenditures by dehumidifier manufacturers in the years between the final rule and the compliance date for the new standards, and (2) incremental additional expenditures by consumers to purchase higher-efficiency dehumidifiers, starting at the compliance date for the applicable standard.

Section 202 of UMRA authorizes a Federal agency to respond to the content requirements of UMRA in any other statement or analysis that accompanies the final rule. (2 U.S.C. 1532(c)). The content requirements of section 202(b) of UMRA relevant to a private sector mandate substantially overlap the economic analysis requirements that apply under section 325(o) of EPCA and Executive Order 12866. The **SUPPLEMENTARY INFORMATION** section of this document and chapter 17 of the TSD for this final rule respond to those requirements.

Under section 205 of UMRA, the Department is obligated to identify and consider a reasonable number of regulatory alternatives before promulgating a rule for which a written statement under section 202 is required. (2 U.S.C. 1535(a)) DOE is required to select from those alternatives the most cost-effective and least burdensome alternative that achieves the objectives of the rule unless DOE publishes an explanation for doing otherwise, or the selection of such an alternative is inconsistent with law. In accordance with the statutory provisions discussed in this document, this final rule establishes amended energy conservation standards for dehumidifiers that are designed to achieve the maximum improvement in energy efficiency that DOE has determined to be both technologically feasible and economically justified. A full discussion of the alternatives considered by DOE is presented in chapter 17 of the TSD for this final rule.

H. Review Under the Treasury and General Government Appropriations Act, 1999

Section 654 of the Treasury and General Government Appropriations Act, 1999 (Pub. L. 105–277) requires Federal agencies to issue a Family Policymaking Assessment for any rule that may affect family well-being. This rule would not have any impact on the autonomy or integrity of the family as an institution. Accordingly, DOE has concluded that it is not necessary to prepare a Family Policymaking Assessment.

I. Review Under Executive Order 12630

Pursuant to Executive Order 12630, ''Governmental Actions and Interference with Constitutionally Protected Property Rights'' 53 FR 8859 (March 18, 1988), DOE has determined that this rule would not result in any takings that might require compensation under the Fifth Amendment to the U.S. Constitution.

J. Review Under the Treasury and General Government Appropriations Act, 2001

Section 515 of the Treasury and General Government Appropriations Act, 2001 (44 U.S.C. 3516, note) provides for Federal agencies to review most disseminations of information to the public under information quality guidelines established by each agency pursuant to general guidelines issued by OMB. OMB's guidelines were published at 67 FR 8452 (Feb. 22, 2002), and DOE's guidelines were published at 67 FR 62446 (Oct. 7, 2002). DOE has reviewed this final rule under the OMB and DOE guidelines and has concluded that it is consistent with applicable policies in those guidelines.

K. Review Under Executive Order 13211

Executive Order 13211, ''Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use,'' 66 FR 28355 (May 22, 2001), requires Federal agencies to prepare and submit to OIRA at OMB, a Statement of Energy Effects for any significant energy action. A ''significant

energy action'' is defined as any action by an agency that promulgates or is expected to lead to promulgation of a final rule, and that: (1) Is a significant regulatory action under Executive Order 12866, or any successor order; and (2) is likely to have a significant adverse effect on the supply, distribution, or use of energy, or (3) is designated by the Administrator of OIRA as a significant energy action. For any significant energy action, the agency must give a detailed statement of any adverse effects on energy supply, distribution, or use should the proposal be implemented, and of reasonable alternatives to the action and their expected benefits on energy supply, distribution, and use.

DOE has concluded that this regulatory action, which sets forth amended energy conservation standards for dehumidifiers, is not a significant energy action because the standards are not likely to have a significant adverse effect on the supply, distribution, or use of energy, nor has it been designated as such by the Administrator at OIRA. Accordingly, DOE has not prepared a Statement of Energy Effects on this final rule.

L. Review Under the Information Quality Bulletin for Peer Review

On December 16, 2004, OMB, in consultation with the Office of Science and Technology Policy (OSTP), issued its Final Information Quality Bulletin for Peer Review (the Bulletin). 70 FR 2664 (Jan. 14, 2005). The Bulletin establishes that certain scientific information shall be peer reviewed by qualified specialists before it is disseminated by the Federal Government, including influential scientific information related to agency regulatory actions. The purpose of the bulletin is to enhance the quality and credibility of the Government's scientific information. Under the Bulletin, the energy conservation standards rulemaking analyses are ''influential scientific information,'' which the Bulletin defines as ''scientific information the agency reasonably can determine will have, or does have, a clear and substantial impact on important public policies or private sector decisions.'' Id at FR 2667.

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

M. Congressional Notification

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

VIII. Approval of the Office of the Secretary

The Secretary of Energy has approved publication of this final rule.

List of Subjects

10 CFR Part 429

Energy conservation, Household appliances, Imports.

10 CFR Part 430

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

Issued in Washington, DC, on May 20, 2016.

David Friedman,

Principal Deputy Assistant Secretary, Energy Efficiency and Renewable Energy.

For the reasons set forth in the preamble, DOE amends parts 429 and 430 of chapter II of title 10 of the Code of Federal Regulations, as set forth below:

PART 429—CERTIFICATION, COMPLIANCE, AND ENFORCEMENT FOR CONSUMER PRODUCTS AND COMMERCIAL AND INDUSTRIAL EQUIPMENT

■ 1. The authority citation for part 429 continues to read as follows:

Authority: 42 U.S.C. 6291–6317.

■ 2. Section 429.36 is amended by adding paragraphs (a)(5) and (6) and revising paragraph (b)(2) to read as follows:

§ 429.36 Dehumidifiers.

(a) * * *

(5) Round the value of energy factor or integrated energy factor for a basic model to two decimal places.

(6) Dehumidifiers distributed in commerce by the manufacturer with the ability to operate as both a portable and whole-home dehumidifier by means of installation or removal of an optional ducting kit, must be rated and certified under both configurations.

(b) * * *

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

(i) For dehumidifiers tested in accordance with appendix X: The energy factor in liters per kilowatt hour (liters/kWh) and capacity in pints per day.

(ii) For dehumidifiers tested in accordance with appendix X1: The integrated energy factor in liters per kilowatt hour (liters/kWh), capacity in pints per day, and for whole-home dehumidifiers, case volume in cubic feet.

■ 3. Section 429.134 is amended by revising paragraph (f) to read as follows:

§ 429.134 Product-specific enforcement provisions.

* * * * *

(f) *Dehumidifiers*—(1) *Verification of capacity*. The capacity will be measured pursuant to the test requirements of part 430 for each unit tested. The results of the measurement(s) will be averaged and compared to the value of capacity certified by the manufacturer for the basic model. The certified capacity will be considered valid only if the measurement is within five percent, or 1.00 pint per day, whichever is greater, of the certified capacity.

(i) If the certified capacity is found to be valid, the certified capacity will be used as the basis for determining the minimum energy factor or integrated energy factor allowed for the basic model.

(ii) If the certified capacity is found to be invalid, the average measured capacity of the units in the sample will be used as the basis for determining the minimum energy factor or integrated energy factor allowed for the basic model.

(2) Verification of whole-home dehumidifier case volume. The case volume will be measured pursuant to the test requirements of part 430 for each unit tested. The results of the measurement(s) will be averaged and compared to the value of case volume certified by the manufacturer for the basic model. The certified case volume will be considered valid only if the measurement is within two percent, or

0.2 cubic feet, whichever is greater, of the certified case volume.

(i) If the certified case volume is found to be valid, the certified case volume will be used as the basis for determining the minimum integrated energy factor allowed for the basic model.

(ii) If the certified case volume is found to be invalid, the average measured case volume of the units in the sample will be used as the basis for determining the minimum integrated energy factor allowed for the basic model.

* * * * *

PART 430—ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS

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

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

■ 5. Section 430.32 is amended by adding paragraph (v)(3) to read as follows:

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

* * * * *

(v) * * *

(3) Dehumidifiers manufactured on or after June 13, 2019, shall have an integrated energy efficiency ratio that meets or exceeds the following values:

	Minimum integrated energy efficiency factor (liters/kWh)
Portable dehumidifier Product Capacity (pints/day)	
25.00 or less	1.30
25.01–50.00	1.60
50.01 or more	2.80
Whole-home dehumidifier product case volume (cubic feet)	
8.0 or less	1.77
More than 8.0	2.41

* * * * *

[FR Doc. 2016–12881 Filed 6–10–16; 8:45 am]

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