DEPARTMENT OF ENERGY

10 CFR Part 430

[EERE–2019–BT–STD–0043]

RIN 1904–AE61

Energy Conservation Program: Energy Conservation Standards for Dehumidifiers

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

ACTION: Notice of proposed rulemaking and announcement of public meeting.

SUMMARY: The Energy Policy and Conservation Act, as amended (''EPCA''), 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 result in significant energy savings. In this notice of proposed rulemaking (''NOPR''), DOE proposes amended energy conservation standards for dehumidifiers, and also announces a public meeting to receive comment on these proposed standards and associated analyses and results.

DATES:

Comments: DOE will accept comments, data, and information regarding this NOPR no later than January 5, 2024.

Meeting: DOE will hold a public meeting via webinar on Thursday, December 14, 2023, from 1:00 p.m. to 4:00 p.m. See section VII of this document, ''Public Participation,'' for webinar registration information, participant instructions, and information about the capabilities available to webinar participants.

Comments regarding the likely competitive impact of the proposed standard should be sent to the U.S. Department of Justice (''DOJ'') contact listed in the **ADDRESSES** section on or before December 6, 2023.

ADDRESSES: Interested persons are encouraged to submit comments using the Federal eRulemaking Portal at *www.regulations.gov* under docket number EERE–2019–BT–STD–0043. Follow the instructions for submitting comments. Alternatively, interested persons may submit comments, identified by docket number EERE–2019–BT–STD–0043, by any of the following methods:

Email: Dehumidifiers2019STD0043@ee.doe.gov. Include docket number EERE–2019–BT–STD–0043 in the subject line of the message.

Postal Mail: Appliance and Equipment Standards Program, U.S. Department of Energy, Building Technologies Office, Mailstop EE–5B, 1000 Independence Avenue SW, Washington, DC 20585–0121. Telephone: (202) 287–1445. If possible, please submit all items on a compact disc (''CD''), in which case it is not necessary to include printed copies.

Hand Delivery/Courier: Appliance and Equipment Standards Program, U.S. Department of Energy, Building Technologies Office, 1000 Independence Avenue SW, Washington, DC 20585–0121. Telephone: (202) 287–1445. If possible, please submit all items on a CD, in which case it is not necessary to include printed copies.

No telefacsimiles (''faxes'') will be accepted. For detailed instructions on submitting comments and additional information on this process, see section IV of this document.

Docket: The docket for this activity, which includes **Federal Register** notices, 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.

The docket web page can be found at *www.regulations.gov/docket/EERE-2019-BT-STD-0043.* The docket web page contains instructions on how to access all documents, including public comments, in the docket. See section VII of this document for information on how to submit comments through *www.regulations.gov.*

EPCA requires the Attorney General to provide DOE a written determination of whether the proposed standard is likely to lessen competition. The U.S. Department of Justice Antitrust Division invites input from market participants and other interested persons with views on the likely competitive impact of the proposed standard. Interested persons may contact the Division at *energy.standards@usdoj.gov* on or before the date specified in the **DATES** section. Please indicate in the subject line of your email the title and docket number of this proposed rulemaking.

FOR FURTHER INFORMATION CONTACT:

Dr. Carl Shapiro, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Office, EE–2J, 1000 Independence Avenue SW, Washington, DC 20585–0121. Email: *ApplianceStandardsQuestions@ee.doe.gov.*

Mr. Peter Cochran, U.S. Department of Energy, Office of the General Counsel, GC–33, 1000 Independence Avenue SW, Washington, DC 20585–0121. Telephone: (202) 586–9496. Email: *Peter.Cochran@hq.doe.gov.*

For further information on how to submit a comment, review other public comments and the docket, or participate in the public meeting, contact the Appliance and Equipment Standards Program staff at (202) 287–1445 or by email: *ApplianceStandardsQuestions@ee.doe.gov.*

SUPPLEMENTARY INFORMATION:

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I. Synopsis of the Proposed Rule

The Energy Policy and Conservation Act, Public Law 94–163, as amended (''EPCA''),[1] authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment. (42 U.S.C. 6291–6317) Title III, Part B of EPCA [2] established the Energy Conservation Program for Consumer Products Other Than Automobiles. (42 U.S.C. 6291–6309) These products include dehumidifiers, the subject of this proposed rulemaking.

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 a 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 NOPR including new proposed energy conservation standards (proceeding to a final rule, as appropriate). (42 U.S.C. 6295(m))

In accordance with these and other statutory provisions discussed in this document, DOE analyzed the benefits and burdens of four trial standard levels (''TSLs'') for dehumidifiers. The TSLs and their associated benefits and burdens are discussed in detail in sections V.A through V.C of this document. As discussed in section V.C of this document, DOE has tentatively determined that TSL 3 represents the maximum improvement in energy efficiency that is technologically feasible and economically justified. The proposed standards, which are expressed in Integrated Energy Factor (''IEF''), or the volume of water in liters (''L'') removed by a kilowatt hour (''kWh'') of energy, are shown in Table I.1. These proposed standards, if adopted, would apply to all dehumidifiers listed in Table I.1. manufactured in, or imported into, the United States starting on the date 3 years after the publication of the final rule for this proposed rulemaking.

[1] All references to EPCA in this document refer to the statute as amended through the Energy Act of 2020, Public Law 116–260 (Dec. 27, 2020), which reflect the last statutory amendments that impact Parts A and A–1 of EPCA.

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

TABLE I.1—PROPOSED ENERGY CONSERVATION STANDARDS FOR DEHUMIDIFIERS

Portable dehumidifier product capacity (pints/day)	Minimum integrated energy factor (L/kWh)
25.00 or less	1.70
25.01–50.00	2.01
50.01 or more	3.10
Whole-home dehumidifier product case volume (cubic feet):	
8.0 or less	2.22
More than 8.0	3.81

A. Benefits and Costs to Consumers

Table I.2 presents DOE's evaluation of the economic impacts of the proposed 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 for all product classes, and the PBP is less than the average lifetime of dehumidifiers, which is estimated to be 10 years for portable dehumidifiers and 12 years for whole-home dehumidifiers (see section IV.F.6 of this document).

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

Product class	Average LCC savings (2022$)	Simple payback period (years)
Portable dehumidifiers, ≤25.00 pints/day	$42	0.9
Portable dehumidifiers, 25.01–50.00 pints/day	81	0.6
Portable dehumidifiers, >50.00 pints per day	31	4.8
Whole-home dehumidifiers, ≤8.0 cubic feet case volume	56	6.4
Whole-home dehumidifiers, >8.0 cubic feet case volume	146	5.7

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

B. Impact on Manufacturers [4]

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 (2023–2057). 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 $158.3 million. Under the proposed standards, the change in INPV is estimated to range from −3.3 percent to −2.1 percent, which is approximately −$5.2 million to −$3.3 million. In order to bring products into compliance with amended standards, it is estimated that the industry would incur total conversion costs of $6.9 million.

DOE's analysis of the impacts of the proposed standards on manufacturers is described in section IV.J of this document. The analytic results of the manufacturer impact analysis (''MIA'') are presented in section V.B.2 of this document.

C. National Benefits and Costs

DOE's analyses indicate that the proposed 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 (2028–2057) amount to 0.33 quadrillion British thermal units (''Btu''), or quads.[5] This represents a savings of 5.8 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 benefits of the proposed standards for dehumidifiers ranges from $1.26 billion (at a 7-percent discount rate) to $2.61 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 from 2028 through 2057.

In addition, the proposed standards for dehumidifiers are projected to yield significant environmental benefits. DOE estimates that the proposed standards would result in cumulative emission reductions (over the same period as for energy savings) of 6.94 million metric tons (''Mt'') [6] of carbon dioxide (''CO_2''), 1.76 thousand tons of sulfur dioxide (''SO_2''), 11.81 thousand tons of nitrogen oxides (''NO_X''), 51.94 thousand tons of methane (''CH_4''), 0.06 thousand tons of nitrous oxide (''N_2O''), and 0.01 tons of mercury (''Hg'').[7]

DOE estimates the value of climate benefits from a reduction in greenhouse gases (''GHG'') using four different estimates of the social cost (''SC'') of

[3] The average LCC savings refer to consumers that are affected by a standard and 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 new or amended standards (see section IV.F.9 of this document). The simple PBP, which is designed to compare specific efficiency levels, is measured relative to the baseline product (see section IV.C of this document).

[4] All monetary values in this document are expressed in 2022 dollars.

[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 of this document.

[6] A metric ton is equivalent to 1.1 short tons. Results for emissions other than CO_2 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 2023* (''*AEO2023*''). *AEO2023* reflects, to the extent possible, laws and regulations adopted through mid-November 2022, including the Inflation Reduction Act. See section IV.K of this document for further discussion of AEO2023 assumptions that affect air pollutant emissions.

CO_2 (''SC–CO_2''), the social cost of methane (''SC–CH_4''), and the social cost of nitrous oxide (''SC–N_2O''). Together these represent the social cost of GHG (''SC–GHG''). DOE used interim SC–GHG values (in terms of benefit per ton of GHG avoided) developed by the Interagency Working Group on the Social Cost of Greenhouse Gases (''IWG'').[8] The derivation of these values is discussed in section IV.L of this document. For presentational purposes, the climate benefits associated with the average SC–GHG at a 3-percent discount rate are estimated to be $0.40 billion. DOE does not have a single central SC–GHG point estimate and emphasizes the importance and value of considering the benefits calculated using all four sets of SC–GHG estimates.

DOE estimated the monetary health benefits of SO_2 and NO_X emissions reductions using benefit per ton estimates from the Environmental Protection Agency,[9] as discussed in section IV.L of this document. DOE estimated the present value of the health benefits would be $0.33 billion using a 7-percent discount rate, and $0.74 billion using a 3-percent discount rate.[10] DOE is currently only monetizing health benefits from changes in ambient fine particulate matter ($PM_{2.5}$) concentrations from two precursors (SO_2 and NO_X), and from changes in ambient ozone from one precursor (for NO_X), but will continue to assess the ability to monetize other effects such as health benefits from reductions in direct $PM_{2.5}$ emissions.

Table I.3 summarizes the monetized economic benefits and costs expected to result from the proposed standards for dehumidifiers. There are other important unquantified effects, including certain unquantified climate benefits, unquantified public health benefits from the reduction of toxic air pollutants and other emissions, unquantified energy security benefits, and distributional effects, among others.

TABLE I.3—SUMMARY OF MONETIZED BENEFITS AND COSTS OF PROPOSED ENERGY CONSERVATION STANDARDS FOR DEHUMIDIFIERS

[Trial Standard Level (''TSL'') 3]

	Billion ($2022)
3% discount rate	
Consumer Operating Cost Savings	2.75
Climate Benefits*	0.40
Health Benefits**	0.74
Total Benefits†	3.89
Consumer Incremental Product Costs‡	0.14
Net Benefits	3.75
Change in Producer Cashflow (INPV)‡‡	(0.005)–(0.003)
7% discount rate	
Consumer Operating Cost Savings	1.34
Climate Benefits* (3% discount rate)	0.40
Health Benefits**	0.33
Total Benefits†	2.07
Consumer Incremental Product Costs‡	0.08
Net Benefits	1.99
Change in Producer Cashflow (INPV)‡‡	(0.005)–(0.003)

Note: This table presents the costs and benefits associated with dehumidifiers shipped in 2028–2057. These results include consumer, climate, and health benefits that accrue after 2057 from the products shipped in 2028–2057.

*Climate benefits are calculated using four different estimates of the social cost of carbon (SC–CO_2), methane (SC–CH_4), and nitrous oxide (SC–N_2O) (model average at 2.5-percent, 3-percent, and 5-percent discount rates; 95th percentile at a 3-percent discount rate) (see section IV.L of this document). Together these represent the global SC–GHG. For presentational purposes of this table, the climate benefits associated with the average SC–GHG at a 3-percent discount rate are shown, but DOE does not have a single central SC–GHG point estimate. To monetize the benefits of reducing GHG emissions this analysis uses the interim estimates presented in the Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates Under Executive Order 13990 published in February 2021 by the Interagency Working Group on the Social Cost of Greenhouse Gases (IWG).

**Health benefits are calculated using benefit-per-ton values for NO_X and SO_2. DOE is currently only monetizing (for SO_2 and NO_X) $PM_{2.5}$ precursor health benefits and (for NO_X) ozone precursor health benefits but will continue to assess the ability to monetize other effects such as health benefits from reductions in direct $PM_{2.5}$ emissions. See section IV.L of this document for more details.

†Total and net benefits include those consumer, climate, and health benefits that can be quantified and monetized. For presentation purposes, total and net benefits for both the 3-percent and 7-percent cases are presented using the average SC–GHG with 3-percent discount rate, but DOE does not have a single central SC–GHG point estimate and emphasizes the importance and value of considering the benefits calculated using all four sets of SC–GHG estimates.

‡Costs include incremental equipment costs as well as installation costs.

‡‡Operating Cost Savings are calculated based on the life cycle costs analysis and national impact analysis as discussed in detail below. *See* sections IV.F and IV.H of this document. DOE's national impacts analysis includes all impacts (both costs and benefits) along the distribution chain beginning with the increased costs to the manufacturer to manufacture the product and ending with the increase in price experienced by the consumer. DOE also separately conducts a detailed analysis on the impacts on manufacturers (*i.e.,* manufacturer impact analysis, or ''MIA''). *See* section IV.J of this document. In the detailed MIA, DOE models manufacturers' pricing decisions based on assumptions regarding investments, conversion costs, cashflow, and margins. The MIA produces a range of impacts, which is the rule's expected impact on the INPV. The change in INPV is the present value of all changes in industry cash flow, including changes in production costs, capital expenditures, and manufacturer profit margins. Change in INPV is calculated using the industry weighted average cost of capital value of 8.4 percent that is estimated in the manufacturer impact analysis (*see* chapter 12 of the NOPR TSD for a complete description of the industry weighted average cost of capital). For dehumidifiers, the change in INPV ranges from −$5 million to −$3 million. DOE accounts for that range of likely impacts in analyzing whether a trial standard level is economically justified. *See* section V.C of this document. DOE is presenting the range of impacts to the INPV under two markup scenarios: the Preservation of Gross Margin scenario, which is the manufacturer markup scenario used in the calculation of Consumer Operating Cost Savings in this table; and the Preservation of Operating Profit Markup scenario, where DOE assumed manufacturers would not be able to increase per-unit operating profit in proportion to increases in manufacturer production costs. DOE includes the range of estimated INPV in the above table, drawing on the MIA explained further in section IV.J of this document to provide additional context for assessing the estimated impacts of this proposal to society, including potential changes in production and consumption, which is consistent with OMB's Circular A–4 and E.O. 12866. If DOE were to include the INPV into the net benefit calculation for this proposed rule, the net benefits would range from $3.74 billion to $3.75 billion at 3-percent discount rate and would range from $1.98 billion to $1.99 billion at 7-percent discount rate. DOE seeks comment on this approach.

[8] To monetize the benefits of reducing GHG emissions this analysis uses the interim estimates presented in the *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates Under Executive Order 13990* published in February 2021 by the IWG. (''February 2021 SC–GHG TSD''). *www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf.*

[9] U.S. EPA. Estimating the Benefit per Ton of Reducing Directly Emitted $PM_{2.5}$, $PM_{2.5}$ Precursors and Ozone Precursors from 21 Sectors. Available at *www.epa.gov/benmap/estimating-benefit-ton-reducing-pm25-precursors-21-sectors.*

[10] DOE estimates the economic value of these emissions reductions resulting from the considered trial standard levels (''TSLs'') for the purpose of complying with the requirements of Executive Order 12866.

The benefits and costs of the proposed standards can also be expressed in terms of annualized values. The monetary values for the total annualized net benefits are (1) the reduced consumer operating costs, minus (2) the increase in product purchase prices and installation costs, plus (3) the value of climate and health benefits of emission reductions, all annualized.[11]

The national operating cost savings are domestic private U.S. consumer monetary savings that occur as a result of purchasing the covered products and are measured for the lifetime of dehumidifiers shipped between 2028 and 2057. The benefits associated with reduced emissions achieved as a result of the proposed standards are also calculated based on the lifetime of dehumidifiers shipped between 2028 and 2057. Total benefits for both the 3-percent and 7-percent cases are presented using the average GHG social costs with a 3-percent discount rate. Estimates of SC–GHG values are presented for all four discount rates in section V.B.6 of this document.

Table I.4 presents the total estimated monetized benefits and costs associated with the proposed standard, expressed in terms of annualized values. The results under the primary estimate are as follows.

Using a 7-percent discount rate for consumer benefits and costs and health benefits from reduced NO_X and SO_2 emissions, and the 3-percent discount rate case for climate benefits from reduced GHG emissions, the estimated cost of the standards proposed in this rule is $8.55 million per year in increased equipment costs, while the estimated annual benefits are $142.04 million in reduced equipment operating costs, $22.85 million in climate benefits, and $34.54 million in health benefits. In this case, the net benefit would amount to $190.89 million per year.

Using a 3-percent discount rate for all benefits and costs, the estimated cost of the proposed standards is $7.89 million per year in increased equipment costs, while the estimated annual benefits are $157.99 million in reduced operating costs, $22.85 million in climate benefits, and $42.30 million in health benefits. In this case, the net benefit would amount to $215.24 million per year.

TABLE I.4—ANNUALIZED BENEFITS AND COSTS OF PROPOSED ENERGY CONSERVATION STANDARDS FOR DEHUMIDIFIERS

[TSL 3]

	Million 2022$/year		
	Primary estimate	Low-net-benefits estimate	High-net-benefits estimate
3% discount rate			
Consumer Operating Cost Savings	157.99	153.04	163.15
Climate Benefits*	22.85	22.66	22.93
Health Benefits**	42.30	41.95	42.42
Total Benefits†	223.14	217.65	228.50
Consumer Incremental Product Costs‡	7.89	7.94	7.77
Net Benefits	215.24	209.71	220.74
Change in Producer Cashflow (INPV)‡‡	(0.5)–(0.3)	(0.5)–(0.3)	(0.5)–(0.3)
7% discount rate			
Consumer Operating Cost Savings	142.04	138.10	146.50
Climate Benefits* (3% discount rate)	22.85	22.66	22.93
Health Benefits**	34.54	34.31	34.64
Total Benefits†	199.44	195.07	204.06
Consumer Incremental Product Costs‡	8.55	8.58	8.44
Net Benefits	190.89	186.49	195.62
Change in Producer Cashflow (INPV)‡‡	(0.5)–(0.3)	(0.5)–(0.3)	(0.5)–(0.3)

Note: This table presents the costs and benefits associated with dehumidifiers shipped in 2028–2057. These results include consumer, climate, and health benefits that accrue after 2057 from the products shipped in 2028 – 2057. The Primary, Low Net Benefits, and High Net Benefits Estimates utilize projections of energy prices from the AEO 2023 Reference case, Low Economic Growth case, and High Economic Growth case, respectively. In addition, incremental equipment costs reflect a medium decline rate in the Primary Estimate, a low decline rate in the Low Net Benefits Estimate, and a high decline rate in the High Net Benefits Estimate. The methods used to derive projected price trends are explained in sections IV.F.1 and IV.H.3 of this document. Note that the Benefits and Costs may not sum to the Net Benefits due to rounding.

* Climate benefits are calculated using four different estimates of the global SC–GHG (see section IV.L of this document). For presentational purposes of this table, the climate benefits associated with the average SC–GHG at a 3-percent discount rate are shown, but DOE does not have a single central SC–GHG point estimate and emphasizes the importance and value of considering the benefits calculated using all four sets of SC–GHG estimates. To monetize the benefits of reducing GHG emissions this analysis uses the interim estimates presented in the Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates Under Executive Order 13990 published in February 2021 by the Interagency Working Group on the Social Cost of Greenhouse Gases (IWG).

** Health benefits are calculated using benefit-per-ton values for NO_X and SO_2. DOE is currently only monetizing (for SO_2 and NO_X) $PM_{2.5}$ precursor health benefits and (for NO_X) ozone precursor health benefits, but will continue to assess the ability to monetize other effects such as health benefits from reductions in direct $PM_{2.5}$ emissions. See section IV.L of this document for more details.

† Total benefits for both the 3-percent and 7-percent cases are presented using the average SC–GHG with 3-percent discount rate, but DOE does not have a single central SC–GHG point estimate.

‡‡ Costs include incremental equipment costs as well as installation costs.

[11] To convert the time series of costs and benefits into annualized values, DOE calculated a present value in 2023, 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.,* 2030), and then discounted the present value from each year to 2023. 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.

‡‡ Operating Cost Savings are calculated based on the life cycle costs analysis and national impact analysis as discussed in detail below. *See* sections IV.F and IV.H of this document. DOE's national impacts analysis includes all impacts (both costs and benefits) along the distribution chain beginning with the increased costs to the manufacturer to manufacture the product and ending with the increase in price experienced by the consumer. DOE also separately conducts a detailed analysis on the impacts on manufacturers (*i.e.,* manufacturer impact analysis, or ''MIA''). *See* section IV.J of this document. In the detailed MIA, DOE models manufacturers' pricing decisions based on assumptions regarding investments, conversion costs, cashflow, and margins. The MIA produces a range of impacts, which is the rule's expected impact on the INPV. The change in INPV is the present value of all changes in industry cash flow, including changes in production costs, capital expenditures, and manufacturer profit margins. The annualized change in INPV is calculated using the industry weighted average cost of capital value of 8.4 percent that is estimated in the manufacturer impact analysis (*see* chapter 12 of the NOPR TSD for a complete description of the industry weighted average cost of capital). For dehumidifiers, the annualized change in INPV ranges from −$0.5 million to −$0.3 million. DOE accounts for that range of likely impacts in analyzing whether a trial standard level is economically justified. *See* section V.C of this document. DOE is presenting the range of impacts to the INPV under two markup scenarios: the Preservation of Gross Margin scenario, which is the manufacturer markup scenario used in the calculation of Consumer Operating Cost Savings in this table; and the Preservation of Operating Profit Markup scenario, where DOE assumed manufacturers would not be able to increase per-unit operating profit in proportion to increases in manufacturer production costs. DOE includes the range of estimated annualized change in INPV in the above table, drawing on the MIA explained further in section IV.J of this document to provide additional context for assessing the estimated impacts of this proposal to society, including potential changes in production and consumption, which is consistent with OMB's Circular A–4 and E.O. 12866. If DOE were to include the INPV into the annualized net benefit calculation for this proposed rule, the annualized net benefits would range from $214.8 million to $214.9 million at 3-percent discount rate and would range from $190.4 million to $190.6 million at 7-percent discount rate. DOE seeks comment on this approach.

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

D. Conclusion

DOE has tentatively concluded that the proposed standards represent the maximum improvement in energy efficiency that is technologically feasible and economically justified, and would result in the significant conservation of energy. Specifically, with regards to technological feasibility, products achieving these standard levels are already commercially available for all product classes covered by this proposal. As for economic justification, DOE's analysis shows that the benefits of the proposed standard exceed, to a great extent, the burdens of the proposed standards.

Using a 7-percent discount rate for consumer benefits and costs and NO_X and SO_2 reduction benefits, and a 3-percent discount rate case for GHG social costs, the estimated cost of the proposed standards for dehumidifiers is $8.55 million per year in increased product costs, while the estimated annual benefits are $142.04 million in reduced product operating costs, $22.85 million in climate benefits, and $34.54 million in health benefits. The net benefit amounts to $190.89 million per year.

The significance of energy savings offered by a new or amended energy conservation standard cannot be determined without knowledge of the specific circumstances surrounding a given rulemaking.[12] For example, some covered products and equipment have substantial energy consumption occur during periods of peak energy demand. The impacts of these products on the energy infrastructure can be more pronounced than products with relatively constant demand. Accordingly, DOE evaluates the significance of energy savings on a case-by-case basis.

As previously mentioned, the standards are projected to result in estimated national energy savings of 0.33 quad full-fuel-cycle (''FFC''), the equivalent of the primary annual energy use of 3.5 million homes. In addition, they are projected to reduce CO_2 emissions by 6.94 Mt, SO_2 emissions by 1.76 thousand tons, NO_X emissions by 11.81 thousand tons, CH_4 emissions by 51.94 thousand tons, N_2O emissions by 0.06 thousand tons, Hg emissions by 0.01 tons. Based on these findings, DOE has initially determined the energy savings from the proposed standard levels are ''significant'' within the meaning of 42 U.S.C. 6295(o)(3)(B). The basis for these tentative conclusions is detailed in the remainder of this document and the accompanying technical support document (''TSD'').

DOE also considered more stringent energy efficiency levels as potential standards and is still considering them in this rulemaking. However, DOE has tentatively concluded that the potential burdens of more stringent energy efficiency levels would outweigh the projected benefits.

Based on consideration of the public comments DOE receives in response to this document and related information collected and analyzed during the course of this rulemaking effort, DOE may adopt energy efficiency levels presented in this document that are either higher or lower than the proposed standards, or some combination of level(s) that incorporate the proposed standards in part.

II. Introduction

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

A. Authority

EPCA authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment. Title III, Part B of EPCA established the Energy Conservation Program for Consumer Products Other Than Automobiles. These products include dehumidifiers, the subject of this document. (42 U.S.C. 6295(cc)) EPCA prescribed initial energy conservation standards for these products. *Id.* EPCA further provides that, not later than 6 years after the 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 NOPR including new proposed energy conservation standards (proceeding to a final rule, as appropriate). (42 U.S.C. 6295(m)(1))

The energy conservation program under EPCA consists essentially of four parts: (1) testing, (2) labeling, (3) the establishment of Federal energy conservation standards, and (4) certification and enforcement procedures. Relevant provisions of EPCA specifically include definitions (42 U.S.C. 6291), test procedures (42 U.S.C. 6293), labeling provisions (42 U.S.C. 6294), energy conservation standards (42 U.S.C. 6295), and the authority to require information and reports from manufacturers (42 U.S.C. 6296).

Federal energy efficiency requirements for covered products established under EPCA generally supersede State laws and 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 EPCA. (42 U.S.C. 6297(d))

[12] Procedures, Interpretations, and Policies for Consideration in New or Revised Energy Conservation Standards and Test Procedures for Consumer Products and Commercial/Industrial Equipment, 86 FR 70892, 70901 (Dec. 13, 2021).

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) and 42 U.S.C. 6295(r)) 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 42 U.S.C. 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 appear at title 10 of the Code of Federal Regulations (''CFR'') part 430, subpart B, appendix X1.

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 the Secretary of Energy determines is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A) Furthermore, DOE may not adopt any standard that would not result in the significant conservation of energy. (42 U.S.C. 6295(o)(3))

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 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 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 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, EPCA 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 product 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 the 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))

Finally, pursuant to the amendments contained in the Energy Independence and Security Act of 2007 (''EISA 2007''), Public Law 110–140, any final rule for new or amended energy conservation standards promulgated after July 1, 2010, is required to 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 current test procedures for dehumidifiers address standby mode and off mode energy use. In this proposed rulemaking, DOE intends to incorporate such energy use into any amended energy conservation standards that it may adopt.

B. Background

1. Current Standards

In a final rule published on June 13, 2016 (''June 2016 Final Rule''), DOE prescribed the current energy conservation standards for dehumidifiers manufactured on and after June 13, 2019. 81 FR 38338. These standards are set forth in DOE's regulations at 10 CFR 430.32(v)(2).

TABLE II.1—FEDERAL ENERGY CONSERVATION STANDARDS FOR DEHUMIDIFIERS

Portable dehumidifier product capacity (pints/day)	Minimum integrated energy factor (L/kWh)
25.00 or less	1.30

TABLE II.1—FEDERAL ENERGY CONSERVATION STANDARDS FOR DEHUMIDIFIERS—Continued

Portable dehumidifier product capacity (pints/day)	Minimum integrated energy factor (L/kWh)
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. History of Standards Rulemaking for Dehumidifiers

On June 4, 2021, DOE published a Request for Information (''June 2021 RFI'') in the **Federal Register** to collect data and information to inform its decision, consistent with its obligations under EPCA, as to whether the Department should proceed with an energy conservation standards rulemaking for an amended energy conservation standard for dehumidifiers. 86 FR 29964, 29965.

DOE published a notice of public meeting and availability of the preliminary TSD on June 22, 2022 (''June 2022 Preliminary Analysis''). 87 FR 37240. DOE received comments in response to the June 2022 Preliminary Analysis from the interested parties listed in Table II.2.

TABLE II.2—JUNE 2022 PRELIMINARY ANALYSIS WRITTEN COMMENTS

Commenter(s)	Abbreviation	Comment number in the docket	Commenter type
Appliance Standards Awareness Project, American Council for an Energy-Efficient Economy, National Consumer Law Center, Natural Resources Defense Council, Northwest Energy Efficiency Alliance.	Joint Commenters	21	Efficiency Organizations.
Association of Home Appliance Manufacturers	AHAM	22	Trade Association.
Madison Indoor Air Quality	MIAQ	20	Manufacturer.

A parenthetical reference at the end of a comment quotation or paraphrase provides the location of the item in the public record.[13] To the extent that interested parties have provided written comments that are substantively consistent with any oral comments provided during the July 19, 2022, public meeting, DOE cites the written comments throughout this document. Any oral comments provided during the webinar that are not substantively addressed by written comments are summarized and cited separately throughout this document.

C. Deviation From Appendix A

In accordance with section 3(a) of 10 CFR part 430, subpart C, appendix A (''appendix A''), DOE notes that it is deviating from the provision in appendix A regarding the pre-NOPR stages for an energy conservation standards rulemaking. Section 6(a)(2) of appendix A states that if the Department determines it is appropriate to proceed with a rulemaking, the preliminary stages of a rulemaking to issue or amend an energy conservation standard that DOE will undertake will include a framework document and preliminary analysis, or an advance notice of proposed rulemaking. While DOE published a preliminary analysis for this proposed rulemaking, DOE did not publish a framework document in conjunction with the preliminary analysis. 87 FR 37240. DOE notes, however, chapter 2 of the June 2022 Preliminary TSD that accompanied the June 2022 Preliminary Analysis—entitled Analytical Framework, Comments from Interested Parties, and DOE Responses—describes the general analytical framework that DOE uses in evaluating and developing potential amended energy conservation standards. DOE also previously published the June 2021 RFI, in which DOE identified and sought comment on the analyses that would be conducted in support of an energy conservation standards rulemaking for dehumidifiers. 86 FR 29964, 29965–29966. As such, publication of a separate framework document would be largely redundant of previously published documents.

Section 6(f)(2) of appendix A specifies that the length of the public comment period for a NOPR will vary depending upon the circumstances of the particular proposed rulemaking, but will not be less than 75 calendar days. For this NOPR, DOE has opted to instead provide a 60-day comment period. DOE requested comment in the June 2021 RFI on the technical and economic analyses and provided stakeholders a 45-day comment period, after granting a 15-day comment period extension. 86 FR 29964 and 86 FR 34639. Additionally, DOE provided a 60-day comment period for the June 2022 Preliminary Analysis. 87 FR 37240, 37241. The analytical methods used for this NOPR are similar to those used in previous rulemaking documents. As such, DOE believes a 60-day comment period is appropriate and will provide interested parties with a meaningful opportunity to comment on the proposed rule. Section 8(d)(1) of appendix A specifies that test procedure rulemakings establishing methodologies used to evaluate proposed energy conservation standards will be finalized prior to publication of a NOPR proposing new or amended energy conservation standards. Additionally, new test procedures and amended test procedures that impact measured energy use or efficiency will be finalized at least 180 days prior to the close of the

[13] The parenthetical reference provides a reference for information located in the docket of DOE's rulemaking to develop energy conservation standards for dehumidifiers (Docket No. EERE–2019–BT–STD–0043, which is maintained at *www.regulations.gov*). The references are arranged as follows: (commenter name, comment docket ID number, page of that document).

comment period for (1) a NOPR proposing new or amended energy conservation standards or (2) a notice of proposed determination that standards do not need to be amended. In the dehumidifier test procedure final rule published on July 26, 2023, (July 2023 Test Procedure Final Rule), DOE amended the test procedures for dehumidifiers. 88 FR 48035. DOE determined that the amendments adopted will not alter (*i.e.,* will not impact) the measured efficiency of dehumidifiers. *Id.* As such, the requirement that the amended test procedure be finalized at least 180 days prior to the close of the comment period for this NOPR does not apply.

III. General Discussion

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

A. Scope of Coverage

This NOPR covers those consumer products that meet the definition of ''dehumidifier'' as codified at 10 CFR 430.2.

EPCA defines a dehumidifier as a product that is a self-contained, electrically operated, and mechanically encased assembly, consisting of a refrigerated surface (evaporator) that condenses moisture from the atmosphere, a refrigerating system with an electric motor, an air-circulating fan, and a means for collecting or disposing of the condensate. (42 U.S.C. 6291(34)) In a final rule published on July 31, 2015 (''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 45802, 45804–45805 (July 31, 2015). DOE also added definitions for portable dehumidifiers and whole-home dehumidifiers to 10 CFR 430.2. 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. 10 CFR 430.2 DOE further established that dehumidifiers that are able to operate as both a portable and whole-home dehumidifier would be tested and rated for both configurations. 80 FR 45802, 45805–45806. *See* section IV.A.1 of this document for discussion of the product classes analyzed in this NOPR.

B. Test Procedure

EPCA sets forth generally applicable criteria and procedures for DOE's adoption and amendment of test procedures. (42 U.S.C. 6293) Manufacturers of covered products must use these test procedures to certify to DOE that their product complies with energy conservation standards and to quantify the efficiency of their product. DOE's current energy conservation standards for dehumidifiers are expressed in terms of IEF in L/kWh. 10 CFR 430.32(v)(2) and 10 CFR part 430, subpart B, appendix X1.

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 proposed 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. *See* sections 6(b)(3)(i) and 7(b)(1) of appendix A to 10 CFR part 430 subpart C (''appendix A'').

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; (3) adverse impacts on health or safety; and (4) unique pathway proprietary technologies. *See* sections 6(b)(3)(ii)–(v) and 7(b)(2)–(5) of appendix A. 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 proposed rulemaking. For further details on the screening analysis for this proposed rulemaking, see chapter 4 of the NOPR TSD.

2. Maximum Technologically Feasible Levels

When DOE proposes to adopt a new or 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 proposed rulemaking are described in section IV.C.1.b of this document and in chapter 5 of the NOPR 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 the proposed standards (2028–2057).[14] The savings are measured over the entire lifetime of dehumidifiers purchased in the previous 30-year 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 national impact analysis (''NIA'') spreadsheet model to estimate national energy savings (''NES'') from potential amended or new standards for dehumidifiers. The NIA spreadsheet model (described in section IV.H of this document) calculates energy savings in terms of site energy, which is the energy directly consumed by products at the locations where they are used. For electricity, DOE reports national energy savings in terms of primary energy savings, which is the savings in the energy that is used to generate and transmit the site electricity. DOE also calculates NES in terms of FFC energy savings. The FFC metric includes the energy consumed in extracting, processing, and transporting primary

[14] Each TSL is composed of specific efficiency levels for each product class. The TSLs considered for this NOPR are described in section V.A of this document. DOE conducted a sensitivity analysis that considers impacts for products shipped in a 9-year period.

fuels (*i.e.,* coal, natural gas, petroleum fuels), and thus presents a more complete picture of the impacts of energy conservation standards.[15] 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.1 of this document.

2. Significance of Savings

To adopt any new or amended 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))

The significance of energy savings offered by a new or amended energy conservation standard cannot be determined without knowledge of the specific circumstances surrounding a given rulemaking.[16] For example, some covered products and equipment have most of their energy consumption occur during periods of peak energy demand. The impacts of these products on the energy infrastructure can be more pronounced than products with relatively constant demand. Accordingly, DOE evaluates the significance of energy savings on a case-by-case basis, taking into account the significance of cumulative FFC national energy savings, the cumulative FFC emissions reductions, and the need to confront the global climate crisis, among other factors.

As stated, the standard levels proposed in this document are projected to result in national energy savings of 0.33 quad, the equivalent of the primary annual energy use of 3.5 million homes. Based on the amount of FFC savings, the corresponding reduction in emissions, and the need to confront the global climate crisis, DOE has initially determined the energy savings from the proposed standard levels are ''significant'' within the meaning of 42 U.S.C. 6295(o)(3)(B).

E. Economic Justification

1. Specific Criteria

As noted previously, 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 proposed rulemaking.

a. Economic Impact on Manufacturers and Consumers

In determining the impacts of a potential new or amended standard on manufacturers, DOE conducts an MIA, as discussed in section IV.J of this document. 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 consumer costs and benefits expected to result from particular standards. DOE also evaluates the impacts of potential standards on identifiable subgroups of consumers that may be affected disproportionately by a 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 expense (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 new or 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 new or amended standards. DOE's LCC and PBP analysis is discussed in further detail in section IV.F of this document.

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 III.D of this document, 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 proposed in this document would not reduce the utility or performance of the products under consideration in this proposed rulemaking.

[15] 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).

[16] Procedures, Interpretations, and Policies for Consideration in New or Revised Energy Conservation Standards and Test Procedures for Consumer Products and Commercial/Industrial Equipment, 86 FR 70892, 70901 (Dec. 13, 2021).

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 proposed 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 proposed 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 will transmit a copy of this proposed rule to the Attorney General with a request that the DOJ provide its determination on this issue. DOE will publish and respond to the Attorney General's determination in the final rule. DOE invites comment from the public regarding the competitive impacts that are likely to result from this proposed rule. In addition, stakeholders may also provide comments separately to DOJ regarding these potential impacts. See the **ADDRESSES** section for information to send comments to DOJ.

f. Need for National Energy Conservation

DOE also considers the need for national energy and water 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 proposed 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.

DOE maintains that environmental and public health benefits associated with the more efficient use of energy are important to take into account when considering the need for national energy conservation. The proposed standards are likely to result in environmental benefits in the form of reduced emissions of air pollutants and GHGs 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 estimated 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

In determining whether an energy conservation standard is economically justified, DOE may consider any other factors that the Secretary deems to be relevant. (42 U.S.C. 6295(o)(2)(B)(i)(VII)) To the extent DOE identifies any relevant information regarding economic justification that does not fit into the other categories described previously, 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 effects that proposed 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.9 of this document.

IV. Methodology and Discussion of Related Comments

This section addresses the analyses DOE has performed for this proposed 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 proposed 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 shipment projections 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 website for this proposed rulemaking: *www.regulations.gov/docket/EERE-2019-BT-STD-0043.* Additionally, DOE used output from the latest version of the Energy Information Administration's (''EIA's'') *Annual Energy Outlook* (''AEO''), a widely known energy projection 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 proposed 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 in the following sections. See chapter 3 of the NOPR TSD for further discussion of the market and technology assessment.

1. Product Classes

When evaluating and establishing energy conservation standards, DOE must specify a different standard level for a type or class of product 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 the 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))

DOE currently defines separate energy conservation standards using five dehumidifier product classes (10 CFR 430.32(v)(2)):

Portable dehumidifiers have three product classes based on the product capacity: Product Class 1 are those with a capacity of 25.00 pints/day or less, Product Class 2 dehumidifiers have a capacity of 25.01 to 50.00 pints/day, and Product Class 3 dehumidifiers have a capacity of 50.01 pints/day or more. Whole-home dehumidifiers have two product classes based on product case volume: Product Class 4 dehumidifiers have a case volume of 8.0 cubic feet or less, and Product Class 5 have a case volume of more than 8.0 cubic feet.

According to MIAQ, many of the units that are meant to be placed in the crawlspace of a home meet the portable dehumidifier definition due to their installation and configuration but have the same manufacturer production cost (''MPC'') as whole-home dehumidifiers. MIAQ stated that DOE did not clearly distinguish the difference between typical portable dehumidifiers and portable crawlspace dehumidifiers in the June 2022 Preliminary Analysis and requested that DOE keep this difference in mind when updating the TSD. (MIAQ, No. 20 at pp. 1–2)

Dehumidifiers are classified based on their ducting configuration during consumer use, according to the definitions established in 10 CFR 430.2. Portable dehumidifiers operate in applications that require space dehumidification without ducting. Whole-home dehumidifiers operate with ducting, typically in conjunction with a heating, ventilating, and air conditioning (''HVAC'') system. Dehumidifiers installed in basement crawlspaces without ducting are classified as portable dehumidifiers. DOE is not aware of any specific performance-related feature that would justify a new product class for portable dehumidifiers installed in basement crawlspaces. Therefore, when conducting the engineering analysis, as discussed further in section IV.C of this document and chapter 5 of the NOPR TSD, DOE considered the MPCs of a variety of units in the largest portable dehumidifier product class, Product Class 3.

2. Technology Options

In the preliminary market analysis and technology assessment, DOE identified 16 technology options that would be expected to improve the efficiency of dehumidifiers, as measured by the DOE test procedure.

TABLE IV.2—TECHNOLOGY OPTIONS FOR DEHUMIDIFIERS

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

Several commenters provided feedback on some of these technology options. These comments are summarized below, along with DOE's responses.

a. Improved Compressor Efficiency

MIAQ stated that finding suitable high-efficiency compressors at the capacities and price points needed for dehumidifiers is a challenge, particularly with the transition to new refrigerants. According to MIAQ, the whole-home and crawlspace dehumidifier industry does not have sufficient volume to garner the full attention of compressor manufacturers. (MIAQ, No. 20 at p. 2)

DOE has considered MIAQ's comments regarding high-efficiency compressor availability, and for the reasons discussed in chapter 3 of the NOPR TSD, expects that by the time that compliance is required with any new dehumidifier standards, dehumidifier manufacturers will transition to compressors utilizing R–32 in place of compressors designed for the refrigerants currently in use. DOE acknowledges that there is significant uncertainty regarding the availability of the highest-efficiency single-speed compressors designed for operation with R–32 refrigerant that were analyzed for the June 2022 Preliminary Analysis, particularly in the smallest capacities. For this NOPR analysis, DOE has limited the improved compressor efficiency technology option to the maximum R–32 compressor efficiency that was observed within its teardown sample of dehumidifiers, to ensure that such compressors are already commercially available to the dehumidifier industry. Furthermore, should this NOPR proceed to a final rule, compliance with any amended standards would not be required until 3 years after a final rule is published. DOE expects that this 3-year compliance period would provide adequate time for dehumidifier original equipment manufacturers (''OEMs'') to source a sufficient supply of more efficient R–32 compressors ahead of anticipated demand. DOE expects that standards, if adopted, would therefore provide sufficient time and regulatory certainty for manufacturers and compressor suppliers to establish additional capacity in the supply chain, if needed.

MIAQ reiterated its comment on the June 2022 Dehumidifier Test Procedure NOPR [17] that variable-speed compressors do not provide sufficient energy savings to justify the significant increase in cost required to implement this technology, especially in the consumer product market. (MIAQ, No. 20 at p. 3)

In the June 2022 Preliminary Analysis, DOE considered variable-speed compressors as part of the technology assessment, but took into account only their full-load efficiency. As discussed in chapter 3 of the preliminary TSD, the DOE test procedure at appendix X1 does not attribute any partial-load efficiency improvements to variable-speed dehumidifiers as the test procedures for room air conditioners and portable air conditioners do for units with variable-speed compressors, because variable-speed dehumidifiers must maintain a constant evaporator temperature below the dew point regardless of the amount of moisture present in the room. This provides no opportunity for energy savings. DOE also noted the costs associated with implementing variable-speed compressors and accounted for these costs in the engineering analysis where appropriate.

Since publication of the June 2022 Preliminary Analysis, additional market research, manufacturer interviews, and input from commenters led DOE to understand that variable-speed compressors do not offer efficiency benefits sufficient to justify the costs and design challenges associated with implementing them for dehumidifiers. Therefore, in the analysis for this NOPR, DOE did not consider variable-speed compressors as a design option to improve compressor efficiency. *See* chapter 3 of the NOPR TSD for

[17] *See* posted comment on *www.regulations.gov,* Docket No. EERE–2019–BT–TP–0026–0008–0015.

additional discussion about variable-speed compressors.

AHAM requested that DOE evaluate whether the use of variable-frequency drives and similar high frequency components will lead to increased nuisance tripping of ground-fault circuit-interrupters (''GFCIs'') and associated cost implications. According to AHAM, nuisance tripping may require a consumer to call an electrician to change a breaker or replace a unit and could lead to less efficient operation, as continuous dehumidification over time is more efficient than interrupted dehumidification. (AHAM, No. 22 at p. 7)

DOE is aware that when implementing variable-frequency drives, as for both variable-speed compressors and fan blower electronically commutated motors (''ECMs''), it is possible that GFCI systems will trip without a fault present, requiring a manual reset of the dehumidifier by the consumer. However, DOE understands that GFCI tripping, even for units with variable-speed drives, can generally be mitigated through the use of best practices for reducing leakage current, such as minimizing ECM cable length and ensuring that filtered and unfiltered cables are separated to whatever extent possible to reduce leakage current. Additionally, optimizing the variable-frequency controller power filter to reduce total leakage current to levels below the GFCI detection limits can prevent GFCI tripping. Furthermore, DOE does not have any information on the prevalence of nuisance tripping events or on the potential impact of such trips on consumer utility or dehumidifier energy use. DOE notes that despite the potential for nuisance tripping, a wide range of appliances on the market today, including dehumidifiers, implement variable-frequency drives in their designs. The inclusion of these variable-frequency drive designs in units on the market suggests that they do not have a significant impact on the consumer utility of these products. Therefore, DOE is continuing to consider ECMs for fan blowers as a technology option for the NOPR engineering analysis. However, for the reasons discussed above, DOE did not consider variable-speed compressors as a technology option to improve compressor efficiency in this NOPR analysis.

b. Washable Air Filters

MIAQ did not support the use of washable air filters and stated that in a limited study washable filters were changed less frequently than disposable filters, leading to reduced airflow and reduced efficiency. (MIAQ, No. 20 at p. 3)

DOE understands that the efficiency impacts due to air filters are dependent on regular consumer maintenance. As DOE noted in the technology assessment in chapter 3 of the preliminary TSD, it is difficult to predict the amount of energy savings that could be realized with the addition of washable air filters, as it is dependent on the specific dehumidifier model and use characteristics, and on the degree to which the consumer takes advantage of this feature. DOE also noted in the preliminary TSD that most dehumidifiers incorporate an air filter and that most manufacturers design the air filters to be removable and washable. Therefore, DOE did not consider washable air filters as a design option to improve efficiency in the engineering analysis for the June 2022 Preliminary Analysis. The information that MIAQ provided regarding the efficiency impacts of washable air filters further supports DOE's preliminary determination not to include washable air filters as a design option in the engineering analysis, and in light of the uncertainty and lack of sufficient data as to any efficiency benefit associated with them and the prevalence of them in dehumidifiers already on the market, DOE has tentatively removed from consideration washable air filters as a technology option in this NOPR.

c. Air-to-Air Heat Exchangers

According to MIAQ, air-to-air heat exchangers add significant cost and complexity to the design, MPC, and installation of the unit and typically push the unit into the greater than 8 cubic foot category where minimum efficiency values are considerably higher. (MIAQ, No. 20 at p. 3)

DOE considers the costs of design options in the engineering analysis. Although DOE is aware that air-to-air heat exchangers are implemented in many whole-home dehumidifiers with case volumes greater than 8 cubic feet, DOE did not implement air-to-air heat exchangers as a design option to achieve higher efficiency levels in the NOPR engineering analysis because dehumidifiers with size constraints that allow air-to-air heat exchangers already implement them and they require too much case volume increase to implement for other units. (*See* chapter 5 of the NOPR TSD for additional details.)

d. Alternative Refrigerants

The Joint Commenters supported DOE's decision to consider R–32 compressors as a design option for dehumidifiers due to their significant potential to improve efficiencies, and agreed that R–32 will likely be acceptable for use in dehumidifiers by the time amended standards come into effect. The Joint Commenters noted that in July 2022, the U.S. Environmental Protection Agency (''EPA'') proposed to list R–32 as acceptable for use in new residential dehumidifiers. (Joint Commenters, No. 21 at p. 1)

MIAQ requested that DOE consider the impact on efficiency that any new refrigerant would have on dehumidifiers. Although some refrigerants may provide efficiency improvements, optimizing the unit's performance would require time and the assistance of component suppliers. (MIAQ, No. 20 at p. 3)

DOE is aware that new refrigerant regulations from entities such as the California Air Resource Board (''CARB'') are prompting an industry-wide refrigerant changeover. Based on feedback received during the manufacturer interview process, DOE expects that the process of redesigning and optimizing dehumidifiers for new refrigerants such as R–32 will be part of the typical new unit design process, not a result of any amended standards that DOE may adopt. Additionally, DOE estimates that the implementation of R–32 in dehumidifiers is unlikely to result in an efficiency increase due to the refrigerant changeover alone, although compressors designed for R–32 may be slightly more efficient than compressors designed for R–410a due to other design improvements. Therefore, given this industry-wide refrigerant changeover expected to occur by the compliance date of any new dehumidifier standards, in this NOPR analysis DOE considered the impact of compressor improvements on overall dehumidifier efficiency only for those compressors using R–32, assuming that manufacturers will already have transitioned to refrigeration systems optimized for the new refrigerant.

DOE requests comment on the effects of EPA and CARB regulations on refrigerant choices and on whether changes in refrigerant will affect manufacturer's ability to achieve the efficiency levels in the NOPR analysis and the availability of high-efficiency R–32 compressors.

For further discussion of the cumulative regulatory burden, see section V.B.2.e of this document.

e. Low-Standby-Loss Electronic Controls

According to AHAM, low standby-loss electronic controls save as little as 1 watt of power and have a minimal impact to overall energy savings that

does not warrant the cost of implementing this technology option, and should therefore have been screened out by DOE. (AHAM, No. 22 at p. 4)

In the engineering analysis, DOE accounts for the cost relative to the efficiency benefit of all technologies that pass the screening analysis and are considered, as discussed. See chapter 3 of the NOPR TSD for discussion of the potential efficiency benefits of low-standby-loss electronic controls and chapter 5 of the NOPR TSD for further discussion of the costs of this technology.

f. Multi-Circuited Evaporator and Secondary Condenser Coils

Since publication of the June 2022 Preliminary Analysis, DOE became aware of at least one whole-home dehumidifier on the market that implements a novel refrigeration loop design. This patented design ''causes part of the refrigerant within the system to evaporate and condense twice in one refrigeration cycle, thereby increasing the compressor capacity over typical systems without adding any additional power to the compressor.'' [18] DOE has observed that this technology has resulted in a unit that is at least 4-percent more efficient than any other unit available on the market and a significant reduction in case volume compared to units with similar dehumidification capacities. Therefore, DOE has included multi-circuited evaporator and secondary condenser coil refrigerant systems as an additional technology option for this NOPR. See chapter 3 of the NOPR TSD for additional discussion of this technology.

B. Screening Analysis

DOE uses the following five 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 commercially viable, existing prototypes will not be considered further.

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

(3) *Impacts on product utility.* If a technology is determined to have a significant adverse impact on the utility of the product to subgroups of consumers, or 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) *Safety of technologies.* If it is determined that a technology would have significant adverse impacts on health or safety, it will not be considered further.

(5) *Unique-pathway proprietary technologies.* If a technology has proprietary protection and represents a unique pathway to achieving a given efficiency level, it will not be considered further, due to the potential for monopolistic concerns.

10 CFR part 430, subpart C, appendix A, sections 6(b)(3) and 7(b).

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

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

In the June 2022 Preliminary Analysis, DOE screened out pre-cooling air-to-air heat exchangers and heat pipes from the analysis for portable dehumidifiers with capacities up to and including 50 pints/day. DOE determined that these dehumidifiers could not accommodate the significant increases in case size and weight required to implement these technologies without a significant adverse effect on consumer utility (screening criterion 3).

AHAM agreed that implementation of pre-cooling air-to-air heat exchangers is applicable only to high-capacity portable dehumidifiers in Product Class 3 and requested that DOE recognize that current dehumidifier casings may not accommodate the increase in components and product size associated with this technology option. (AHAM, No. 22 at p. 4)

For the reasons given in the June 2022 Preliminary Analysis, DOE is maintaining the same approach to air-to-air heat exchangers and heat pipes in this NOPR analysis. See chapter 4 of the NOPR TSD for further discussion.

DOE is also screening out multi-circuited evaporator and secondary condenser coil refrigerant systems, a technology newly considered for the NOPR per section IV.A.2.f of this document, because it represents a unique-pathway proprietary technology. See chapter 4 of the NOPR TSD for further discussion.

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 of this document meet all five screening criteria to be examined further as design options in DOE's NOPR analysis. In summary, DOE did not screen out the following technology options:

TABLE IV.3—RETAINED DESIGN OPTIONS FOR DEHUMIDIFIERS

1. Microchannel heat exchangers.
2. Built-in hygrometer/humidistat.
3. Improved compressor efficiency.
4. Improved condenser and evaporator performance.
5. Improved controls.
6. Improved defrost methods.
7. Improved demand-defrost controls.
8. Improved fan and fan-motor efficiency.
9. Improved flow-control devices.

[18] U.S. Patent No. 10,845,069.

TABLE IV.3—RETAINED DESIGN OPTIONS FOR DEHUMIDIFIERS—Continued

10. Low-standby-loss electronic controls.
11. Pre-cooling air-to-air heat exchanger (high-capacity portable and whole-home dehumidifiers only).
12. Heat pipes (high-capacity portable and whole-home dehumidifiers only).
13. Improved refrigeration system insulation.
14. Refrigerant-desiccant systems.
15. Alternative refrigerants.

DOE has initially determined that these technology options are technologically feasible because they are being used or have previously been used in commercially available products or working prototypes. DOE also finds that all of the remaining technology 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, unique-pathway proprietary technologies). For additional details, see chapter 4 of the NOPR TSD.

C. Engineering Analysis

The purpose of the engineering analysis is to establish the relationship between the efficiency and cost of dehumidifiers. There are two elements to consider in the engineering analysis; the selection of efficiency levels to analyze (*i.e.,* the ''efficiency analysis'') and the determination of product cost at each efficiency level (*i.e.,* the ''cost analysis''). In determining the performance of higher-efficiency products, DOE considers technologies and design option combinations not eliminated by the screening analysis. For each product class, DOE estimates the baseline cost, as well as the incremental cost for the product at efficiency levels above the baseline. The output of the engineering analysis is a set of cost-efficiency ''curves'' that are used in downstream analyses (*i.e.,* the LCC and PBP analyses and the NIA).

1. Efficiency Analysis

DOE typically uses one of two approaches to develop energy efficiency levels for the engineering analysis: (1) relying on observed efficiency levels in the market (*i.e.,* the efficiency-level approach), or (2) determining the incremental efficiency improvements associated with incorporating specific design options to a baseline model (*i.e.,* the design-option approach). Using the efficiency-level approach, the efficiency levels established for the analysis are determined based on the market distribution of existing products (in other words, based on the range of efficiencies and efficiency level ''clusters'' that already exist on the market). Using the design option approach, the efficiency levels established for the analysis are determined through detailed engineering calculations and/or computer simulations of the efficiency improvements from implementing specific design options that have been identified in the technology assessment. DOE may also rely on a combination of these two approaches. For example, the efficiency-level approach (based on actual products on the market) may be extended using the design option approach to ''gap fill'' levels (to bridge large gaps between other identified efficiency levels) and/or to extrapolate to the max-tech level (particularly in cases where the max-tech level exceeds the maximum efficiency level currently available on the market).

In this proposed rulemaking, DOE relied on a combination of these two methods in developing cost estimates at each efficiency level for dehumidifiers, structured around the reverse engineering approach. For each product class, DOE analyzed a few units from different manufacturers to ensure the analysis was representative of various designs on the market. The analysis involved reviewing publicly available cost and performance information, physically disassembling commercially available products and modeling equipment cost while removing costs associated with non-efficiency related components or features. From this information, DOE estimated the MPCs for a range of products currently available on the market. DOE then considered the incremental steps manufacturers may take to reach higher efficiency levels. In its modeling, DOE started with the baseline MPC and added the expected design options at each higher efficiency level to estimate incremental MPCs. *See* chapter 5 of the NOPR TSD for additional detail on the dehumidifiers analyzed.

DOE analyzed six efficiency levels (''ELs'') as part of the engineering analysis for portable dehumidifiers with capacities less than or equal to 50 pints/day: (1) the current DOE standard (baseline); (2) an intermediate level above the baseline but below the ENERGY STAR® level, representing units that exist on the market above the baseline but are not ENERGY STAR units (EL 1); (3) the ENERGY STAR efficiency criterion (EL 2); (4) the level of the most efficient units available on the market (EL 3); (5) an intermediate level below the maximum technologically feasible (max-tech) efficiency that represents the implementation of more efficient compressors and fan motors on the market without any changes to the unit chassis (EL 4); and (6) the max-tech efficiency (EL 5).

For portable dehumidifiers with capacities of 50.01 pints/day and above, the distribution of efficiencies that are available on the market and the technology options feasible for this product class required DOE to analyze different efficiency levels, as follows: (1) the current DOE standard (baseline); (2) an intermediate level above the baseline but below the ENERGY STAR level, representing units that exist on the market above the baseline but are not ENERGY STAR units (EL 1); (3) the ENERGY STAR efficiency criterion (EL 2); (4) an intermediate level below max tech that represents the implementation of more efficient compressors and fan motors on the market (EL 3); and (5) the max-tech efficiency (EL 4).

For whole-home dehumidifiers with case volumes of 8 cubic feet or below, likewise, the distribution of efficiencies that are available on the market and the technology options feasible for this product class required DOE to analyze different efficiency levels, as follows: (1) the current DOE standard (baseline); (2) the ENERGY STAR efficiency criterion (EL 1); (3) an intermediate level below max tech, representing the level of the most efficient units available on the market (EL 2); and (4) the max-tech efficiency (EL 3).

For whole-home dehumidifiers with case volumes larger than 8 cubic feet, likewise, the distribution of efficiencies that are available on the market and the technology options feasible for this product class required DOE to analyze different efficiency levels, as follows: (1) the current DOE standard (baseline); (2) an intermediate level above the baseline but below the ENERGY STAR level, representing the level of the most efficient units available on the market

(EL 1); (3) the ENERGY STAR efficiency criterion (EL 2); (4) an intermediate level below max tech that represents the implementation of more efficient compressors and fan motors on the market and some increase to heat exchanger size relative to EL 2 (EL 3); and (5) the max-tech efficiency (EL 4).

a. Baseline Efficiency

For each product/equipment class, DOE generally selects a baseline model as a reference point for each class, and measures changes resulting from potential energy conservation standards against the baseline. The baseline model in each product/equipment class represents the characteristics of a product/equipment typical of that class (*e.g.,* capacity, physical size). Generally, a baseline model is one that just meets current energy conservation standards, or, if no standards are in place, the baseline is typically the most common or least efficient unit on the market.

For representative units for teardowns and the NOPR, DOE selected three baseline units that fell within two of the five dehumidifier product classes (Product Class 1 and Product Class 2) as reference points for each analyzed product class, against which DOE measured changes that would result from amended energy conservation standards to support the engineering, LCC, and PBP analyses. Baseline units for two of the other three product classes (Product Class 3 and Product Class 5) were not readily available on the market for analysis. Additionally, as discussed in chapter 5 of the preliminary TSD, for whole-home dehumidifiers with case volumes of 8 cubic feet or less, DOE does not expect that efficiencies and overall designs have changed since the previous standards rulemaking, given that the whole-home dehumidifier standards adopted in the June 2016 Final Rule were the baseline level at the time. For this reason, DOE did not select additional baseline units in Product Class 4 for teardown as part of the NOPR analysis. However, DOE found that higher-efficiency models could provide insight into technologies that were likely to be implemented in baseline units to improve efficiency. Therefore, for product classes where baseline units were not available, DOE estimated the MPC of baseline units by evaluating which design options would need to be removed from the higher-efficiency unit analyzed in order to reduce its efficiency to the baseline level. The baseline units in each of the analyzed product classes represent the basic characteristics of equipment in that class.

MIAQ stated in response to the June 2022 Preliminary Analysis that the current energy conservation standards for portable dehumidifier product classes are not appropriate or in the best interest of the Nation's energy consumption. According to MIAQ, the jump in baseline efficiency from 1.60 L/kWh at the 25.01–50.00 pints/day capacity up to 2.80 L/kWh for larger-capacity units is too drastic and would force MPC and manufacturer selling price (''MSP'') to escalate far above that of smaller dehumidifiers. According to MIAQ, as consumers purchase sufficient dehumidifier capacity match the latent load of their dwelling, this could be through a more expensive, higher-efficiency dehumidifier at an efficiency of 2.80 L/kWh or through multiple less-expensive and less-efficient dehumidifiers at an efficiency of 1.30 L/kWh. MIAQ stated that as MPC and MSP on these two types of units are drastically different, anecdotal evidence indicates many consumers have two or more dehumidifiers in their basement or crawlspace consuming twice the power of a larger unit. Therefore, MIAQ requested that DOE develop a new set of baseline efficiency levels for portable dehumidifiers that create more parity in the MPCs and baseline efficiencies for the product sizes. (MIAQ, No. 20 at pp. 3–4)

As noted, DOE analyzes the changes due to potential energy conservation standards against the baseline for each product class. DOE determined in the June 2016 Final Rule that the current standards were technologically feasible and economically justified for each of the five dehumidifier product classes (81 FR 38338, 38385–38388), and models exist on the market at or above the current standard level in each class. Therefore, DOE has evaluated baseline efficiency levels for this NOPR analysis that correspond to the current energy conservation standards for dehumidifiers. DOE notes that units with capacities larger than 50 pints/day have inherent differences in design from those with smaller capacities related to the different consumer utility they provide. The larger dehumidifiers in Product Class 3 provide dehumidification for large spaces, are more robustly constructed, and are more efficient due to their greater size and capacity. The smaller dehumidifiers are intended to dehumidify smaller spaces and provide consumers with an affordable, lighter-weight, and more compact option to dehumidify a targeted area. The current energy conservation standards on which the baseline efficiency levels are based reflect that consumers derive utility from the greater capacity, efficiency, and robust construction of larger dehumidifiers and that smaller dehumidifiers offer utility in the form of their smaller size and lower cost. These differences in utility are borne out in the design differences observed between these classes of dehumidifiers, with larger dehumidifiers implementing more durable materials and larger heat exchangers. These design differences lead to the cost differential observed by manufacturers and consumers between larger and smaller dehumidifiers. DOE developed the higher efficiency levels in each product class based on the units currently on the market, external efficiency criteria such as ENERGY STAR, and technological feasibility of design options to improve dehumidifier efficiency. DOE then evaluated the economic impacts of potential standards at each of these efficiency levels, including incremental impacts on MPCs and MSPs in each product class, as part of the NOPR analysis. DOE is not aware of and lacks sufficient consumer usage data showing that consumers install multiple smaller dehumidifiers in the same room instead of purchasing one larger, more efficient dehumidifier as part of an average period of use, and therefore did not model any product class switching as a result of evaluated potential standards.

DOE requests comment regarding consumer's dehumidifier usage patterns and whether consumers typically purchase multiple smaller dehumidifiers to meet dehumidification requirements as opposed to a single, higher capacity dehumidifier.

b. Higher Efficiency Levels

As discussed above, DOE modeled several efficiency levels above the baseline for dehumidifiers in each product class, using a combination of design options that varied by product class (for detailed discussion of the design options used to model each efficiency level, see chapter 5 of the NOPR TSD). As part of DOE's analysis, the maximum available efficiency level is the highest efficiency unit currently available on the market. DOE also defines a ''max-tech'' efficiency level to represent the maximum possible efficiency for a given product. At all of these levels, DOE considered incremental compressor efficiency improvements as a design option. In the June 2022 Preliminary Analysis, DOE reviewed compressor manufacturer product catalogues to identify the maximum technologically feasible R–32 compressor efficiency. However, based on additional research and input from

manufacturer interviews, DOE understands that the most efficient compressors listed in catalogues may not be widely available to all dehumidifier manufacturers or available at the scale necessary to serve the dehumidifier market at the anticipated date of compliance of any new standards. This is especially true for the relatively small manufacturers that produce dehumidifiers in Product Class 4 and Product Class 5, given the specialized applications for these products and the corresponding lower production volumes. To address this concern in the NOPR analysis, DOE considered incremental compressor efficiency increases for each product class only up to the highest R–32 single-speed compressor efficiency observed in the teardown sample in that class. This change ensures that the higher-efficiency compressors considered as design options are widely available and technologically feasible for all dehumidifier manufacturers to implement. As discussed in chapter 5 of the NOPR TSD, DOE modeled replacing permanent split capacitor (''PSC'') fan motors with more efficient ECMs, replacing baseline single-speed compressors with the most efficient single-speed compressors already available on the market, reducing standby power using more efficient controls, and increasing the cabinet and heat exchanger to the largest sizes feasible without impacting consumer utility to improve efficiency. For all product classes, the max-tech level identified exceeds any other regulatory or voluntary efficiency criteria currently in effect.

DOE received the following comments related to the higher efficiency levels modeled in the preliminary engineering analysis.

AHAM requested that DOE account for additional controls, specifically variable-frequency drives that are required for ECMs in the improved fan and fan motor efficiency technology option. According to AHAM, in addition to the significant cost increase associated with ECMs being a significant obstacle to widespread adoption in dehumidifiers, additional controls would only further increase the cost and require additional space within the product case, potentially affecting the size and weight of the product. (AHAM, No. 22 at p. 5)

DOE is aware that ECMs require specialized control boards and additional space within dehumidifier chassis to locate them and considered this issue as part of the engineering analysis. DOE found that there is a variable-speed dehumidifier on the market that implements a variable-speed compressor, and this model has the same chassis size as another comparable dehumidifier from the same manufacturer that does not implement the variable-speed components and functionality. DOE expects that a variable-speed dehumidifier would have similar control requirements to one that implements ECMs. Therefore, DOE tentatively finds that the implementation of ECMs for fan blowers in dehumidifiers does not inherently necessitate a change in chassis size.

According to AHAM and a survey of its members, employing the technology options that DOE suggested in the preliminary TSD to meet the analyzed efficiency levels for Product Classes 1, 2, and 3 would require significant increases in both model weight and model dimensions. For Product Classes 1 and 2, AHAM stated that an increase of up to 30 percent in model weight and up to 59 percent in model dimensions is required to meet EL 3, and an increase of up to 38 percent in model weight and up to 68 percent in model dimensions is required to meet EL 4. For Product Class 3, AHAM stated that EL 2 would require a product redesign and likely an increase in both weight and dimension by unknown quantities. AHAM also stated that increased product size and weight associated with implementing the technology options specified in the preliminary TSD will affect the consumer utility of dehumidifiers, specifically regarding portability. According to AHAM, consumers must move or lift dehumidifiers when purchased and when used in different spaces in their homes. Additionally, manufacturers design models to meet a 51-pound weight threshold for a one-person lift, a design parameter that not only reflects consumer utility but also is a requirement under worker safety standards, parcel delivery service fee structures, and other distribution requirements that AHAM stated DOE should consider for all product classes. AHAM urged DOE to assess impacts on product weight associated with increased heat exchanger area and added tube rows in the improved condenser and evaporator performance technology option. According to AHAM, an increase in weight of the coil section could severely impact consumer use in existing dehumidifier designs that require lifting the coil section in order to access the water collection bucket. Additionally, AHAM stated that its members specifically identified weight increases associated with this technology option in meeting EL 3 for all product classes. AHAM requested that DOE assess all potential cost increases associated with the technology options that increase product size and/or weight and noted its recommendation for a standard that does not go beyond EL 2 for Product Class 1, a gap-fill analysis for Product Class 2, and no change in the standard for Product Class 3 to avoid these negative impacts. (AHAM, No. 22 at pp. 2–5)

In the June 2022 Preliminary Analysis, DOE modeled the efficiency levels below max-tech mentioned by AHAM by implementing more efficient compressors without any additional design options. In DOE's assessment, these higher-efficiency compressors would result in a slight weight increase but would require no changes to the dehumidifier's chassis size or any substantive change in overall weight. Additionally, based on teardowns of other space conditioning products, DOE does not expect that ECMs are heavier than the PSC motors currently used in dehumidifiers. However, as AHAM suggested, DOE does expect weight changes at the max-tech level associated with increasing the heat exchanger size. DOE accounted for the effect of these weight changes and changes to chassis size in its analysis of shipping costs, and limited the maximum increase in heat exchanger size for portable dehumidifiers in Product Classes 1 and 2 to dimensions already observed on the market in these product classes to ensure the units analyzed retained their consumer utility as smaller, portable units. Because product weight changes due to heat exchanger size increases are correlated with product dimensions, DOE does not expect that these weight increases will result in units that are significantly heavier than those currently on the market, such that any weight increases will not adversely affect consumer utility. For Product Class 3, DOE's market analysis suggests that most models in Product Class 3, even at baseline efficiency, typically weigh roughly between 55 and 70 pounds, already surpassing the 51-pound weight limit for a single-person lift mentioned by AHAM. Therefore, Product Class 3 units already require two people to lift and install, a requirement that would not be altered by minor increases in chassis size and thus weight. However, a significantly larger chassis size might become more unwieldy for two people to lift. Accordingly, DOE limited the heat exchanger dimension increases considered for Product Class 3 to 5 percent greater than those observed in product teardowns in order to preclude any adverse effects on consumer utility.

DOE further notes that portable dehumidifiers are typically equipped with wheels that allow consumers to move them from room to room within the home. While DOE is aware of a dehumidifier design that requires consumers to lift the coil section to access the water bucket, the design is not efficiency-related and is proprietary, and therefore DOE did not consider this design in its analysis. In sum, DOE expects that the NOPR analysis and any subsequent amended energy conservation standards would not impact the design, weight, or dimensions of any dehumidifier significantly, as the required chassis dimensions are within the scope of those previously observed in dehumidifiers. For these reasons, in the NOPR analysis DOE continued to consider design options that increase the weight of dehumidifiers, limited to the extent discussed by restrictions on the allowable chassis size increases.

DOE requests comment on whether limiting needed chassis size increases is sufficient to preserve consumer utility at the max-tech level.

AHAM stated that while improved compressor efficiency can achieve higher overall efficiency, changes in compressor technology may require product redesigns in the form of additional safety components, particularly with the transition to R–32 refrigerant. According to AHAM, these additional safety components would make it more difficult to implement other technology options that will require room within the product casing. (AHAM, No. 22 at p. 5)

DOE is aware that the EPA's Significant New Alternatives Policy (''SNAP'') regulations now allow the use of R–32 in new dehumidifiers, provided that they comply with the relevant industry safety standard [19] to ensure new dehumidifiers are designed with the flammability of R–32 in mind. *See* 88 FR 26382. However, DOE does not have information regarding the sorts of design changes necessary to comply with this standard. See section V.B.2.e of this document for discussion of how DOE accounts for refrigerant transition costs in its cumulative regulatory burden analysis.

ASAP and the Joint Commenters encouraged DOE to evaluate at least one intermediate efficiency level between EL 3 and EL 4 for Product Classes 1 and 2 to address the large gap in efficiencies due to the introduction of multiple design options at EL 4. The Joint Commenters added that DOE could evaluate an intermediate level based on the highest-efficiency compressors, or one reflecting all design options except for increases in heat exchanger size. According to the Joint Commenters, DOE may refer to the April 2022 NOPR for room air conditioners in which the most efficient single-speed compressors were associated with an increase in efficiency of 19 to 25 percent relative to baseline units and an incremental cost of less than $15. (ASAP, Public Meeting Transcript, No. 19 at pp. 19–20; Joint Commenters, No. 21 at p. 2)

In the June 2022 Preliminary Analysis for Product Classes 1 and 2, DOE analyzed two efficiency levels above the ENERGY STAR level: the maximum available efficiency on the market and the max-tech efficiency. For Product Class 3 and for whole-home dehumidifiers, DOE analyzed the max-tech efficiency level above the ENERGY STAR level and no other intermediate levels, because there were no units on the market above the ENERGY STAR efficiency. While conducting the analysis for this NOPR, DOE noted the potential to add an efficiency level for all product classes beyond the maximum available efficiency but below max tech by using more efficient single-speed compressors and implementing ECM technology. DOE used these design options to model a new intermediate efficiency level, EL 4, for all product classes. The new EL 4 level improves the efficiency by 35 to 63 percent relative to baseline units with incremental costs between $83 and $119, depending on product class. See chapter 5 of the NOPR TSD for additional discussion of the new efficiency levels and incremental costs.

2. Cost Analysis

The cost analysis portion of the engineering analysis is conducted using one or a combination of cost approaches. The selection of cost approach depends on a suite of factors, including the availability and reliability of public information, characteristics of the regulated product, and the availability and timeliness of purchasing the product on the market. The cost approaches are summarized as follows:

□ *Physical teardowns:* Under this approach, DOE physically dismantles a commercially available product, component by component, to develop a detailed bill of materials for the product.

□ *Catalog teardowns:* In lieu of physically deconstructing a product, DOE identifies each component using parts diagrams (*e.g.,* available from manufacturer websites or appliance repair websites) to develop the bill of materials for the product.

□ *Price surveys:* If neither a physical nor catalog teardown is feasible (*e.g.,* for tightly integrated products such as fluorescent lamps, which are infeasible to disassemble and for which parts diagrams are unavailable) or is cost-prohibitive and otherwise impractical (*e.g.,* for large commercial boilers), DOE conducts price surveys using publicly available pricing data published on major online retailer websites and/or by soliciting prices from distributors and other commercial channels.

In the present case, DOE conducted the analysis using physical teardowns. The resulting bill of materials provides the basis for the MPC estimates.

To account for manufacturers' non-production costs and profit margin, DOE applies a multiplier (the manufacturer markup) to the MPC. The resulting manufacturer selling price (''MSP'') is the price at which the manufacturer distributes a unit into commerce. DOE developed an average manufacturer markup by examining corporate annual reports filed by publicly traded manufacturers primarily engaged in appliance manufacturing and whose combined product range includes dehumidifiers. See section IV.J.2.d of this document or chapter 12 of the NOPR TSD for additional information on the manufacturer markup.

In response to June 2022 Preliminary Analysis, MIAQ stated that although the manufacturer markup of 1.45 used in the preliminary analysis was historically accurate, it now overstates the current market situation which is decreasing as costs continue to increase and are unable to be passed onto the consumer. MIAQ also stated it would be willing to share information on their current markup for dehumidifiers. (MIAQ, No. 20 at p. 5)

For this NOPR analysis, DOE adjusted the estimated industry average manufacturer markup from the 1.45 estimate published in the June 2022 Preliminary Analysis. DOE used market share weights to adjust the manufacturer markup based on confidential feedback provided in manufacturer interviews and a review of recent corporate annual reports by public companies engaged in manufacturing dehumidifiers. DOE estimates that the industry average manufacturer markup is 1.40 for all product classes. See section IV.J.2.d of this document and chapter 12 of the NOPR TSD for additional information on the manufacturer markup.

[19] 3rd edition, dated November 1, 2019, of Underwriters Laboratories (''UL'') Standard 60335–2–40, ''Household and Similar Electrical Appliances—Safety—Part 2–40: Particular Requirements for Electrical Heat Pumps, Air Conditioners and Dehumidifiers''.

AHAM stated that implementation of technology options that both increase product efficiency and product size and/or weight runs counter to manufacturer efforts to decrease product size and maximize shipping container space in order to deliver products to consumers in a timely manner while minimizing added costs due to ongoing supply chain and logistics issues. AHAM requested that DOE avoid design options that require increases in size and/or weight for these reasons and requested that DOE account for these added costs in its analysis. (AHAM, No. 22 at p. 3)

In this NOPR, DOE's analysis includes the impact of changes in dimensions on overseas container and domestic shipping rates. For efficiency levels below max-tech, DOE does not find increases in shipping costs, because chassis size and weight of the units are not expected to change from the baseline at these efficiency levels. At max-tech, there are increases in shipping costs due to the expected increase in chassis size. Additional information about shipping costs is available in section IV.F.1 of this document and chapter 8 of the NOPR TSD.

3. Cost-Efficiency Results

The results of the engineering analysis are presented as cost-efficiency data for each of the efficiency levels for each of the product classes. DOE developed estimates of MPCs for each unit in the teardown sample, and also performed additional modeling for each of the teardown samples, to develop a comprehensive set of MPCs at each efficiency level. DOE then consolidated the resulting MPCs for each of DOE's teardown units and modeled units using a weighted average for product classes in which DOE analyzed units from multiple manufacturers. DOE's weighting factors were based on a market penetration analysis for each of the manufacturers within each product class. The resulting weighted-average incremental MPCs (*i.e.,* the additional costs manufacturers would likely incur by producing dehumidifiers at each efficiency level compared to the baseline) are provided in Tables 5.5.12 and 5.5.13 in chapter 5 of the NOPR TSD. *See* chapter 5 of the NOPR TSD for additional detail on the engineering analysis.

DOE requests comment on the incremental MPCs from the NOPR engineering analysis.

D. Markups Analysis

The markups analysis develops appropriate markups (*e.g.,* retailer markups, distributor markups, contractor markups) in the distribution chain and sales taxes to convert the MSP estimates derived in the engineering analysis to consumer prices, which are then used in the LCC and PBP analysis. At each step in the distribution channel, companies mark up the price of the product to cover business costs and profit margin.

DOE developed baseline and incremental markups for each actor in the distribution chain. Baseline markups are applied to the price of products with baseline efficiency, while incremental markups are applied to the difference in price between baseline and higher-efficiency models (the incremental cost increase). The incremental markup is typically less than the baseline markup and is designed to maintain similar per-unit operating profit before and after new or amended standards.[20]

For portable dehumidifiers with capacities less than or equal to 50.0 pints/day, DOE assumed all sales were through the retail channel. DOE developed baseline and incremental retail markups using data from the 2017 Annual Retail Trade Survey for the ''electronics and appliance stores'' sector.[21] The whole-home dehumidifier distribution channel reflects two additional markups to include wholesalers and contractors used in the purchase of the larger dehumidifiers. DOE developed wholesaler and contractor markups using U.S. Census Bureau data from the 2017 Annual Wholesale Trade Report [22] and the 2017 U.S. Economic Census,[23] respectively. For portable dehumidifiers with capacities greater than 50.00 pints/day, DOE assumed 60 percent of shipments were through the retail channel, and 40 percent of shipments were through the whole-home dehumidifier distribution channel based on feedback from manufacturer interviews.

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

E. Energy Use Analysis

The purpose of the energy use analysis is to determine the annual energy consumption of dehumidifiers at different efficiencies in representative U.S. single-family homes and multi-family residences, and to assess the energy savings potential of increased dehumidifier efficiency. The energy use analysis estimates the range of energy use of dehumidifiers in the field (*i.e.,* as they are actually used by consumers). The energy use analysis provides 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 or new standards.

DOE used data from the EIA's 2020 Residential Energy Consumption Survey (''*RECS* 2020'') [24] to determine dehumidifier ownership and usage across the United States. *RECS* 2020 represents the largest nationally available dataset of installed residential appliance stock of dehumidifiers in households (either portable or whole home) as well as the number of portable units in each household. *RECS* also provides dehumidifier usage information in the form of broad categories of annual usage frequency as reported by the households. DOE estimated monthly vapor density data for each household that reported owning a portable dehumidifier by using corresponding outdoor temperature and humidity information for the year 2020 provided by the National Oceanic and Atmospheric Administration (NOAA).[25] DOE used this vapor density data in conjunction with the annual usage information to estimate the respective annual operating hours of portable dehumidifiers for each consumer sample as applicable.

DOE determined that portable dehumidifiers operated in active (dehumidification) mode, fan-only mode, and standby mode while whole-home dehumidifiers operated in active and standby modes only. To estimate the annual dehumidifier energy consumption, DOE first calculated the number of operating hours in each mode. For portable dehumidifiers, DOE used available dehumidifier field

[20] Because the projected prices of standards-compliant products are typically higher than the price of baseline products, using the same markup for the incremental cost and the baseline cost would result in higher per-unit operating profit. While such an outcome is possible in the short term, DOE maintains that in markets that are reasonably competitive, it is unlikely that standards would lead to a sustainable increase in profitability in the long run.

[21] US Census Bureau, Annual Retail Trade Survey. 2017. *www.census.gov/programs-surveys/arts.html.*

[22] US Census Bureau, Annual Retail Trade Survey. 2017. *www.census.gov/programs-surveys/arts.html.*

[23] US Census Bureau, 2017 Economic Census. *www.census.gov/programs-surveys/economic-census/year/2017/economic-census-2017/data.html.*

[24] U.S. Department of Energy–Energy Information Administration. Residential Energy Consumption Survey. 2020. *www.eia.gov/consumption/residential/data/2020/.*

[25] Available at *https://www.ncdc.noaa.gov/cdo-web/datatools/lcd.*

studies [26] [27] that provided a relationship between vapor density and daily operating hours. DOE estimated that portable dehumidifiers operated in active mode for an average of 1,337 hours annually. For whole-home dehumidifiers, based on data from the field study, DOE estimated that, on average, 28 percent of the daily operating hours were spent in active or dehumidification mode and the remaining in standby mode. DOE paired these data with estimates of the number of months that dehumidifiers may be used based on usage behavior as reported in RECS 2020. DOE estimated that consumers leave the dehumidifier to cycle on and off for the entire month or months of the dehumidification season.

MIAQ stated that although dehumidifiers use the same vapor compression refrigeration cycle as air conditioners, their operation is much different and the latent load or run time is affected by many variables. According to MIAQ, consumers typically do not manually change the mode of operation or settings once a dehumidifier is installed. (MIAQ, No. 20 at p. 4)

DOE agrees that there are differences in operation between dehumidifiers and air conditioners. DOE's energy use analysis is based on dehumidifier field studies that capture real world dehumidifier operation in a variety of different operating conditions. The studies used by DOE support MIAQ's assertion that consumers do not manually change the mode of operation or settings once the dehumidifier is installed.

MIAQ stated that more than 10 percent of households have more than one dehumidifier, which indicates that consumers understand they can purchase two smaller capacity units rather than one large capacity unit. (MIAQ, No. 20 at p. 4)

Using RECS 2020, DOE estimates that 10.6 percent of portable dehumidifier-owning households own multiple units, similar to the estimate provided by MIAQ. DOE adjusted the consumer sample to account for households with multiple units using the household weights derived by RECS 2020 and the reported number of portable dehumidifiers in each household.

[26] Willem, H., T. Burke, C. Dunham, B. Beraki, J. Lutz, M. Melody, M. Nagaraju, C. Ni, S. Pratt, S. Price, and V. Tavares. *Using Field-Metered Data to Quantify Annual Energy Use of Residential Portable Unit Dehumidifiers.* 2013. Report No. LBNL–6469e.

[27] Burke, T. A., H. Willem, C. C. Ni, H. Stratton, C. Dunham Whitehead, and R. Johnson. *Whole-Home Dehumidifiers: Field-Monitoring Study.* 2014. Report No. LBNL–1003950E.

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

F. Life-Cycle Cost and Payback Period Analysis

DOE conducted LCC and PBP analyses to evaluate the economic impacts on individual consumers of potential energy conservation standards for dehumidifiers. 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:

□ The LCC is the total consumer expense of an appliance or product over the life of that product, consisting of total installed cost (manufacturer selling price, distribution chain markups, sales tax, and installation costs) plus operating costs (expenses for energy use, maintenance, and repair). To compute the operating costs, DOE discounts future operating costs to the time of purchase and sums them over the lifetime of the product.

□ 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 at higher efficiency levels by the change in annual operating cost for the year that amended or new standards are assumed to take effect.

For any given efficiency level, DOE measures the change in LCC relative to the LCC in the no-new-standards case, which reflects the estimated efficiency distribution of dehumidifiers in the absence of new or amended energy conservation standards. In contrast, the PBP for a given efficiency level is measured relative to the baseline product.

For each considered efficiency level in each product class, DOE calculated the LCC and PBP for a nationally representative set of U.S. households. As stated previously, DOE developed household samples from RECS 2020. For each sample household, DOE determined the energy consumption for the dehumidifiers and the appropriate energy 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.

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 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 for products at each efficiency level for 10,000 households per simulation run. The analytical results include a distribution of 10,000 data points showing the range of LCC savings for a given efficiency level relative to the no-new-standards case efficiency distribution. In performing an iteration of the Monte Carlo simulation for a given consumer, product efficiency is chosen based on its probability. If the chosen product efficiency is greater than or equal to the efficiency of the standard level under consideration, the LCC calculation reveals that a consumer is not impacted by the standard level. By accounting for consumers who already purchase more efficient products, DOE avoids overstating the potential benefits from increasing product efficiency.

DOE calculated the LCC and PBP for consumers of dehumidifiers as if each were to purchase a new product in the expected year of required compliance with new or amended standards. New and amended standards would apply to dehumidifiers manufactured 3 years after the date on which any new or amended standard is published. (42 U.S.C. 6295 (m)(4)(A)) At this time, DOE estimates publication of a final rule in 2025. Therefore, for purposes of its analysis, DOE used 2028 as the first year of compliance with any amended standards for dehumidifiers.

Table IV.3 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 NOPR TSD and its appendices.

TABLE IV.4—SUMMARY OF INPUTS AND METHODS FOR THE LCC ANALYSIS *

Inputs	Source/method
Product Costs	Derived by multiplying MPCs by manufacturer, retailer, and contractor markups and sales tax, as appropriate. Used historical data to derive a price scaling index to project product costs. Applied price trend to electronic controls used on products with variable-speed blower motors.
Installation Costs	Baseline installation cost determined with data from RSMeans. Assumed no change with efficiency level.
Annual Energy Use	The total annual energy use derived from power demand of each mode multiplied by the hours per year in that mode. Average number of hours based on field data. Variability: Based on RECS 2020.
Energy Prices	Electricity: Based on Edison Electric Institute data for 2022. Variability: Regional energy prices determined for each census division.
Energy Price Trends	Based on *AEO2023* electricity price projections from 2022–2050; constant value based on average of price for 2046–2050 thereafter.
Repair and Maintenance Costs	Assumed no change with efficiency level.
Product Lifetime	Weibull probability distribution based on averages provided from manufacturer interviews: 10 years for portable dehumidifiers and 12 years for whole-home dehumidifiers.
Discount Rates	Approach involves identifying all possible debt or asset classes that might be used to purchase the considered appliances or that might be affected indirectly. Primary data source was the Federal Reserve Board's Survey of Consumer Finances.
Compliance Date	2028.

* Not used for PBP calculation. References for the data sources mentioned in this table are provided in the following sections and in chapter 8 of the NOPR TSD.

1. Product Cost

To calculate consumer product costs, DOE multiplied the MPCs developed in the engineering analysis by the markups described previously (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.

Economic literature and historical data suggest that the real costs of many products may trend downward over time according to ''learning'' or ''experience'' curves. Experience curve analysis implicitly includes factors such as efficiencies in labor, capital investment, automation, materials prices, distribution, and economies of scale at an industry-wide level. DOE developed two types of experience curves to project the future dehumidifier prices. One is an overall price trend applied to the cost of dehumidifier units excluding the cost of electronic controls used for variable-speed blower fans, and the other is a separate learning rate associated with the electronic controls used in units with variable-speed blower fans. To derive the first type of experience curve for portable dehumidifiers, DOE used historical Producer Price Index (''PPI'') data between 1983 and 2014 for ''small electric household appliances, except fans'' and data from the Bureau of Labor Statistics (''BLS'') [28] between 2014 and 2022 for ''small electric household appliances manufacturing'' to construct a combined price index that is most representative of portable dehumidifiers. Inflation-adjusted price indices were calculated by dividing the PPI series by the implicit gross domestic product (''GDP'') price deflator for the same years. DOE assembled a time series of annual shipments of portable dehumidifiers from AHAM and *Appliance Magazine*.[29] For efficiency levels that include variable-speed blowers, DOE applied a different price trend to the controls portion of the variable-speed blowers that contributes to the price increments moving from single-speed blower to variable-speed blower. DOE used PPI data between 1967 and 2022 on ''semiconductors and related device manufacturing'' to estimate the historic price trend of electronic components in the controls. The regression performed as an exponential trend line fit results in an R-square of 0.99, with an annual price decline rate of 6.3 percent. DOE applied the same learning parameters for whole-home dehumidifiers. See chapter 8 of the NOPR TSD for further details on this topic.

DOE included the cost to internationally ship and domestically transport dehumidifier units to the United States. DOE calculated shipping costs for the baseline and for higher efficiency levels that have larger product dimensions that increase shipping costs.

2. Installation Cost

Installation cost includes labor, overhead, and any miscellaneous materials and parts needed to install the product. In the June 2022 Preliminary Analysis, DOE assumed that there were no installation costs for portable dehumidifiers given that consumers were directed by manufacturer instructions to simply plug them in to a wall outlet for operation. For whole-home dehumidifiers, DOE used data from RSMeans' 2022 Residential Cost Data to estimate installation costs for baseline and more efficient units.

For this NOPR, DOE assumed that whole-home dehumidifier installation costs do not increase with efficiency based on feedback from manufacturer interviews. DOE used the baseline installation cost for all efficiency levels for whole-home dehumidifiers. DOE maintained the assumption of no installation costs for portable dehumidifiers.

DOE seeks available data on installation costs for baseline and more efficient units.

3. Annual Energy Consumption

For each sampled household, DOE determined the energy consumption for dehumidifiers at different efficiency levels using the approach described

[28] Product series IDs: PCU33521033521014 and PCU335210335210. More information at *www.bls.gov/ppi/*.

[29] Appliance Magazine. *Appliance Historical Statistical Review: 1954–2012*. 2014. UBM Canon.

previously in section IV.E of this document.

4. Energy Prices

Because marginal electricity price more accurately captures the incremental savings associated with a change in energy use from higher efficiency, it provides a better representation of incremental change in consumer costs than average electricity prices. Therefore, DOE applied average electricity prices for the energy use of the product purchased in the no-new-standards case, and marginal electricity prices for the incremental change in energy use associated with the other efficiency levels considered.

DOE derived electricity prices in 2022 using data from Edison Electric Institute (''EEI'') Typical Bills and Average Rates reports. Based upon comprehensive, industry-wide surveys, this semi-annual report presents typical monthly electric bills and average kilowatt-hour costs to the customer as charged by investor-owned utilities. For the residential sector, DOE calculated electricity prices using the methodology described in Coughlin and Beraki (2018).[30] DOE used the EEI data to define a marginal price as the ratio of the change in the bill to the change in energy consumption.

To estimate energy prices in future years, DOE multiplied the 2022 energy prices by the projection of annual average price changes for each of the nine census divisions from the Reference case in AEO2023, which has an end year of 2050.[31] To estimate energy prices after 2050, DOE assumed a constant 2050 value for all years.

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 compared to baseline efficiency products.

In the June 2022 Preliminary Analysis, DOE assumed that maintenance and repair costs would not vary by efficiency level and did not include them in the LCC analysis.

MIAQ stated that, in general, more efficient dehumidifiers are typically made with more complex components which potentially increases the failure probability and the skill level of the technician required to conduct any repairs. (MIAQ, No. 20 at p. 5)

Feedback from manufacturer interviews (*see* section IV.J.3 of this document) indicated that portable dehumidifiers do not require maintenance costs that would change with efficiency and whole-home dehumidifier consumers are more likely to replace rather than repair their units. Based on this feedback, DOE assumed that portable dehumidifier consumers are also more likely to replace a unit rather than repair it, similar to whole-home units. For this NOPR analysis, DOE did not include maintenance or repair costs for portable or whole-home dehumidifiers. DOE assumes that filter change frequency and cost would not change with efficiency for each product class. DOE notes that higher failure rates for units with more complex technology could potentially indicate a different lifetime for those units. However, DOE is unaware of any data indicating differences in failure rates based on the components used in more efficient dehumidifiers.

DOE seeks comment on the assumption that dehumidifier consumers are most likely to replace a broken unit rather than repair it. DOE also seeks available data on the filter change and repair frequency and costs.

6. Product Lifetime

In the June 2022 Preliminary Analysis, DOE assumed a lifetime distribution with an average age of 11 years for portable dehumidifiers, based on the June 2016 Final Rule. 81 FR 38338, 38359. In the absence of data specific to whole-home dehumidifiers, DOE assumed that whole-home dehumidifiers would have a lifetime distribution similar to residential packaged central air conditioners that operate in humid climates. For whole-home dehumidifiers, DOE used the lifetime distribution with an average lifetime of 18 years from the Residential Central Air and Heat Pumps Direct Final Rule, published on January 6, 2017. 82 FR 1786.

MIAQ stated that since dehumidifiers operate under different conditions than air conditioning equipment, dehumidifiers may have a shorter average lifetime due to increased freeze/thaw cycling, corrosion from increased water saturation time, and component failure from extreme intake air temperatures. MIAQ suggested a shorter 8- to 12-year lifetime as more applicable for dehumidifiers due to these different conditions. (MIAQ, No. 20 at p. 2)

For this NOPR analysis, DOE has included the estimates from MIAQ and other feedback from manufacturers in its lifetime distributions. For portable dehumidifiers, DOE incorporated additional average lifetime estimates from manufacturers indicating an average lifetime of 10 years. A previous estimate of an average lifetime of 12 years from the Northeast Energy Star Lighting and Appliance is no longer available online and thus not included in the lifetime estimates. For whole-home units, as described by MIAQ, dehumidifiers are subject to different operating conditions relative to other air conditioning equipment that could lead to a different average lifetime. For whole-home dehumidifiers, DOE used an average value of 12 years whole-home dehumidifiers based on MIAQ's comments.

7. Discount Rates

In the calculation of LCC, DOE applies discount rates appropriate to households to estimate the present value of future operating cost savings. DOE estimated a distribution of discount rates for dehumidifiers based on the opportunity cost of consumer funds.

DOE applies weighted average discount rates calculated from consumer debt and asset data, rather than marginal or implicit discount rates.[32] The LCC analysis estimates net present value over the lifetime of the product, so the appropriate discount rate will reflect the general opportunity cost of household funds, taking this time scale into account. Given the long time horizon modeled in the LCC analysis, the application of a marginal interest rate associated with an initial source of funds is inaccurate. Regardless of the method of purchase, consumers are expected to continue to rebalance their debt and asset holdings over the LCC analysis period, based on the restrictions consumers face in their debt payment requirements and the relative size of the interest rates available on debts and assets. DOE estimates the

[30] Coughlin, K. and B. Beraki. 2018. Residential Electricity Prices: A Review of Data Sources and Estimation Methods. Lawrence Berkeley National Laboratory. Berkeley, CA. Report No. LBNL–2001169. *ees.lbl.gov/publications/residential-electricity-prices-review.*

[31] EIA. *Annual Energy Outlook 2023.* Washington, DC. Available at *www.eia.gov/forecasts/aeo/* (accessed August 21, 2023).

[32] The implicit discount rate is inferred from a consumer purchase decision between two otherwise identical goods with different first cost and operating cost. It is the interest rate that equates the increment of first cost to the difference in net present value of lifetime operating cost, incorporating the influence of several factors: transaction costs; risk premiums and response to uncertainty; time preferences; and interest rates at which a consumer is able to borrow or lend. The implicit discount rate is not appropriate for the LCC analysis because it reflects a range of factors that influence consumer purchase decisions, rather than the opportunity cost of the funds that are used in purchases.

aggregate impact of this rebalancing using the historical distribution of debts and assets.

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. It 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 triennial Survey of Consumer Finances [33] (''SCF'') starting in 1995 and ending in 2019. Using the SCF and other sources, DOE 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 type, is 4.3 percent. See chapter 8 of the NOPR TSD for further details on the development of consumer discount rates.

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

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

In the June 2022 Preliminary Analysis, DOE used shipments-weighted efficiency data submitted by AHAM to estimate the efficiency distribution for portable dehumidifiers. DOE used these data in conjunction with the model counts from the Compliance Certification Database (''CCD'') database to assign market share to efficiency levels defined in the June 2022 Preliminary Analysis. DOE assumed an annual efficiency improvement of 0.25 percent to develop the efficiency distribution in the first year of compliance.

AHAM stated that model counts based on the CCD database are not an accurate proxy to estimate the efficiency distribution for portable dehumidifiers. AHAM suggested DOE use shipment-weighted data gathered from AHAM members. AHAM also noted that data from AHAM members indicated that 100 percent of shipments for Product Class 3 are at the baseline efficiency level and the one model in CCD meeting EL 2 is a whole-home dehumidifier. (AHAM, No. 22 at p. 7)

DOE thanks AHAM for providing shipments-weighted distributions and has included the data for establishing the efficiency distribution of portable dehumidifiers in 2022. DOE notes in response to AHAM's note on current market efficiency distribution that the no-new-standards case efficiency distribution used in the LCC is the projected efficiency distribution in the compliance year (2028) and includes the impact of market efficiency trends. For dehumidifiers, the efficiency trend employed by DOE is based on historical market trends towards more efficient products in response to ENERGY STAR criterion updates. The current ENERGY STAR specification 5.0 criterion were adopted in 2019. As indicated by ENERGY STAR shipments data, 94 percent of the dehumidifier market met ENERGY STAR levels in 2021, compared to 88 percent in 2020 and 80 percent in 2019. On October 10, 2023, EPA released the final recognition criteria for ENERGY STAR Most Efficient 2024, which meet or exceed the proposed standards in all product classes.[34] The expected publication of ENERGY STAR specification 6.0 for dehumidifiers in 2024 will likely continue to shift the dehumidifier market toward more efficient products in the absence of a standard. To account for this observed historical trend towards a higher average market efficiency in the absence of a new standard, DOE included an annual improvement of 0.25 percent in the average shipment-weighted IEF, based on trends observed for room air conditioners [35] and also used in the June 2016 Final Rule for dehumidifiers. For whole-home dehumidifiers, in the absence of shipments-weighted data, DOE has maintained the approach of using model counts from the CCD database for the estimation of efficiency distributions and included an annual improvement of 0.25 percent in average shipment-weighted IEF for the no-new-standards case.

DOE seeks data and comment on its efficiency distribution estimate and the assumption of an annual efficiency improvement of 0.25 percent and the expected market respond to updated ENERGY STAR 6.0 specifications.

The estimated market shares for the no-new-standards case for dehumidifiers in 2028 are shown in Tables IV.4 and IV.5. See chapter 8 of the NOPR TSD for further information on the derivation of the efficiency distributions.

TABLE IV.5—MARKET SHARE OF EACH EFFICIENCY LEVEL FOR PORTABLE DEHUMIDIFIERS FOR THE NO-NEW-STANDARDS CASE IN 2028

Product class	≤25.00 pints/day		25.01–50.00 pints/day		≥50.01 pints/day	
Product class market share	19.5%		77.9%		1.1%	
EL	Integrated energy factor (L/kWh)	Market share (%)	Integrated energy factor (L/kWh)	Market share (%)	Integrated energy factor (L/kWh)	Market share (%)
0	1.30	0	1.60	0	2.80	86
1	1.40	25	1.70	0	3.10	14
2	1.57	66	1.80	87	3.30	0
3	1.70	9	2.01	13	3.51	0
4	1.94	0	2.07	0	3.67	0
5	2.32	0	2.38	0	.....	.....

[33] U.S. Board of Governors of the Federal Reserve System. Survey of Consumer Finances. 1995, 1998, 2001, 2004, 2007, 2010, 2013, 2016, and 2019. Available at *www.federalreserve.gov/econresdata/scf/scfindex.htm* (last accessed February 22, 2023).

[34] Available at *https://www.energystar.gov/sites/default/files/asset/document/Dehumidifiers%20ENERGY%20STAR%20Most%20Efficient%202024%20Final%20Criteria.pdf.*

[35] Ganeshalingam, M., Ni, C., and Yang, H–C. 2021. A Retrospective Analysis of the 2011 Direct Final Rule for Room Air Conditioners. Lawrence Berkeley National Laboratory. LBNL-2001413.

TABLE IV.6—MARKET SHARE OF EACH EFFICIENCY LEVEL FOR WHOLE-HOME DEHUMIDIFIERS FOR THE NO-NEW-STANDARDS CASE IN 2028

Product class	≤8.0 cu ft case volume		>8.0 cu ft case volume	
Product class market share	1.2%		0.3%	
EL	Integrated energy factor (L/kWh)	Market share (%)	Integrated energy factor (L/kWh)	Market share (%)
0	1.77	8	2.41	54
1	2.09	14	2.70	46
2	2.22	74	3.30	0
3	2.39	4	3.81	0
4	.....	.....	4.17	0

The LCC Monte Carlo simulations draw from the efficiency distributions and randomly assign an efficiency to the dehumidifiers purchased by each sample household in the no-new-standards case. The resulting percent shares within the sample match the market shares in the efficiency distributions.

9. Payback Period Analysis

The payback period is the amount of time (expressed in years) it takes the consumer to recover the additional installed cost of more efficient products, compared to baseline products, through energy cost savings. Payback periods 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. DOE refers to this as a ''simple PBP'' because it does not consider changes over time in operating cost savings. The PBP calculation uses the same inputs as the LCC analysis when deriving first-year operating costs.

As noted previously, EPCA 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 calculating the energy savings in accordance with the applicable DOE test procedure, and multiplying those savings by the average energy price projection for the year in which compliance with the amended standards would be required.

G. Shipments Analysis

DOE uses projections of annual product shipments to calculate the national impacts of potential amended or new energy conservation standards on energy use, NPV, and future manufacturer cash flows.[36] 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.

DOE's stock accounting model is calibrated based on historical shipments for portable and whole-home dehumidifiers. In the June 2022 Preliminary Analysis, DOE used historical shipments provided by AHAM for portable dehumidifiers and assumed that whole-home dehumidifiers accounted for 1 percent of total dehumidifier shipments. In this NOPR analysis, DOE included 2022 shipments estimates for whole-home dehumidifiers based on feedback from manufacturers indicating whole-home dehumidifiers shipments account for 1.6 percent of the total dehumidifier market.

DOE's shipments model for dehumidifiers considers shipments to replace existing units and to first-time owners. To determine replacement shipments, DOE used survival probability distributions based on average lifetime estimates of 10 years for portable dehumidifiers and 12 years for whole-home dehumidifiers provided by manufacturers. To estimate shipments to first-time owners, DOE used projections of AEO2023 housing stock coupled with the historical shipments data. DOE's shipments projections include shipments reductions due to consumers that do not replace a failed unit.

DOE considers the impacts on shipments from changes in product purchase price associated with higher energy efficiency levels using a price elasticity. As in the June 2022 Preliminary Analysis, DOE employs a price elasticity of −0.45 in its shipments model. These values are based on analysis of aggregated data for five residential appliances.[37] The market impact is defined as the difference between the product of price elasticity of demand and the change in price due to a standard level.

When comparing the first cost of the efficiency level selected for PC1 and PC2 at each TSL, DOE considers that the difference of installed cost in standards case is not significant enough to warrant a product switching scenario that would result in a different market share distribution from the no-new-standards case. Given the small overall market share of PC3, DOE did not include a product switching scenario in the analysis. DOE assumed that consumers are unlikely to purchase multiple lower capacity units in place of a larger capacity unit as a result of a standard.

DOE seeks comment on the assumption that dehumidifier consumers' purchase decision are unlikely to change as a result of a standard.

H. National Impact Analysis

The NIA assesses the national energy savings (''NES'') and the NPV from a national perspective of total consumer costs and savings that would be expected to result from new or amended

[36] 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.

[37] Fujita, K. (2015) Estimating Price Elasticity using Market-Level Appliance Data. Lawrence Berkeley National Laboratory, LBNL–188289.

standards at specific efficiency levels.[38] (''Consumer'' in this context refers to consumers of the product being regulated.) DOE calculates the NES and NPV for the potential standard levels considered 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. For the present analysis, DOE projected the energy savings, operating cost savings, product costs, and NPV of consumer benefits over the lifetime of dehumidifiers sold from 2028 through 2057.

DOE evaluates the impacts of new or 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.

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.6 summarizes the inputs and methods DOE used for the NIA analysis for the NOPR. Discussion of these inputs and methods follows the table. See chapter 10 of the NOPR TSD for further details.

TABLE IV.7—SUMMARY OF INPUTS AND METHODS FOR THE NATIONAL IMPACT ANALYSIS

Inputs	Method
Shipments	Annual shipments from shipments model.
Compliance Date of Standard	2028.
Efficiency Trends	No-new-standards case: 0.25 percent annual increase in efficiency. Standards cases: Roll-up in compliance year to meet potential efficiency level.
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 projection 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 Price Trends	AEO2023 projections to 2050 and constant 2050 value thereafter.
Energy Site-to-Primary and FFC Conversion	A time-series conversion factor based on AEO2023.
Discount Rate	3 percent and 7 percent.
Present Year	2023.

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. 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 year of anticipated compliance with an amended or new standard. As described in section IV.F.8 of this document, the efficiency trend used in the no-new-standards case is based on historical market trends towards more efficient product in response to ENERGY STAR specifications. To account for the historical movement towards more efficient products in the market in the absence of a standard, DOE included an annual improvement of 0.25 percent in the average shipment-weighted IEF in each year of the analysis period shipments projection in the no-new-standards case. The approach is further described in chapter 10 of the NOPR 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 (2028). In this scenario, the market shares 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.

2. National Energy Savings

The national energy savings analysis involves a comparison of national energy consumption of the considered products between each TSL and the case with no new or amended energy conservation standards. DOE calculated the national energy consumption by multiplying the number of units (stock) of each product (by vintage or age) by the unit energy consumption (also by vintage). DOE calculated annual NES based on the difference in national energy consumption for the no-new standards case and for each higher efficiency standard case. DOE estimated energy consumption and savings based on site energy and converted the electricity consumption and savings to primary energy (*i.e.,* the energy consumed by power plants to generate site electricity) using annual conversion factors derived from AEO 2023. Cumulative energy savings are the sum of the NES for each year over the timeframe of the analysis.

Use of higher-efficiency products is sometimes associated with a direct rebound effect, which refers to an increase in utilization of the product due to the increase in efficiency. DOE did not find any data on the rebound effect specific to dehumidifiers and assumed no rebound in the NOPR analysis.

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

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 (Aug. 17, 2012). NEMS is a public domain, multi-sector, partial equilibrium model of the U.S. energy sector [39] that EIA uses to prepare its *Annual Energy Outlook.* The FFC factors incorporate losses in production and delivery in the case of natural gas (including fugitive emissions) and additional energy used to produce and deliver the various fuels used by power plants. The approach used for deriving FFC measures of energy use and emissions is described in appendix 10B of the NOPR TSD.

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 operating costs (energy costs and repair and maintenance 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 projection period.

As discussed in section IV.F.1 of this document, DOE developed dehumidifier price trends based on historical PPI data. DOE applied the same trends to project prices for each product class at each considered efficiency level. By 2057, which is the end date of the projection period, the average dehumidifier price is projected to drop 25 percent relative to 2028. DOE's projection of product prices is described in appendix 10C of the NOPR TSD.

To evaluate the effect of uncertainty regarding the price trend estimates, DOE investigated the impact of different product price projections on the consumer NPV for the considered TSLs for dehumidifiers. In addition to the default price trend, DOE considered two product price sensitivity cases: (1) a high price decline case and (2) a low price decline case. In the high price decline case, DOE used a faster price decline for the non-controls portion of the price derived from the same combined price index PPI data for dehumidifiers between 2005 and 2022. In the low price decline case, DOE used the same combined price index PPI data for dehumidifiers between 1983 and 1998. For both high and low price decline cases, DOE used the default price decline for variable-speed blower controls. The derivation of these price trends and the results of these sensitivity cases are described in appendix 10C of the NOPR TSD.

The energy cost savings 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 regional energy prices by the projection of annual national-average residential energy price changes in the Reference case from AEO2023, which has an end year of 2050. To estimate price trends after 2050, the 2050 value was used for all years. As part of the NIA, DOE also analyzed scenarios that used inputs from variants of the AEO2023 Reference case that have lower and higher economic growth. Those cases have lower and higher energy price trends compared to the Reference case. NIA results based on these cases are presented in appendix 10C of the NOPR TSD.

In calculating the NPV, DOE multiplies the net savings in future years by a discount factor to determine their present value. For this NOPR, 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.[40] 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 energy conservation standards on consumers, DOE evaluates the impact on identifiable subgroups of consumers that may be disproportionately affected by a new or amended national standard. The purpose of a subgroup analysis is to determine the extent of any such disproportional impacts. 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 NOPR, DOE analyzed the impacts of the considered standard levels on two subgroups: (1) low-income households and (2) senior-only households. The analysis used subsets of the RECS 2020 sample composed of households that meet the criteria for the two subgroups. DOE used the LCC and PBP spreadsheet model to estimate the impacts of the considered efficiency levels on these subgroups. Chapter 11 in the NOPR 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 projected 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 GRIM, an industry cash flow model with inputs specific to this proposed rulemaking.

[39] For more information on NEMS, refer to *The National Energy Modeling System: An Overview 2018,* DOE/EIA–0581(2018), April 2019. Available at *https://www.eia.gov/outlooks/aeo/nems/overview/pdf/0581(2018).pdf* (last accessed February 22, 2023).

[40] United States Office of Management and Budget. *Circular A–4: Regulatory Analysis.* September 17, 2003. Section E. Available at *https://www.whitehouse.gov/wp-content/uploads/legacy_drupal_files/omb/circulars/A4/a-4.pdf.*

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 standards cases (*i.e.,* TSLs). To capture the uncertainty relating to manufacturer pricing strategies following amended standards, the GRIM estimates a range of possible impacts under different manufacturer markup scenarios.

The qualitative part of the MIA addresses manufacturer characteristics and market trends. Specifically, the MIA considers such factors as a potential standard's impact on 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 NOPR TSD.

DOE conducted the MIA for this rulemaking in three phases. In Phase 1 of the MIA, DOE prepared a profile of the dehumidifier manufacturing industry based on the market and technology assessment, preliminary manufacturer interviews, and publicly available information. This included a top-down analysis of dehumidifier manufacturers that DOE used to derive preliminary financial inputs for the GRIM (*e.g.,* revenues; materials, labor, overhead, and depreciation expenses; selling, general, and administrative expenses (SG&A); and R&D expenses). DOE also used public sources of information to further calibrate its initial characterization of the dehumidifier manufacturing industry, including corporate annual reports, the U.S. Census Bureau's *Annual Survey of Manufactures* (*ASM*),[41] and reports from Dun & Bradstreet.[42]

In Phase 2 of the MIA, DOE prepared a framework 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. In general, energy conservation standards can affect manufacturer cash flow in three distinct ways: (1) creating a need for increased investment, (2) raising production costs per unit, and (3) altering revenue due to higher per-unit prices and changes in sales volumes.

In addition, during Phase 2, DOE developed interview guides to distribute to manufacturers of dehumidifiers in order to develop other key GRIM inputs, including product and capital conversion costs, and to gather additional information on the anticipated effects of energy conservation standards on revenues, direct employment, capital assets, industry competitiveness, and subgroup impacts.

In Phase 3 of the MIA, DOE conducted structured, detailed interviews with representative manufacturers. During these interviews, DOE discussed engineering, manufacturing, procurement, and financial topics to validate assumptions used in the GRIM and to identify key issues or concerns. See section IV.J.3 of this document for a description of the key issues raised by manufacturers during the interviews. As part of Phase 3, DOE also 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 may include small business manufacturers, low-volume manufacturers, niche players, and/or manufacturers exhibiting a cost structure that largely differs from the industry average. DOE identified one subgroup for a separate impact analysis: small business manufacturers. The small business subgroup is discussed in section VI.B of this document, ''Review under the Regulatory Flexibility Act'' and in chapter 12 of the NOPR TSD.

2. Government Regulatory Impact Model and Key Inputs

DOE uses the GRIM to quantify the changes in cash flow due to amended standards that result in a higher or lower industry value. The GRIM uses a standard, annual discounted cash-flow analysis that incorporates manufacturer costs, markups, shipments, and industry financial information as inputs. The GRIM models changes in costs, distribution of shipments, investments, and manufacturer margins that could result from an amended energy conservation standard. The GRIM spreadsheet uses the inputs to arrive at a series of annual cash flows, beginning in 2023 (the base year of the analysis) and continuing to 2057. DOE calculated INPVs by summing the stream of annual discounted cash flows during this period. For manufacturers of dehumidifiers, DOE used a real discount rate of 8.4 percent, which was derived from industry financials and then modified according to feedback received during manufacturer interviews.

The GRIM calculates cash flows using standard accounting principles and compares changes in INPV between the no-new-standards case and each standards case. The difference in INPV between the no-new-standards case and a standards case represents the financial impact of the amended energy conservation standard on manufacturers. As discussed previously, DOE developed critical GRIM inputs using a number of sources, including publicly available data, results of the engineering analysis, and information gathered from industry stakeholders during the course of manufacturer interviews. The GRIM results are presented in section V.B.2 of this document. Additional details about the GRIM, the discount rate, and other financial parameters can be found in chapter 12 of the NOPR TSD.

a. Manufacturer Production Costs

Manufacturing more efficient equipment is typically more expensive than manufacturing baseline equipment due to the use of more complex components, which are typically more costly than baseline components. The changes in the MPCs of covered products can affect the revenues, gross margins, and cash flow of the industry.

DOE typically uses one of two approaches to develop energy efficiency levels for the engineering analysis: (1) relying on observed efficiency levels in the market (*i.e.,* the efficiency-level approach), or (2) determining the incremental efficiency improvements associated with incorporating specific design options to a baseline model (*i.e.,* the design-option approach). In this proposed rulemaking, DOE relied on a combination of the efficiency-level approach and the design-option

[41] U.S. Census Bureau, *Annual Survey of Manufactures.* ''Summary Statistics for Industry Groups and Industries in the U.S (2021).'' Available at: *www.census.gov/data/tables/time-series/econ/asm/2018-2021-asm.html* (last accessed March 3, 2023).

[42] The Dun & Bradstreet Hoovers login is available at: *app.dnbhoovers.com* (last accessed March 3, 2023).

approach to develop cost estimates at each efficiency level for dehumidifiers, structured around the reverse engineering approach. The analysis involved reviewing publicly available cost and performance information, physically disassembling commercially available products and modeling equipment cost while removing costs associated with non-efficiency related components or features. DOE then considered the incremental steps manufacturers may take to reach higher efficiency levels. In its modeling, DOE started with the baseline MPC and added the expected design options at each higher efficiency level to estimate incremental MPCs. For a complete description of the MPCs, see section IV.C of this document or chapter 5 of the NOPR TSD.

b. Shipments Projections

The GRIM estimates manufacturer revenues based on total unit shipment projections and the distribution of those shipments by efficiency level. Changes in sales volumes and efficiency distributions over time can significantly affect manufacturer finances. For this analysis, the GRIM uses the NIA's annual shipment projections derived from the shipments analysis from 2023 (the base year) to 2057 (the end year of the analysis period). 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. DOE's stock accounting model is calibrated based on historical shipments for portable and whole-home dehumidifiers. See section IV.G of this document or chapter 9 of the NOPR TSD for additional details.

c. Capital and Product Conversion Costs

Amended energy conservation standards could cause manufacturers to incur conversion costs to bring their production facilities and equipment designs into compliance. DOE evaluated the level of conversion-related expenditures that would be needed to comply with each considered efficiency level in each product class. For the MIA, DOE classified these conversion costs into two major groups: (1) capital conversion costs; and (2) product conversion costs. Capital conversion costs are investments in property, plant, and equipment necessary to adapt or change existing production facilities such that new compliant product designs can be fabricated and assembled. Product conversion costs are investments in research, development, testing, marketing, and other non-capitalized costs necessary to make product designs comply with amended energy conservation standards.

DOE relied on feedback from manufacturer interviews and information from the product teardown and engineering analyses to estimate the capital investment required at each analyzed efficiency level. DOE asked manufacturers to estimate the capital conversion costs (*e.g.,* changes in production processes, equipment, and tooling) to implement the various design options. The data generated from the product teardown and engineering analyses were used to estimate the capital investment in equipment and tooling required of OEMs at each efficiency level, considering such factors as product design, raw materials, purchased components, and fabrication method. Changes in equipment and tooling were used to estimate capital conversion costs.

DOE relied on feedback from manufacturer interviews, the engineering analysis, and model counts from DOE's Compliance Certification Database (CCD) to evaluate the product conversion costs industry would likely incur at the considered standard levels. In interviews, DOE asked manufacturers to estimate the redesign effort and engineering resources required at various efficiency levels to quantify the product conversion costs. DOE integrated feedback from manufacturers on redesign effort and staffing to estimate product conversion cost. Manufacturer numbers were aggregated to protect confidential information. DOE used model counts to scale the feedback gathered in interviews to the overall dehumidifier industry.

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

d. Manufacturer Markup Scenarios

MSPs include direct manufacturing production costs (*i.e.,* labor, materials, and overhead 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 for each product class and efficiency level. Modifying these manufacturer markups in the standards case yields different sets of impacts on manufacturers. For the MIA, DOE modeled two standards-case scenarios to represent uncertainty regarding the potential impacts on prices and profitability for manufacturers following the implementation of amended energy conservation standards: (1) a preservation of gross margin percentage scenario; and (2) a preservation of operating profit scenario. These scenarios lead to different manufacturer markup values that, when applied to the MPCs, result in varying revenue and cash flow impacts.

Under the preservation of gross margin percentage scenario, DOE applied a single uniform ''gross margin percentage'' markup across all efficiency levels, which assumes that manufacturers would be able to maintain the same amount of profit as a percentage of revenues at all efficiency levels within a product class. As manufacturer production costs increase with efficiency, this scenario implies that the per-unit dollar profit will increase. DOE assumed a gross margin percentage of 29 percent for all product classes.[43] Manufacturers tend to believe it is optimistic to assume that they would be able to maintain the same gross margin percentage as their production costs increase, particularly for minimally efficient products. Therefore, this scenario represents an upper bound of industry profitability under an amended energy conservation standard.

In the preservation of operating profit scenario, as the cost of production goes up under a standards case, manufacturers are generally required to reduce their manufacturer markups to a level that maintains base-case operating profit. DOE implemented this scenario in the GRIM by lowering the manufacturer markups at each TSL to yield approximately the same earnings before interest and taxes in the standards case as in the no-new-standards case in the year after the expected compliance date of the amended standards. The implicit assumption behind this scenario is that the industry can only maintain its operating profit in absolute dollars after the standard takes effect.

A comparison of industry financial impacts under the two markup scenarios is presented in section V.B.2.a of this document.

[43] The gross margin percentage of 29 percent is based on a manufacturer markup of 1.40.

3. Manufacturer Interviews

DOE interviewed manufacturers representing approximately 52 percent of industry shipments. Participants included both foreign and domestic OEMs with varying market shares and product class offerings.

In interviews, DOE asked manufacturers to describe their major concerns regarding potential more stringent energy conservation standards for dehumidifiers. The following section highlights manufacturer concerns that helped inform the projected potential impacts of an amended standard on the industry. Manufacturer interviews are conducted under non-disclosure agreements (NDAs), so DOE does not document these discussions in the same way that it does public comments in the comment summaries and DOE's responses throughout the rest of this document.

a. Increases in Chassis Size

In interviews, manufacturers expressed concern about efficiency levels that would necessitate increasing the chassis size to accommodate larger heat exchangers. First, these manufacturers stated that increasing the chassis size would require significant capital investment and engineering time to fully redesign their portfolio of dehumidifier models. Second, manufacturers stated that increasing the chassis size would add significant product costs, which would likely lead to lower sales volumes if consumers are not willing to pay for the higher upfront cost. Third, manufacturers of portable dehumidifiers with overseas production facilities expressed concern that increasing the chassis or cabinet size would negatively impact the loading capacity of the shipping container and increase shipping costs. Finally, some portable dehumidifier manufacturers expressed concern that the 3-year compliance period would be insufficient to develop cost-optimized models with new chassis designs to accommodate larger heat exchangers across their entire product portfolio.

b. Refrigerant Regulation

In interviews, manufacturers noted that new refrigerant regulations restrict the use of high-global warming potential (GWP) refrigerants in dehumidifiers, which increases cumulative regulatory burden. Specifically, during interviews, manufacturers discussed State regulations, such as CARB's rulemaking prohibiting the use of refrigerants with a GWP of 750 or greater starting January 1, 2023 for self-contained, residential dehumidifiers and starting January 1, 2025 for whole-home dehumidifiers.[44] [45] Most manufacturers of portable dehumidifiers noted that they would likely transition to R–32, which is a classified as a flammable refrigerant.[46] A whole-home manufacturer expressed uncertainty about the choice of low-GWP refrigerants but noted that the various alternative refrigerant options being considered are also classified as flammable refrigerants. All manufacturers interviewed stated that transitioning to a low-GWP refrigerant requires notable engineering time and capital investment to update production facilities to accommodate flammable refrigerants. Some portable dehumidifier manufacturers with experience transitioning other products (*e.g.,* portable air conditioners) to make use of R–32 stated that the dehumidifier transition would be relatively straightforward given their prior experience with R–32. In interviews, manufacturers indicated that they had already started the development process but were waiting on EPA to finalize its SNAP proposed rule before starting production of dehumidifiers with low-GWP refrigerants. EPA has since finalized the SNAP rule allowing for the use of R–32. *See* 88 FR 26382.

4. Discussion of MIA Comments

In response to the June 2022 Preliminary Analysis, AHAM requested that DOE consider the impacts of tariffs on manufacturers, noting that manufacturers currently pay an additional 25 percent tariff under the China Section 301 tariffs for importing dehumidifiers on top of existing excise taxes and tariffs. According to AHAM, shipping costs are also impacted due to the shortage in shipping containers and lack of availability of transport to deliver manufactured products. (AHAM, No. 22 at pp. 3–4)

Based on information from manufacturer interviews and a review of model listings from DOE's CCD, DOE assumes nearly all portable units with 25.00 pints/day or less (Product Class 1) and portable units with 25.01 to 50.00 pints/day (Product Class 2) are manufactured in Asia. DOE also assumes that 50 percent of portable units greater than 50.00 pints/day (Product Class 3) and 20 percent of whole-home units (Product Classes 4 and 5) are manufactured in Asia. Regarding U.S. tariffs on Chinese imports, DOE is aware that the Section 301 tariffs on dehumidifiers increased to 10 percent in September 2018 and to 25 percent in May 2019. As result of tariffs, DOE expects that manufactures will begin to shift production of these products to countries in East Asia and Southeast Asia not subject to Section 301 tariffs. However, due to uncertainty about the exact countries of origin, DOE's engineering analysis continues to rely on data based on a Chinese point of origin. To revise MPCs to account for points of origin outside of China, DOE would require information on the countries of manufacture and 5-year averages for key inputs used to develop manufacturer production costs, such as fully-burdened production labor wage rates and local raw material prices.

To better model the impact of Section 301 tariffs on dehumidifiers that continue to be manufactured in China, DOE requires additional information about the portion of products still manufactured there and how the tariffs are absorbed by the entities along the room AC value chain, such as the foreign OEMs, U.S. importers, retailers, and consumers. Increases in retail price may affect consumer purchasing decisions, as captured by the price sensitivity modeled in the shipments analysis. Furthermore, DOE considers the costs of overseas and domestic shipping in its calculation of consumer price used in the LCC and PBP analyses.

AHAM stated that manufacturers will face significant retooling and redesign costs if existing chassis sizes are insufficient to implement the technology options specified in the June 2022 Preliminary Analysis. (AHAM, No. 22 at p. 3)

DOE used results of the product teardown and engineering analyses as well as feedback from confidential manufacturer interviews to estimate the capital and product conversion costs required to reach each analyzed efficiency level, which included design options that would require a change in chassis size. See section IV.J.2.c of this document for a discussion on the conversion cost methodology and

[44] State of California Air Resource Board, ''Prohibitions on Use of Certain Hydrofluorocarbons in Stationary Refrigeration, Chillers, Aerosols-Propellants, and Foam End-Uses Regulation.'' Amendments effective January 1, 2022. *ww2.arb.ca.gov/sites/default/files/barcu/regact/2020/hfc2020/frorevised.pdf* (last accessed March 4, 2023).

[45] In a public hearing to consider the proposed amendments to the Prohibitions on the Use of Certain Hydrofluorocarbons in Stationary Refrigeration, Chillers, Aerosols-Propellants, and Foam End-Uses regulation, CARB stated that a whole home dehumidifier would be regulated as ''Other Air-Conditioning Equipment'' with a regulation effective date of January 1, 2025, and not as a ''Residential Dehumidifier,'' which is both self-contained and portable. Public hearing date December 10, 2020. Agenda item number: 20–13–4. *ww2.arb.ca.gov/sites/default/files/barcu/regact/2020/hfc2020/fsorrevised.pdf* (last accessed March 4, 2023).

[46] R–32 is classified as an A2L refrigerant. The A2L class defines refrigerants that are nontoxic, but mildly flammable.

section V.B.2.a of this document for a description of conversion costs by TSL.

MIAQ stated that in addition to small business manufacturers, refrigerant desiccant dehumidifier manufacturers could also be disproportionally affected by amended energy conservation standards for dehumidifiers. (MIAQ, No. 20 at pp. 5–6)

At the time of this NOPR analysis, DOE is not aware of any consumer refrigerant desiccant dehumidifiers currently available on the market. However, DOE tentatively expects that manufacturers of refrigerant desiccant dehumidifiers would follow a similar design path as pure refrigerant-based whole-home dehumidifiers if they were to introduce new models of consumer refrigerant desiccant dehumidifiers to the market. Thus, DOE tentatively determined that the industry analysis reasonably represents the potential impacts to refrigerant desiccant dehumidifier manufacturers.

DOE requests comment on its tentative conclusion that refrigerant desiccant dehumidifier manufacturers would be similarly impacted by potential amended standards and therefore would not warrant a separate subgroup analysis.

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 other gases due to ''upstream'' activities in the fuel production chain. These upstream activities comprise extraction, processing, and transporting fuels to the site of combustion.

The analysis of electric power sector emissions of CO_2, NO_X, SO_2, and Hg uses emissions factors intended to represent the marginal impacts of the change in electricity consumption associated with amended or new standards. The methodology is based on results published for the AEO, including a set of side cases that implement a variety of efficiency-related policies. The methodology is described in appendix 13A in the NOPR TSD. The analysis presented in this document uses projections from AEO2023. Power sector emissions of CH_4 and N_2O from fuel combustion are estimated using Emission Factors for Greenhouse Gas Inventories published by the Environmental Protection Agency (EPA).[47] FFC upstream emissions, which include emissions from fuel combustion during extraction, processing, and transportation of fuels, and ''fugitive'' emissions (direct leakage to the atmosphere) of CH_4 and CO_2, are estimated based on the methodology described in chapter 15 of the NOPR TSD.

The emissions intensity factors are expressed in terms of physical units per megawatt hour (MWh) or metric million British thermal unit MMBtu of site energy savings. For power sector emissions, specific emissions intensity factors are calculated by sector and end use. Total emissions reductions are estimated using the energy savings calculated in the national impact analysis.

1. Air Quality Regulations Incorporated in DOE's Analysis

DOE's no-new-standards case for the electric power sector reflects the AEO, which incorporates the projected impacts of existing air quality regulations on emissions. AEO2023 reflects, to the extent possible, laws and regulations adopted through mid-November 2022, including the emissions control programs discussed in the following paragraphs and the Inflation Reduction Act.[48]

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 numerous States in the eastern half of the United States are also limited under the Cross-State Air Pollution Rule (''CSAPR''). 76 FR 48208 (Aug. 8, 2011). CSAPR requires these States to reduce certain emissions, including annual SO_2 emissions, and went into effect as of January 1, 2015.[49] The AEO incorporates implementation of CSAPR, including the update to the CSAPR ozone season program emission budgets and target dates issued in 2016. 81 FR 74504 (Oct. 26, 2016). Compliance with CSAPR is flexible among EGUs and is enforced through the use of tradable emissions allowances. 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 another regulated EGU.

However, beginning in 2016, SO_2 emissions began to fall as a result of the Mercury and Air Toxics Standards (''MATS'') for power plants. 77 FR 9304 (Feb. 16, 2012). Because of the emissions reductions under the MATS, 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 another regulated EGU. Therefore, energy conservation standards that decrease electricity generation would generally reduce SO_2 emissions. DOE estimated SO_2 emissions reduction using emissions factors based on AEO2023.

CSAPR also established limits on NO_X emissions for numerous States in the eastern half of the United States. Energy conservation standards would have little effect on NO_X emissions in those States covered by CSAPR emissions limits if excess NO_X emissions allowances resulting from the lower electricity demand could be used to permit offsetting increases in NO_X emissions from other EGUs. In such case, NO_X emissions would remain near the limit even if electricity generation goes down. A different case could possibly result, depending on the configuration of the power sector in the different regions and the need for allowances, such that NO_X emissions might not remain at the limit in the case of lower electricity demand. In this case, energy conservation standards might reduce NO_X emissions in covered States. Despite this possibility, DOE has chosen to be conservative in its analysis and has maintained the assumption that standards will not reduce NO_X emissions in States covered by CSAPR. Energy conservation standards would be expected to reduce NO_X emissions in the States not covered by CSAPR. DOE used AEO2023 data to derive NO_X

[47] Available at *www.epa.gov/sites/production/files/2021-04/documents/emission-factors_apr2021.pdf* (last accessed July 12, 2021).

[48] For further information, see the *Assumptions to AEO2023* report that sets forth the major assumptions used to generate the projections in the *Annual Energy Outlook 2023.* Available at *www.eia.gov/outlooks/aeo/assumptions/* (last accessed August 21, 2023).

[49] CSAPR requires states to address annual emissions of SO_2 and NO_X, precursors to the formation of fine particulate matter ($PM_{2.5}$) pollution, in order to address the interstate transport of pollution with respect to the 1997 and 2006 $PM_{2.5}$ National Ambient Air Quality Standards (''NAAQS''). CSAPR also requires certain states to address the ozone season (May–September) emissions of NO_X, a precursor to the formation of ozone pollution, in order to address the interstate transport of ozone pollution with respect to the 1997 ozone NAAQS. 76 FR 48208 (Aug. 8, 2011). EPA subsequently issued a supplemental rule that included an additional five states in the CSAPR ozone season program. 76 FR 80760 (Dec. 27, 2011) (Supplemental Rule).

emissions factors for the group of States not covered by CSAPR.

The MATS limit mercury emissions from power plants, but they do not include emissions caps and, as such, DOE's energy conservation standards would be expected to slightly reduce Hg emissions. DOE estimated mercury emissions reduction using emissions factors based on AEO2023, which incorporates the MATS.

L. Monetizing Emissions Impacts

As part of the development of this proposed rule, for the purpose of complying with the requirements of Executive Order (''E.O.'') 12866, DOE considered the estimated monetary benefits from the reduced emissions of CO_2, CH_4, N_2O, NO_X, and SO_2 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 projection period for each TSL. This section summarizes the basis for the values used for monetizing the emissions benefits and presents the values considered in this NOPR.

To monetize the benefits of reducing GHG emissions this analysis uses the interim estimates presented in the Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates Under Executive Order 13990 published in February 2021 by the Interagency Working Group on the Social Cost of Greenhouse Gases (IWG).

DOE requests comment on how to address the climate benefits and other effects of the proposal.

1. Monetization of Greenhouse Gas Emissions

DOE estimates the monetized benefits of the reductions in emissions of CO_2, CH_4, and N_2O by using a measure of the social cost (''SC'') of each pollutant *(e.g.,* SC–CO_2). These estimates represent the monetary value of the net harm to society associated with a marginal increase in emissions of these pollutants in a given year, or the benefit of avoiding that increase. These estimates are intended to include (but are not limited to) climate change-related changes in net agricultural productivity, human health, property damages from increased flood risk, disruption of energy systems, risk of conflict, environmental migration, and the value of ecosystem services.

DOE exercises its own judgment in presenting monetized climate benefits as recommended by applicable executive orders, and DOE would reach the same conclusion presented in this proposed rulemaking in the absence of the social cost of greenhouse gases. That is, the social costs of greenhouse gases, whether measured using the February 2021 interim estimates presented by the Interagency Working Group on the Social Cost of Greenhouse Gases or by another means, did not affect the rule ultimately proposed by DOE.

DOE estimated the global social benefits of CO_2, CH_4, and N_2O reductions *(i.e.,* SC–GHGs) using the estimates presented in the Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under E.O. 13990, published in February 2021 by the IWG (''February 2021 SC–GHG TSD''). The SC–GHGs is the monetary value of the net harm to society associated with a marginal increase in emissions in a given year, or the benefit of avoiding that increase. In principle, SC–GHGs includes the value of all climate change impacts, including (but not limited to) changes in net agricultural productivity, human health effects, property damage from increased flood risk and natural disasters, disruption of energy systems, risk of conflict, environmental migration, and the value of ecosystem services. The SC–GHGs therefore reflects the societal value of reducing emissions of the gas in question by one metric ton. The SC–GHGs is the theoretically appropriate value to use in conducting benefit-cost analyses of policies that affect CO_2, N_2O, and CH_4 emissions. As a member of the IWG involved in the development of the February 2021 SC–GHG TSD, DOE agrees that the interim SC–GHG estimates represent the most appropriate estimate of the SC–GHG until revised estimates have been developed reflecting the latest peer-reviewed science.

The SC–GHG estimates presented in this NOPR were developed over many years using a transparent process, the best science available at the time of that process, peer-reviewed methodologies, and input from the public. Specifically, in 2009, the IWG—which included the DOE and other executive branch agencies and offices—was established to ensure that agencies were using the best available science and to promote consistency in the social cost of carbon (''SC–CO_2'') values used across agencies. The IWG published SC–CO_2 estimates in 2010 that were developed from an ensemble of three widely cited integrated assessment models (''IAMs'') that estimate global climate damages using highly aggregated representations of climate processes and the global economy combined into a single modeling framework. The three IAMs were run using a common set of input assumptions in each model for future population, economic, and CO_2 emissions growth, as well as equilibrium climate sensitivity—a measure of the globally averaged temperature response to increased atmospheric CO_2 concentrations. These estimates were updated in 2013 based on new versions of each IAM. In August 2016, the IWG published estimates of the social cost of methane (''SC–CH_4'') and nitrous oxide (''SC–N_2O'') using methodologies that are consistent with the methodology underlying the SC–CO_2 estimates. The modeling approach that extends the IWG SC–CO_2 methodology to non-CO_2 GHGs has undergone multiple stages of peer review. The SC–CH_4 and SC–N_2O estimates were developed by Marten *et al.*[50] and underwent a standard double-blind peer review process prior to journal publication. In 2015, as part of the response to public comments received to a 2013 solicitation for comments on the SC–CO_2 estimates, the IWG announced a National Academies of Sciences, Engineering, and Medicine (''National Academies'') review of the SC–CO_2 estimates to offer advice on how to approach future updates to ensure that the estimates continue to reflect the best available science and methodologies. In January 2017, the National Academies released their final report, Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide, and recommended specific criteria for future updates to the SC–CO_2 estimates, a modeling framework to satisfy the specified criteria, and both near-term updates and longer-term research needs pertaining to various components of the estimation process.[51] Shortly thereafter, in March 2017, President Trump issued E.O. 13783, which disbanded the IWG, withdrew the previous TSDs, and directed agencies to ensure SC–CO_2 estimates used in regulatory analyses are consistent with the guidance contained in OMB's Circular A–4, ''including with respect to the consideration of domestic versus international impacts and the consideration of appropriate discount

[50] Marten, A.L., E.A. Kopits, C.W. Griffiths, S.C. Newbold, and A. Wolverton. Incremental CH_4 and N_2O mitigation benefits consistent with the US Government's SC–CO_2 estimates. *Climate Policy.* 2015. 15(2): pp. 272–298.

[51] National Academies of Sciences, Engineering, and Medicine. *Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide.* 2017. The National Academies Press: Washington, DC.

rates'' (E.O. 13783, Section 5(c)). Benefit-cost analyses following E.O. 13783 used SC–GHG estimates that attempted to focus on the U.S.-specific share of climate change damages as estimated by the models and were calculated using two discount rates recommended by Circular A–4: 3-percent and 7-percent. All other methodological decisions and model versions used in SC–GHG calculations remained the same as those used by the IWG in 2010 and 2013, respectively.

On January 20, 2021, President Biden issued E.O. 13990, which re-established the IWG and directed it to ensure that the U.S. Government's estimates of the social cost of carbon and other greenhouse gases reflect the best available science and the recommendations in the National Academies 2017 report. The IWG was tasked with first reviewing the SC–GHG estimates currently used in Federal analyses and publishing interim estimates within 30 days of the E.O. that reflect the full impact of GHG emissions, including by taking global damages into account. The interim SC–GHG estimates published in February 2021 are used here to estimate the climate benefits for this proposed rulemaking. The E.O. instructs the IWG to undertake a fuller update of the SC–GHG estimates that takes into consideration the advice of the National Academies 2017 report and other recent scientific literature. The February 2021 SC–GHG TSD provides a complete discussion of the IWG's initial review conducted under E.O. 13990. In particular, the IWG found that the SC–GHG estimates used under E.O. 13783 fail to reflect the full impact of GHG emissions in multiple ways.

First, the IWG found that the SC–GHG estimates used under E.O. 13783 fail to fully capture many climate impacts that affect the welfare of U.S. citizens and residents, and those impacts are better reflected by global measures of the SC–GHG. Examples of omitted effects from the E.O. 13783 estimates include direct effects on U.S. citizens, assets, and investments located abroad, supply chains, U.S. military assets and interests abroad, and tourism, and spillover pathways such as economic and political destabilization and global migration that can lead to adverse impacts on U.S. national security, public health, and humanitarian concerns. In addition, assessing the benefits of U.S. GHG mitigation activities requires consideration of how those actions may affect mitigation activities by other countries, as those international mitigation actions will provide a benefit to U.S. citizens and residents by mitigating climate impacts that affect U.S. citizens and residents. A wide range of scientific and economic experts have emphasized the issue of reciprocity as support for considering global damages of GHG emissions. If the United States does not consider impacts on other countries, it is difficult to convince other countries to consider the impacts of their emissions on the United States. The only way to achieve efficient allocation of resources for emissions reduction on a global basis—and so benefit the U.S. and its citizens—is for all countries to base their policies on global estimates of damages. As a member of the IWG involved in the development of the February 2021 SC–GHG TSD, DOE agrees with this assessment and, therefore, in this proposed rule DOE centers attention on a global measure of SC–GHG. This approach is the same as that taken in DOE regulatory analyses from 2012 through 2016. A robust estimate of climate damages that accrue only to U.S. citizens and residents does not currently exist in the literature. As explained in the February 2021 TSD, existing estimates are both incomplete and an underestimation of total damages that accrue to the citizens and residents of the U.S. because they do not fully capture the regional interactions and spillovers discussed above, nor do they include all of the important physical, ecological, and economic impacts of climate change recognized in the climate change literature. As noted in the February 2021 SC–GHG TSD, the IWG will continue to review developments in the literature, including more robust methodologies for estimating a U.S.-specific SC–GHG value, and explore ways to better inform the public of the full range of carbon impacts. As a member of the IWG, DOE will continue to follow developments in the literature pertaining to this issue.

Second, the IWG found that the use of the social rate of return on capital (7 percent under current OMB Circular A–4 guidance) to discount the future benefits of reducing GHG emissions inappropriately underestimates the impacts of climate change for the purposes of estimating the SC–GHG. Consistent with the findings of the National Academies and the economic literature, the IWG continued to conclude that the consumption rate of interest is the theoretically appropriate discount rate in an intergenerational context,[52] and recommended that discount rate uncertainty and relevant aspects of intergenerational ethical considerations be accounted for in selecting future discount rates.

Furthermore, the damage estimates developed for use in the SC–GHG are estimated in consumption-equivalent terms, and so an application of OMB Circular A–4's guidance for regulatory analysis would then use the consumption discount rate to calculate the SC–GHG. DOE agrees with this assessment and will continue to follow developments in the literature pertaining to this issue. DOE also notes that while OMB Circular A–4, as published in 2003, recommends using 3-percent and 7-percent discount rates as ''default'' values, Circular A–4 also reminds agencies that ''different regulations may call for different emphases in the analysis, depending on the nature and complexity of the regulatory issues and the sensitivity of the benefit and cost estimates to the key assumptions.'' On discounting, Circular A–4 recognizes that ''special ethical considerations arise when comparing benefits and costs across generations,'' and Circular A–4 acknowledges that analyses may appropriately ''discount future costs and consumption benefits . . . at a lower rate than for intragenerational analysis.'' In the 2015 Response to Comments on the Social Cost of Carbon for Regulatory Impact Analysis, OMB, DOE, and the other IWG members recognized that ''Circular A–4 is a living document'' and ''the use of 7 percent is not considered appropriate for intergenerational discounting. There is wide support for this view in the academic literature, and it is recognized in Circular A–4 itself.'' Thus, DOE

[52] Interagency Working Group on Social Cost of Carbon, United States Government. Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. 2010. Available at *www.epa.gov/sites/default/files/2016-12/documents/scc_tsd_2010.pdf* (last accessed April 15, 2022); Interagency Working Group on Social Cost of Carbon, United States Government. Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order No. 12866. 2013. Available at *www.federalregister.gov/documents/2013/11/26/2013-28242/technical-support-document-technical-update-of-the-social-cost-of-carbon-for-regulatory-impact* (last accessed April 15, 2022); Interagency Working Group on Social Cost of Greenhouse Gases, United States Government. Technical Support Document: Technical Update on the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. August 2016. Available at *www.epa.gov/sites/default/files/2016-12/documents/sc_co2_tsd_august_2016.pdf* (last accessed January 18, 2022); Interagency Working Group on Social Cost of Greenhouse Gases, United States Government. Addendum to Technical Support Document on Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866: Application of the Methodology to Estimate the Social Cost of Methane and the Social Cost of Nitrous Oxide. August 2016. *www.epa.gov/sites/default/files/2016-12/documents/addendum_to_sc-ghg_tsd_august_2016.pdf* (last accessed January 18, 2022).

concludes that a 7-percent discount rate is not appropriate to apply to value the social cost of greenhouse gases in the analysis presented in this analysis.

To calculate the present and annualized values of climate benefits, DOE uses the same discount rate as the rate used to discount the value of damages from future GHG emissions, for internal consistency. That approach to discounting follows the same approach that the February 2021 TSD recommends ''to ensure internal consistency—*i.e.,* future damages from climate change using the SC–GHG at 2.5 percent should be discounted to the base year of the analysis using the same 2.5 percent rate.'' DOE has also consulted the National Academies' 2017 recommendations on how SC–GHG estimates can ''be combined in RIAs with other cost and benefits estimates that may use different discount rates.'' The National Academies reviewed several options, including ''presenting all discount rate combinations of other costs and benefits with [SC–GHG] estimates.''

As a member of the IWG involved in the development of the February 2021 SC–GHG TSD, DOE agrees with the above assessment and will continue to follow developments in the literature pertaining to this issue. While the IWG works to assess how best to incorporate the latest peer-reviewed science to develop an updated set of SC–GHG estimates, it set the interim estimates to be the most recent ones developed by the IWG prior to the group being disbanded in 2017. The estimates rely on the same models and harmonized inputs and are calculated using a range of discount rates. As explained in the February 2021 SC–GHG TSD, the IWG has recommended that agencies revert to the same set of four values drawn from the SC–GHG distributions based on three discount rates as were used in regulatory analyses between 2010 and 2016 and were subject to public comment. For each discount rate, the IWG combined the distributions across models and socioeconomic emissions scenarios (applying equal weight to each) and then selected a set of four values recommended for use in benefit-cost analyses: an average value resulting from the model runs for each of three discount rates (2.5-percent, 3-percent, and 5-percent), plus a fourth value, selected as the 95th percentile of estimates based on a 3-percent discount rate. The fourth value was included to provide information on potentially higher-than-expected economic impacts from climate change. As explained in the February 2021 SC–GHG TSD, and DOE agrees, this update reflects the immediate need to have an operational SC–GHG for use in regulatory benefit-cost analyses and other applications developed using a transparent process, the science available at the time of that process, and peer-reviewed methodologies. Those estimates were subject to public comment in the context of dozens of proposed rulemakings as well as in a dedicated public comment period in 2013.

There are a number of limitations and uncertainties associated with the SC–GHG estimates. First, the current scientific and economic understanding of discounting approaches suggests discount rates appropriate for intergenerational analysis in the context of climate change are likely to be less than 3 percent, near 2 percent, or lower.[53] Second, the IAMs used to produce these interim estimates do not include all of the important physical, ecological, and economic impacts of climate change recognized in the climate change literature and the science underlying their ''damage functions'' (*i.e.,* the core parts of the IAMs that map global mean temperature changes and other physical impacts of climate change into economic (both market and nonmarket) damages) lags behind the most recent research. For example, limitations include the incomplete treatment of catastrophic and non-catastrophic impacts in the integrated assessment models, their incomplete treatment of adaptation and technological change, the incomplete way in which inter-regional and intersectoral linkages are modeled, uncertainty in the extrapolation of damages to high temperatures, and inadequate representation of the relationship between the discount rate and uncertainty in economic growth over long time horizons. Likewise, the socioeconomic and emissions scenarios used as inputs to the models do not reflect new information from the last decade of scenario generation or the full range of projections. The modeling limitations do not all work in the same direction in terms of their influence on the SC–CO_2 estimates. However, as discussed in the February 2021 TSD, the IWG has recommended that, taken together, the limitations suggest that the interim SC–GHG estimates used in this proposed rule likely underestimate the damages from GHG emissions. DOE concurs with this assessment.

DOE's derivations of the SC–CO_2, SC–N_2O, and SC–CH_4 values used for this NOPR are discussed in the following sections, and the results of DOE's analyses estimating the benefits of the reductions in emissions of these GHGs are presented in section V.B.6 of this document.

a. Social Cost of Carbon

The SC–CO_2 values used for this final rule were based on the values developed for the IWG's February 2021 TSD, which are shown in Table IV.7 in five-year increments from 2020 to 2050. The set of annual values that DOE used, which was adapted from estimates published by EPA,[54] is presented in appendix 14A of the NOPR TSD. These estimates are based on methods, assumptions, and parameters identical to the estimates published by the IWG (which were based on EPA modeling), and include values for 2051 to 2070. DOE expects additional climate benefits to accrue for products still operating after 2070, but a lack of available SC–CO_2 estimates for emissions years beyond 2070 prevents DOE from monetizing these potential benefits in this analysis.

[53] Interagency Working Group on Social Cost of Greenhouse Gases (IWG). 2021. Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990. February. United States Government. Available at *https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf.*

[54] *See* EPA, Revised 2023 and Later Model Year Light-Duty Vehicle GHG Emissions Standards: Regulatory Impact Analysis, Washington, DC, December 2021. Available at *nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1013ORN.pdf* (last accessed February 21, 2023).

TABLE IV.8—ANNUAL SC–CO_2 VALUES FROM 2021 INTERAGENCY UPDATE, 2020–2050

[2020$ per metric ton CO_2]

Year	Discount rate and statistic			
	5%	3%	2.5%	3%
	Average	Average	Average	95th percentile
2020	14	51	76	152
2025	17	56	83	169
2030	19	62	89	187
2035	22	67	96	206
2040	25	73	103	225
2045	28	79	110	242
2050	32	85	116	260

DOE multiplied the CO_2 emissions reduction estimated for each year by the SC–CO_2 value for that year in each of the four cases. DOE adjusted the values to 2022$ using the implicit price deflator for GDP from the Bureau of Economic Analysis. 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 SC–CO_2 values in each case.

b. Social Cost of Methane and Nitrous Oxide

The SC–CH_4 and SC–N_2O values used for this NOPR were based on the values developed for the February 2021 TSD. Table IV.8 shows the updated sets of SC–CH_4 and SC–N_2O estimates from the latest interagency update in 5-year increments from 2020 to 2050. The full set of annual values used is presented in appendix 14A of the NOPR TSD. To capture the uncertainties involved in regulatory impact analysis, DOE has determined it is appropriate to include all four sets of SC–CH_4 and SC–N_2O values, as recommended by the IWG. DOE derived values after 2050 using the approach described above for the SC–CO_2 values.

TABLE IV.9—ANNUAL SC–CH_4 AND SC–N_2O VALUES FROM 2021 INTERAGENCY UPDATE, 2020–2050

[2020$ per metric ton]

Year	SC–CH_4				SC–N_2O			
	Discount rate and statistic				Discount rate and statistic			
	5%	3%	2.5%	3%	5%	3%	2.5%	3%
	Average	Average	Average	95th percentile	Average	Average	Average	95th percentile
2020	670	1,500	2,000	3,900	5,800	18,000	27,000	48,000
2025	800	1,700	2,200	4,500	6,800	21,000	30,000	54,000
2030	940	2,000	2,500	5,200	7,800	23,000	33,000	60,000
2035	1,100	2,200	2,800	6,000	9,000	25,000	36,000	67,000
2040	1,300	2,500	3,100	6,700	10,000	28,000	39,000	74,000
2045	1,500	2,800	3,500	7,500	12,000	30,000	42,000	81,000
2050	1,700	3,100	3,800	8,200	13,000	33,000	45,000	88,000

DOE multiplied the CH_4 and N_2O emissions reduction estimated for each year by the SC–CH_4 and SC–N_2O estimates for that year in each of the cases. DOE adjusted the values to 2022$ using the implicit price deflator for GDP from the Bureau of Economic Analysis. To calculate a present value of the stream of monetary values, DOE discounted the values in each of the cases using the specific discount rate that had been used to obtain the SC–CH_4 and SC–N_2O estimates in each case.

2. Monetization of Other Emissions Impacts

For the NOPR, DOE estimated the monetized value of NO_X and SO_2 emissions reductions from electricity generation using the latest benefit per ton estimates for that sector from the EPA's Benefits Mapping and Analysis Program.[55] DOE used EPA's values for $PM_{2.5}$-related benefits associated with NO_X and SO_2 and for ozone-related benefits associated with NO_X for 2025, 2030, and 2040, calculated with discount rates of 3-percent and 7-percent. DOE used linear interpolation to define values for the years not given in the 2025 to 2040 period; for years beyond 2040, the values are held constant. DOE combined the EPA regional benefit-per-ton estimates with regional information on electricity consumption and emissions from *AEO2023* to define weighted-average national values for NO_X and SO_2 (see appendix 14B of the NOPR TSD).

[55] U.S. Environmental Protection Agency. Estimating the Benefit per Ton of Reducing Directly-Emitted $PM_{2.5}$,$PM_{2.5}$ Precursors and Ozone Precursors from 21 Sectors. *www.epa.gov/benmap/estimating-benefit-ton-reducing-directly-emitted-pm25-pm25-precursors-and-ozone-precursors.*

M. Utility Impact Analysis

The utility impact analysis estimates the changes in installed electrical capacity and generation projected to result for each considered TSL. The analysis is based on published output from the NEMS associated with AEO2023. 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. For the current analysis, impacts are quantified by comparing the levels of electricity sector generation, installed capacity, fuel consumption and emissions in the AEO2023 Reference case and various side cases. Details of the methodology are provided in the appendices to chapters 13 and 15 of the NOPR 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 potential new or amended energy conservation standards.

N. Employment Impact Analysis

DOE considers employment impacts in the domestic economy as one factor in selecting a proposed 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 consumers on energy, (2) reduced spending on new energy supply by the utility industry, (3) increased consumer spending on the products to which the new standards apply and other goods and services, and (4) the effects of those three factors throughout the economy.

One method for assessing the possible effects on the demand for labor of such shifts in economic activity is to compare sector employment statistics developed by the Labor Department's Bureau of Labor Statistics (''BLS''). BLS regularly publishes its estimates of the number of jobs per million dollars of economic activity in different sectors of the economy, as well as the jobs created elsewhere in the economy by this same economic activity. Data from BLS indicate that expenditures in the utility sector generally create fewer jobs (both directly and indirectly) than expenditures in other sectors of the economy.[56] There are many reasons for these differences, including wage differences and the fact that the utility sector is more capital-intensive and less labor-intensive than other sectors. Energy conservation standards have the effect of reducing consumer utility bills. Because reduced consumer expenditures for energy likely lead to increased expenditures in other sectors of the economy, the general effect of efficiency standards is to shift economic activity from a less labor-intensive sector (*i.e.,* the utility sector) to more labor-intensive sectors (*e.g.,* the retail and service sectors). Thus, 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 NOPR using an input/output model of the U.S. economy called Impact of Sector Energy Technologies version 4 (''ImSET'').[57] 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 that 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 overestimate actual job impacts over the long run for this rule. Therefore, DOE used ImSET only to generate results for near-term timeframes (2028–2032), where these uncertainties are reduced. For more details on the employment impact analysis, see chapter 16 of the NOPR 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 proposing to adopt in this NOPR. Additional details regarding DOE's analyses are contained in the NOPR TSD supporting this document.

A. Trial Standard Levels

In general, DOE typically evaluates new or potential amended standards for products and equipment by grouping individual efficiency levels for each class into TSLs. Use of TSLs allows DOE to identify and consider manufacturer cost interactions between the product classes, to the extent that there are such interactions, and price elasticity of consumer purchasing decisions that may change when different standard levels are set.

In the analysis conducted for this NOPR, DOE analyzed the benefits and burdens of four TSLs for dehumidifiers. DOE developed TSLs that combine efficiency levels for each analyzed product class. TSL 1 represents the smallest incremental increase in analyzed efficiency level above the baseline for each analyzed product class. TSL 2 corresponds to current ENERGY STAR® requirements for all product classes. TSL 3 is an intermediate TSL that maintains positive average LCC savings for all product classes while increasing stringency for Product Classes 1, 2, 4, and 5. TSL 4 represents max-tech. DOE presents the results for the TSLs in this document, while the results for all efficiency levels that DOE analyzed are in the NOPR TSD.

In response to the June 2022 Preliminary Analysis, AHAM raised concerns about the technological feasibility and the economic impact of setting the amended energy conservation standard at EL 3 for all portable product classes. AHAM also questioned whether DOE can justify proposing a standard where a majority of energy savings come from one product class. (AHAM, No. 22 at p. 8)

To clarify, DOE does not propose adopting standard levels at the Preliminary Analysis stage. The current NOPR analysis has been updated based on stakeholder feedback received in response to the June 2022 Preliminary Analysis, additional tear down of units to support the engineering analysis, and manufacturer interviews. For this NOPR analysis, DOE analyzed four trial standard levels and proposes a TSL that DOE considers technologically feasible and economically justified based on a multitude of factors (see section V.C.1 for discussion of the benefits and burdens of TSLs considered in this NOPR).

Table V.1 presents the TSLs and the corresponding efficiency levels that DOE has identified for potential

[56] See U.S. Department of Commerce—Bureau of Economic Analysis. *Regional Multipliers: A User Handbook for the Regional Input-Output Modeling System (RIMS II).* 1997. U.S. Government Printing Office: Washington, DC. Available at *https://www.bea.gov/sites/default/files/methodologies/RIMSII_User_Guide.pdf* (last accessed February 22, 2023).

[57] Livingston, O.V., S.R. Bender, M.J. Scott, and R.W. Schultz. *ImSET 4.0: Impact of Sector Energy Technologies Model Description and User Guide.* 2015. Pacific Northwest National Laboratory: Richland, WA. PNNL–24563.

amended energy conservation standards for dehumidifiers.

TABLE V.1—TRIAL STANDARD LEVELS FOR DEHUMIDIFIERS

TSL	Portable						Whole-home			
	PC1: ≤25.00 pints/day		PC2: 25.01–50.00 pints/day		PC3: >50.00 pints/day		PC4: ≤8.0 cu. ft.		PC5: >8.0 cu. ft.	
	EL	IEF (L/kWh)	EL	IEF (L/kWh)	EL	IEF (L/kWh)	EL	IEF (L/kWh)	EL	IEF (L/kWh)
1	1	1.40	1	1.70	1	3.10	1	2.09	1	2.70
2	2	1.57	2	1.80	2	3.30	1	2.09	2	3.30
3	3	1.70	3	2.01	1	3.10	2	2.22	3	3.81
4	5	2.32	5	2.38	4	3.67	3	2.39	4	4.17

For Product Class 3, DOE found that EL 3 results in the largest average LCC loss and the highest percent of consumers negatively impacted consumers among considered efficiency levels. Similarly, for Product Classes 1 and 2, EL 4 results in the smallest average LCC savings and the highest percent of consumers negatively impacted among considered efficiency levels. Therefore, DOE did not include these ELs in the construction of TSLs.

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 that potential amended standards at each TSL would have on the LCC and PBP. DOE also examined the impacts of potential standards on selected consumer subgroups. These analyses are discussed in the following sections.

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 decreases. 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 NOPR TSD provides detailed information on the LCC and PBP analyses.

Table V.2 through Table V.11 show the LCC and PBP results for the TSLs 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, 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 the baseline product 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.

TABLE V.2—AVERAGE LCC AND PBP RESULTS FOR PRODUCT CLASS 1: PORTABLE DEHUMIDIFIERS

[≤25.00 pints/day]

TSL	Efficiency level	IEF (L/kWh)	Average costs (2022$)				Simple payback (years)	Average lifetime (years)
			Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	Baseline	1.30	$279	$66	$569	$848	.....	10.0
1	1	1.40	283	61	531	814	1.0	10.0
2	2	1.57	288	55	479	767	0.9	10.0
3	3	1.70	293	51	444	737	0.9	10.0
	4	1.94	397	46	396	793	5.9	10.0
4	5	2.32	447	39	337	784	6.3	10.0

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.3—AVERAGE LCC SAVINGS RELATIVE TO THE NO-NEW-STANDARDS CASE FOR PRODUCT CLASS 1: PORTABLE DEHUMIDIFIERS

[≤25.00 pints/day]

TSL	Efficiency level	Life-cycle cost savings	
		Average LCC savings*+ (2022$)	Percentage of consumers that experience net cost (%)
1	1	$0	0
2	2	46	1
3	3	42	3
	4	(17)	70
4	5	(9)	65

*The savings represent the average LCC for affected consumers.
+Parentheses denote negative (−) values.

TABLE V.4—AVERAGE LCC AND PBP RESULTS FOR PRODUCT CLASS 2: PORTABLE DEHUMIDIFIERS

[25.01–50.00 pints/day]

TSL	Efficiency level	IEF (L/kWh)	Average costs (2022$)				Simple payback (years)	Average lifetime (years)
			Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	Baseline	1.60	$315	$112	$968	$1,283	.....	10.0
1	1	1.70	319	106	915	1,234	0.7	10.0
2	2	1.80	324	100	869	1,193	0.8	10.0
3	3	2.01	327	91	784	1,112	0.6	10.0
	4	2.07	429	89	767	1,196	4.9	10.0
4	5	2.38	493	78	676	1,169	5.3	10.0

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 NO-NEW-STANDARDS CASE FOR PRODUCT CLASS 2: PORTABLE DEHUMIDIFIERS

[25.01–50.00 pints/day]

TSL	Efficiency level	Life-cycle cost savings	
		Average LCC savings* (2022$)	Percentage of consumers that experience net cost (%)
1	1	$0	0
2	2	0	0
3	3	81	0
	4	(13)	68
4	5	14	60

*The savings represent the average LCC for affected consumers.

TABLE V.6—AVERAGE LCC AND PBP RESULTS FOR PRODUCT CLASS 3: PORTABLE DEHUMIDIFIERS

[>50.00 pints/day]

TSL	Efficiency level	IEF (L/kWh)	Average costs (2022$)				Simple payback (years)	Average lifetime (years)
			Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	Baseline	2.80	$1,043	$88	$765	$1,807	.....	10.0
1,3	1	3.10	1,080	80	696	1,776	4.8	10.0
2	2	3.30	1,149	76	657	1,807	8.7	10.0
	3	3.51	1,248	72	622	1,870	12.5	10.0

TABLE V.6—AVERAGE LCC AND PBP RESULTS FOR PRODUCT CLASS 3: PORTABLE DEHUMIDIFIERS—Continued

[>50.00 pints/day]

TSL	Efficiency level	IEF (L/kWh)	Average costs (2022$)				Simple payback (years)	Average lifetime (years)
			Installed cost	First year's operating cost	Lifetime operating cost	LCC		
4	4	3.67	1,257	69	597	1,854	11.2	10.0

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 NO-NEW-STANDARDS CASE FOR PRODUCT CLASS 3: PORTABLE DEHUMIDIFIERS

[>50.00 pints/day]

TSL	Efficiency level	Life-cycle cost savings	
		Average LCC savings *+ (2022$)	Percentage of consumers that experience net cost (%)
1,3	1	$31	33
2	2	(4)	65
	3	(67)	79
4	4	(52)	74

*The savings represent the average LCC for affected consumers.
+Parentheses denote negative (−) values.

TABLE V.8—AVERAGE LCC AND PBP RESULTS FOR PRODUCT CLASS 4: WHOLE-HOME DEHUMIDIFIERS

[≤8.0 cu ft case volume]

TSL	Efficiency level	IEF (L/kWh)	Average costs (2022$)				Simple payback (years)	Average lifetime (years)
			Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	Baseline	1.77	$2,733	$144	$1,441	$4,174	.....	12.0
1,2	1	2.09	2,876	123	1,235	4,110	6.9	12.0
3	2	2.22	2,907	117	1,170	4,077	6.4	12.0
4	3	2.39	2,978	110	1,099	4,077	7.2	12.0

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 NO-NEW-STANDARDS CASE FOR PRODUCT CLASS 4: WHOLE-HOME DEHUMIDIFIERS

[≤8.0 cu ft case volume]

TSL	Efficiency level	Life-cycle cost savings	
		Average LCC savings * (2022$)	Percentage of consumers that experience net cost (%)
1,2	1	$63	4
3	2	56	8
4	3	12	56

*The savings represent the average LCC for affected consumers.

TABLE V.10—AVERAGE LCC AND PBP RESULTS FOR PRODUCT CLASS 5: WHOLE-HOME DEHUMIDIFIERS

[>8.0 cu ft case volume]

TSL	Efficiency level	IEF (L/kWh)	Average costs (2022$)				Simple payback (years)	Average lifetime (years)
			Installed cost	First year's operating cost	Lifetime operating cost	LCC		
	Baseline	2.41	$2,734	$115	$1,166	$3,901	.....	12.0
1	1	2.70	2,797	104	1,053	3,850	5.6	12.0
2	2	3.30	2,816	87	882	3,698	2.9	12.0
3	3	3.81	2,954	77	778	3,731	5.7	12.0
4	4	4.17	3,077	71	720	3,796	7.8	12.0

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 NO-NEW-STANDARDS CASE FOR PRODUCT CLASS 5: WHOLE-HOME DEHUMIDIFIERS

[>8.0 cu ft case volume]

TSL	Efficiency level	Life-cycle cost savings	
		Average LCC savings* (2022$)	Percentage of consumers that experience net cost (%)
1	1	$53	19
2	2	179	7
3	3	146	38
4	4	81	53

* The savings represent the average LCC for affected consumers.

b. Consumer Subgroup Analysis

In the consumer subgroup analysis, DOE estimated the impact of the considered TSLs on low-income households and senior-only households. Table V.12 through Table V.16 compares the average LCC savings and PBP at each efficiency level for the consumer subgroups with similar metrics for the entire consumer sample for each product class. 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 NOPR TSD presents the complete LCC and PBP results for the subgroups.

TABLE V.12—COMPARISON OF LCC SAVINGS AND PBP FOR CONSUMER SUBGROUPS AND ALL HOUSEHOLDS; PRODUCT CLASS 1: PORTABLE DEHUMIDIFIERS

[≤25.00 pints/day]

	Low-income households	Senior-only households	All households
Average LCC Savings (2022$):*			
TSL 1	$0	$0	$0
TSL 2	$38	$43	$46
TSL 3	$34	$39	$42
TSL 4	($37)	($22)	($9)
Payback Period (years):			
TSL 1	1.2	1.1	1.0
TSL 2	1.1	1.0	0.9
TSL 3	1.1	1.0	0.9
TSL 4	7.6	6.9	6.3
Consumers with Net Benefit (%):			
TSL 1	0%	0%	0%
TSL 2	23%	24%	24%
TSL 3	83%	89%	88%
TSL 4	27%	30%	35%
Consumers with Net Cost (%):			
TSL 1	0%	0%	0%
TSL 2	1%	0%	1%
TSL 3	7%	2%	3%
TSL 4	73%	70%	65%

* Parentheses denote negative (−) values.

TABLE V.13—COMPARISON OF LCC SAVINGS AND PBP FOR CONSUMER SUBGROUPS AND ALL HOUSEHOLDS; PRODUCT CLASS 2: PORTABLE DEHUMIDIFIERS

[25.01–50.00 pints/day]

	Low-income households	Senior-only households	All households
Average LCC Savings (2022$): *			
TSL 1	$0	$0	$0
TSL 2	$0	$0	$0
TSL 3	$65	$74	$81
TSL 4	($21)	($2)	$14
Payback Period (years):			
TSL 1	0.9	0.8	0.7
TSL 2	1.0	0.9	0.8
TSL 3	0.7	0.7	0.6
TSL 4	6.4	5.8	5.3
Consumers with Net Benefit (%):			
TSL 1	0%	0%	0%
TSL 2	0%	0%	0%
TSL 3	87%	87%	87%
TSL 4	32%	35%	40%
Consumers with Net Cost (%):			
TSL 1	0%	0%	0%
TSL 2	0%	0%	0%
TSL 3	0%	0%	0%
TSL 4	68%	65%	60%

* Parentheses denote negative (−) values.

TABLE V.14—COMPARISON OF LCC SAVINGS AND PBP FOR CONSUMER SUBGROUPS AND ALL HOUSEHOLDS; PRODUCT CLASS 3: PORTABLE DEHUMIDIFIERS

[>50.00 pints/day]

	Low-income households	Senior-only households	All households
Average LCC Savings (2022$): *			
TSL 1	$21	$25	$31
TSL 2	($19)	($13)	($4)
TSL 3	$21	$25	$31
TSL 4	($76)	($66)	($52)
Payback Period (years):			
TSL 1	5.6	5.3	4.8
TSL 2	10.0	9.5	8.7
TSL 3	5.6	5.3	4.8
TSL 4	12.9	12.3	11.2
Consumers with Net Benefit (%):			
TSL 1	53%	51%	53%
TSL 2	29%	29%	35%
TSL 3	53%	51%	53%
TSL 4	17%	20%	26%
Consumers with Net Cost (%):			
TSL 1	33%	34%	33%
TSL 2	71%	71%	65%
TSL 3	33%	34%	33%
TSL 4	83%	80%	74%

* Parentheses denote negative (−) values.

TABLE V.15—COMPARISON OF LCC SAVINGS AND PBP FOR CONSUMER SUBGROUPS AND ALL HOUSEHOLDS; PRODUCT CLASS 4: WHOLE-HOME DEHUMIDIFIERS

[≤8.0 cu ft case volume]

	Low-income households	Senior-only households	All households
Average LCC Savings (2022$): *			
TSL 1	$99	$70	$63
TSL 2	$99	$70	$63
TSL 3	$76	$60	$56
TSL 4	$37	$14	$12
Payback Period (years):			
TSL 1	4.8	6.8	6.9
TSL 2	4.8	6.8	6.9

TABLE V.15—COMPARISON OF LCC SAVINGS AND PBP FOR CONSUMER SUBGROUPS AND ALL HOUSEHOLDS; PRODUCT CLASS 4: WHOLE-HOME DEHUMIDIFIERS—Continued

[≤8.0 cu ft case volume]

	Low-income households	Senior-only households	All households
TSL 3	4.4	6.3	6.4
TSL 4	4.9	7.1	7.2
Consumers with Net Benefit (%):			
TSL 1	5%	4%	4%
TSL 2	5%	4%	4%
TSL 3	15%	14%	14%
TSL 4	48%	39%	40%
Consumers with Net Cost (%):			
TSL 1	3%	4%	4%
TSL 2	3%	4%	4%
TSL 3	5%	8%	8%
TSL 4	40%	58%	56%

* Parentheses denote negative (−) values.

TABLE V.16—COMPARISON OF LCC SAVINGS AND PBP FOR CONSUMER SUBGROUPS AND ALL HOUSEHOLDS; PRODUCT CLASS 5: WHOLE-HOME DEHUMIDIFIERS

[>8.0 cu ft case volume]

	Low-income households	Senior-only households	All households
Average LCC Savings (2022$): *			
TSL 1	$64	$51	$53
TSL 2	$178	$179	$179
TSL 3	$187	$147	$146
TSL 4	$163	$82	$81
Payback Period (years):			
TSL 1	3.8	5.5	5.6
TSL 2	2.0	2.9	2.9
TSL 3	3.9	5.6	5.7
TSL 4	5.3	7.6	7.8
Consumers with Net Benefit (%):			
TSL 1	36%	33%	34%
TSL 2	89%	95%	93%
TSL 3	66%	62%	62%
TSL 4	55%	47%	47%
Consumers with Net Cost (%):			
TSL 1	13%	20%	19%
TSL 2	3%	5%	7%
TSL 3	26%	38%	38%
TSL 4	37%	53%	53%

* Parentheses denote negative (−) values.

c. Rebuttable Presumption Payback

As discussed in section III.E.2 EPCA establishes a rebuttable presumption that an energy conservation standard is economically justified if the increased purchase cost for 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 payback period for each of the considered TSLs, DOE used discrete values, and, as required by EPCA, based the energy use calculation on the DOE test procedure for dehumidifiers. In contrast, the PBPs presented in section V.B.1.a were calculated using average values derived from distributions that reflect the range of energy use in the field.

Table V.17 presents the rebuttable-presumption payback periods for the considered TSLs for dehumidifiers. While DOE examined the rebuttable-presumption criterion, it 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), that considers the full range of impacts to the consumer, manufacturer, Nation, and environment. The results of that analysis serve as the basis for DOE to definitively 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—REBUTTABLE-PRESUMPTION PAYBACK PERIODS

Product class	Efficiency level				
	1	2	3	4	5
	years				
Product Class 1: Portable Dehumidifiers ≤25.00 Pints/Day	1.2	1.1	1.2	6.6	7.3
Product Class 2: Portable Dehumidifiers 25.01–50.00 Pints/Day	0.9	1.0	0.8	5.4	6.1
Product Class 3: Portable Dehumidifiers >50.00 Pints/Day	5.9	10.7	11.5	10.7	
Product Class 4: Whole-Home Dehumidifiers ≤8.0 cu ft Case Volume	4.8	4.8	5.6		
Product Class 5: Whole-Home Dehumidifiers >8.0 cu ft Case Volume	5.2	2.7	4.7	6.5	

2. Economic Impacts on Manufacturers

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

a. Industry Cash Flow Analysis Results

In this section, DOE provides GRIM results from the analysis, which examines changes in the industry that would result from a standard. The following tables summarize the estimated financial impacts (represented by changes in INPV) of potential amended energy conservation standards on manufacturers of dehumidifiers, as well as the conversion costs that DOE estimates manufacturers of dehumidifiers would incur at each TSL.

The impact of potential amended energy conservation standards were analyzed under two scenarios: (1) the preservation of gross margin percentage; and (2) the preservation of operating profit, as discussed in section IV.J.2.d of this document. The preservation of gross margin percentages applies a ''gross margin percentage'' of 29 percent for all product classes across all efficiency levels.[58] This scenario assumes that a manufacturer's per-unit dollar profit would increase as MPCs increase in the standards cases and represents the upper-bound to industry profitability under potential amended energy conservation standards.

The preservation of operating profit scenario reflects manufacturers' concerns about their inability to maintain margins as MPCs increase to reach more-stringent efficiency levels. In this scenario, while manufacturers make the necessary investments required to convert their facilities to produce compliant equipment, operating profit does not change in absolute dollars and decreases as a percentage of revenue. The preservation of operating profit scenario results in the lower bound to impacts of potential amended standards on industry.

Each of the modeled scenarios results in a unique set of cash flows and corresponding INPV for each TSL. INPV is the sum of the discounted cash flows to the industry from the base year through the end of the analysis period (2023–2057). The ''change in INPV'' results refer to the difference in industry value between the no-new-standards case and standards case at each TSL. To provide perspective on the short-run cash flow impact, 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 would take effect. This figure provides an understanding of the magnitude of the required conversion costs relative to the cash flow generated by the industry in the no-new-standards case.

Conversion costs are one-time investments for manufacturers to bring their manufacturing facilities and product designs into compliance with potential amended standards. As described in section IV.J.2.c of this document, conversion cost investments occur between the year of publication of the final rule and the year by which manufacturers must comply with the new standard. The conversion costs can have a significant impact on the short-term cash flow on the industry and generally result in lower free cash flow in the period between the publication of the final rule and the compliance date of potential amended standards. Conversion costs are independent of the manufacturer markup scenarios and are not presented as a range in this analysis.

TABLE V.18—MANUFACTURER IMPACT ANALYSIS DEHUMIDIFIER INDUSTRY RESULTS

	Unit	No-new-standards case	TSL 1	TSL 2	TSL 3	TSL 4
INPV	*2022$ Million*	158.3	157.8 to 158.0	157.4 to 158.1	153.1 to 155.0	73.0 to 121.6
Change in INPV	%		(0.3) to (0.2)	(0.6) to (0.2)	(3.3) to (2.1)	(53.9) to (23.2)
Free Cash Flow (2027)	*2022$ Million*	12.6	12.4	12.4	10.3	(18.2)
Change in Free Cash Flow (2027)	%		(1.5)	(2.2)	(18.4)	(244.3)
Product Conversion Costs	*2022$ Million*		0.6	0.8	6.9	20.9
Capital Conversion Costs	*2022$ Million*		0.0	0.0	0.0	53.1
Conversion Costs	*2022$ Million*	-	0.6	0.8	6.9	73.9

At TSL 4, the standard represents the max-tech efficiency levels for all product classes. The change in INPV is expected to range from −53.9 to −23.2 percent. At this level, free cash flow is estimated to decrease by 244.3 percent compared to the no-new-standards case value of $12.6 million in the year 2027, the year before the standards year. Currently, less than 1 percent of domestic dehumidifier shipments meet the efficiencies required at TSL 4.

At max-tech, all product classes would require the most efficient compressor observed in teardown

[58] The gross margin percentage of 29 percent is based on a manufacturer markup of 1.40.

models, ECM blower fan with associated variable-speed driver, controls with less inactive mode power consumption and the largest heat exchangers observed in teardown models in each product class. Increasing heat exchanger surface area would necessitate notable changes to the chassis size of both portable and whole-home units as most dehumidifier designs cannot accommodate a larger heat exchanger within the existing cabinet structure. For the portable dehumidifier classes, which together account for approximately 98 percent of industry shipments, almost all manufacturers would need to make significant investments to adjust equipment, molding, and tooling to accommodate new dimensions across their entire product portfolio. None of the 15 portable dehumidifier OEMs currently offer any models that meet the max-tech efficiencies required. Product conversion costs at this level are significant as manufacturers work to completely redesign all existing models and develop new chassis designs to incorporate larger heat exchangers and more efficient components. DOE estimates capital conversion costs of $53.1 million and product conversion costs of $20.9 million. Conversion costs total $73.9 million.

Compared to the market for portable dehumidifiers, the whole-home dehumidifier market is low-volume and relatively concentrated. Whole-home dehumidifiers account for approximately 2 percent of total industry shipments. DOE identified three OEMs producing whole-home dehumidifiers for the U.S. market. Of the two whole-home product classes, whole-home dehumidifiers ≤8.0 cu. ft. (Product Class 4) account for approximately 85 percent of whole-home dehumidifier shipments. Of the three whole-home OEMs identified, only one OEM currently offers a Product Class 4 model that meets the max-tech level. The remaining two OEMs would need to dedicate significant engineering resources to redesign their entire product portfolio to include larger heat exchangers, which would necessitate a change in dimensions and new chassis design. One of the OEMs without any models that meet max-tech is a small, domestic business with a significant market share of Product Class 4 shipments. For the other whole-home product class, only one OEM currently offers whole-home dehumidifiers >8.0 cu. ft. (Product Class 5). This OEM does not currently offer any models that meet the max-tech efficiency required. Given the limited number of whole-home OEMs, the limited number of models currently available that meet the max-tech efficiency levels, and the extent of the redesign required for the OEMs without any max-tech product offerings, it is possible that the 3-year period between the announcement of the final rule and the compliance date of the amended energy conservation standard might be insufficient to design, test, and manufacture the necessary number of products to meet consumer demand.

At TSL 4, the large conversion costs result in a free cash flow dropping below zero in the years before the standards year. The negative free cash flow calculation indicates manufacturers may need to access cash reserves or outside capital to finance conversion efforts.

At TSL 4, the shipment-weighted average MPC for all dehumidifiers is expected to increase by 52.7 percent relative to the no-new-standards case shipment-weighted average MPC for all dehumidifiers in 2028. Given the projected increase in production costs, DOE expects an estimated 23.5 percent drop in shipments in the year the standard takes effect relative to the no-new-standards case. In the preservation of gross margin percentage scenario, the increase in cashflow from the higher MSP is outweighed by the $73.9 million in conversion costs and drop in annual shipments, causing a significant negative change in INPV at TSL 4 under this scenario. Under the preservation of operating profit scenario, the manufacturer markup decreases in 2029, the year after the analyzed compliance year. This reduction in the manufacturer markup, the $73.9 million in conversion costs incurred by manufacturers, and the drop in annual shipments cause a significant decrease in INPV at TSL 4 under the preservation of operating profit scenario.

At TSL 3, the standard represents an intermediate TSL that maintains positive average LCC savings for all products while increasing stringency for Product Classes 1, 2, 4, and 5. The change in INPV is expected to range from −3.3 to −2.1 percent. At this level, free cash flow is estimated to decrease by 18.4 percent compared to the no-new-standards case value of $12.6 million in the year 2027, the year before the standards year. Currently, approximately 3 percent of domestic dehumidifier shipments meet the efficiencies required at TSL 3.

For the portable dehumidifier classes ≤50.00 pints/day (Product Class 1 and Product Class 2), TSL 3 corresponds to EL3. For portable dehumidifiers >50 pints/day, TSL 3 corresponds to EL1. For whole home dehumidifiers ≤8.0 cu. ft., TSL 3 corresponds to EL2. For whole home dehumidifiers >8.0 cu. ft., TSL 3 corresponds to EL3. At this level, DOE expects that all product classes would incorporate a higher efficiency compressor compared to the current baseline. For the whole-home dehumidifier classes, the analyzed design options also included the addition of an ECM blower and a larger heat exchanger as compared to baseline product offerings but to a lesser extent than what was analyzed at max-tech. At this level, DOE does not expect manufacturers of portable dehumidifiers to adopt new or larger chassis designs. As such, DOE does not expect industry would incur capital conversion costs since portable OEMs can likely achieve TSL 3 efficiencies without changes to the heat exchanger and chassis design. Portable dehumidifiers 25.01–50.00 pints/day (Product Class 2) accounts for approximately 73 percent of industry shipments. Of the 15 portable dehumidifier OEMs, around two OEMs currently offer Product Class 2 models that meet the efficiency required by TSL 3. Product conversion costs may be necessary for developing, qualifying, sourcing, and testing more efficient compressors. For whole-home dehumidifiers, DOE expects some manufacturers would need to adopt new or larger chassis designs to accommodate larger heat exchangers but not to the extent required at max-tech. For whole-home designs, DOE expects that the size differences would not necessitate capital investment since existing machinery could likely still be used. Of the three whole-home OEMs, two OEMs currently offer Product Class 4 models that meet the efficiency required. As with TSL 4, whole-home manufacturers would likely need to completely redesign non-compliant models. However, approximately 60 percent of basic model listings (around 32 unique basic models) already meet the efficiency level required. DOE estimates total conversion costs of $6.9 million, all of which are product conversion costs.

At TSL 3, the shipment-weighted average MPC for all dehumidifiers is expected to increase by 1.6 percent relative to the no-new-standards case shipment-weighted average MPC for all dehumidifiers in 2028. Given the projected increase in production costs, DOE does not expect a notable drop in shipments in the year the standard takes effect relative to the no-new-standards case. In the preservation of gross margin percentage scenario, the slight increase in cashflow from the higher MSP is outweighed by the $6.9 million in conversion costs, causing a slightly

negative change in INPV at TSL 3 under this scenario. Under the preservation of operating profit scenario, the manufacturer markup decreases in 2029, the year after the analyzed compliance year. This reduction in the manufacturer markup and the $6.9 million in conversion costs incurred by manufacturers cause a slightly negative change in INPV at TSL 3 under the preservation of operating profit scenario.

At TSL 2, the standard represents efficiency levels consistent with ENERGY STAR requirements for dehumidifiers. The change in INPV is expected to range from −0.9 to −0.2 percent. At this level, free cash flow is estimated to decrease by 2.2 percent compared to the no-new-standards case value of $12.6 million in the year 2027, the year before the standards year. Currently, approximately 89 percent of domestic dehumidifier shipments meet the efficiencies required at TSL 2.

For all product classes, except for whole-home dehumidifiers ≤8.0 cu. ft. (Product Class 4), TSL 2 corresponds to EL2. For Product Class 4, TSL 2 corresponds to EL1. The design options analyzed for most product classes include incorporating incrementally more efficient compressors, similar to TSL 3. For Product Class 5, DOE also expects that manufacturers would need to increase the heat exchanger beyond what would be required at baseline. At this level, DOE estimates that most manufacturers can achieve TSL 2 efficiencies with relatively simple component changes. For the largest portable dehumidifier class (Product Class 2), all 15 OEMs have models that meet the efficiency level required. For the largest whole-home dehumidifier class (Product Class 4), all three OEMs have models that meet the efficiency level required. Product conversion costs may be necessary for developing, qualifying, sourcing, and testing more efficient compressors. DOE estimates total conversion costs of $0.8 million, all of which are product conversion costs.

At TSL 2, the shipment-weighted average MPC for all dehumidifiers is expected to increase by 0.4 percent relative to the no-new-standards case shipment-weighted average MPC for all dehumidifiers in 2028. Given the projected increase in production costs, DOE does not expect a notable drop in shipments in the year the standard takes effect relative to the no-new-standards case. In the preservation of gross margin percentage scenario, the slight increase in cashflow from the higher MSP is outweighed by the $0.8 million in conversion costs, causing a slightly negative change in INPV at TSL 2 under this scenario. Under the preservation of operating profit scenario, the manufacturer markup decreases in 2029, the year after the analyzed compliance year. This reduction in the manufacturer markup and the $0.8 million in conversion costs incurred by manufacturers cause a slightly negative change in INPV at TSL 2 under the preservation of operating profit scenario.

At TSL 1, the standard represents the lowest analyzed efficiency level above baseline for all product classes (EL1). The change in INPV is expected to range from −0.4 to −0.1 percent. At this level, free cash flow is estimated to decrease by 1.5 percent compared to the no-new-standards case value of $12.6 million in the year 2027, the year before the standards year. Currently, approximately 99 percent of domestic dehumidifier shipments meet the efficiencies required at TSL 1.

For all product classes, TSL 1 corresponds to EL1. At TSL 1, DOE analyzed implementing various design options for the range of directly analyzed product classes. corresponds to EL2. For whole-home dehumidifiers under 8.0 cubic feet, TSL 2 corresponds to EL1. The design options analyzed included implementing incrementally more efficient compressors compared to the current baseline, and, for whole home dehumidifiers >8.0 cu. ft. (Product Class 5), the analyzed design options also included implementing larger heat exchangers as compared to the current baseline. At this level, there are no capital conversion costs since most manufacturers can achieve TSL 1 efficiencies with relatively simple component changes. Product conversion costs may be necessary for developing, qualifying, sourcing, and testing more efficient components. DOE estimates total conversion costs of $0.6 million, all of which is product conversion cost.

At TSL 1, the shipment-weighted average MPC for all dehumidifiers is expected to increase by 0.1 percent relative to the no-new-standards case shipment-weighted average MPC for all dehumidifiers in 2028. Given the relatively small increase in production costs, DOE does not project a notable drop in shipments in the year the standard takes effect. In the preservation of gross margin percentage scenario, the minor increase in cashflow from the higher MSP is slightly outweighed by the $0.6 million in conversion costs, causing a slightly negative change in INPV at TSL 1 under this scenario. Under the preservation of operating profit scenario, manufacturers earn the same per-unit operating profit as would be earned in the no-new-standards case, but manufacturers do not earn additional profit from their investments. In this scenario, the manufacturer markup decreases in 2029, the year after the analyzed compliance year. This reduction in the manufacturer markup and the $0.6 million in conversion costs incurred by manufacturers cause a slightly negative change in INPV at TSL 1 under the preservation of operating profit scenario.

DOE seeks comments, information, and data on the capital conversion costs and product conversion costs estimated for each TSL.

b. Direct Impacts on Employment

To quantitatively assess the potential impacts of amended energy conservation standards on direct employment in the dehumidifier industry, DOE used the GRIM to estimate the domestic labor expenditures and number of direct employees in the no-new-standards case and in each of the standards cases during the analysis period. DOE calculated these values using statistical data from the 2021 *ASM*,[59] BLS employee compensation data,[60] results of the engineering analysis, and manufacturer interviews.

Labor expenditures related to product manufacturing depend on the labor intensity of the product, the sales volume, and an assumption that wages remain fixed in real terms over time. The total labor expenditures in each year are calculated by multiplying the total MPCs by the labor percentage of MPCs. The total labor expenditures in the GRIM were then converted to total production employment levels by dividing production labor expenditures by the average fully burdened wage multiplied by the average number of hours worked per year per production worker. To do this, DOE relied on the *ASM* inputs: Production Workers Annual Wages, Production Workers Annual Hours, Production Workers for Pay Period, and Number of Employees. DOE also relied on the BLS employee compensation data to determine the fully burdened wage ratio. The fully burdened wage ratio factors in paid leave, supplemental pay, insurance,

[59] U.S. Census Bureau, *Annual Survey of Manufactures.* ''Summary Statistics for Industry Groups and Industries in the U.S. (2021).'' Available at *www.census.gov/data/tables/time-series/econ/asm/2018-2021-asm.html* (last accessed March 4, 2023).

[60] U.S. Bureau of Labor Statistics. *Employer Costs for Employee Compensation—September 2022.* December 15, 2022. Available at *www.bls.gov/news.release/pdf/ecec.pdf* (last accessed March 4, 2023).

retirement and savings, and legally required benefits.

The number of production employees is then multiplied by the U.S. labor percentage to convert total production employment to total domestic production employment. The U.S. labor percentage represents the industry fraction of domestic manufacturing production capacity for the covered products. This value is derived from manufacturer interviews, equipment database analysis, and publicly available information. The U.S. labor percentage varies by product class. Nearly all portable units are manufactured outside of the United States. Comparatively, DOE estimates that 80 percent of whole-home units are manufactured in the United States. Overall, DOE estimates that 2 percent of all covered dehumidifiers units are manufactured domestically.

The domestic production employees estimate covers production line workers, including line supervisors, who are directly involved in fabricating and assembling products within the 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 equipment covered by this proposed rulemaking.

Non-production workers account for the remainder of the direct employment figure. The non-production employees estimate covers domestic workers who are not directly involved in the production process, such as sales, engineering, human resources, and management. Using the amount of domestic production workers calculated above, non-production domestic employees are extrapolated by multiplying the ratio of non-production workers in the industry compared to production employees. DOE assumes that this employee distribution ratio remains constant between the no-new-standards case and standards cases.

Using the GRIM, DOE estimates in the absence of amended energy conservation standards there would be 72 domestic production and non-production workers of dehumidifiers in 2028. Table V.19 shows the range of the impacts of potential amended energy conservation standards on U.S. manufacturing employment in dehumidifier industry.

TABLE V.19—DIRECT EMPLOYMENT IMPACTS FOR DOMESTIC DEHUMIDIFIER MANUFACTURERS IN 2028 *

	No-new-standards case	TSL 1	TSL 2	TSL 3	TSL 4
Direct Employment in 2028 (Production Workers + Non-Production Workers).	72	72	72	72	64.
Potential Changes in Direct Employment in 2028*	.....	(53) to 0	(53) to 0	(53) to 0	(53) to (8).

* DOE presents a range of potential employment impacts. Numbers in parentheses denote negative values.

The direct employment impacts shown in Table V.19 represent the potential domestic employment changes that could result following the compliance date of amended energy conservation standards. The upper bound estimate corresponds to the change in the number of domestic workers that would result from amended energy conservation standards if manufacturers continued to produce the same scope of covered products within the United States after compliance takes effect. To establish a conservative lower bound, DOE assumes all manufacturers would shift production to foreign countries with lower costs of labor. At lower TSLs (*i.e.,* TSL 1 through TSL 3), DOE believes the likelihood of changes in production location due to amended standards are low due to the relatively minor production line updates required. However, as amended standards increase in stringency and both the complexity and cost of production facility updates increases, manufacturers are more likely to revisit their production location decisions and/or their make vs. buy decisions.

Additional detail on the analysis of direct employment can be found in chapter 12 of the NOPR TSD. Additionally, the employment impacts discussed in this section are independent of the employment impacts from the broader U.S. economy, which are documented in chapter 16 of the NOPR TSD.

c. Impacts on Manufacturing Capacity

In interviews, some manufacturers expressed concern about efficiency levels that would require increasing the chassis and heat exchanger. These manufacturers asserted that since manufacturing larger units requires longer production and processing time, increasing chassis size could reduce their manufacturing capacity. Furthermore, manufacturers expressed concern that the 3-year compliance period would be insufficient to develop completely new, cost-optimized models across their entire product portfolio if chassis size changes are required.

DOE notes that there could be technical resource constraints due to overlapping regulations, particularly for whole-home dehumidifier manufacturers. Whole-home dehumidifier manufacturers may face resource constraints should DOE set more stringent standards that necessitate the redesign of the majority of models given State (*e.g.,* CARB) and potential Federal refrigerant regulations requiring low-GWP refrigerants over a similar compliance timeline.

DOE seeks comment on whether manufacturers expect manufacturing capacity constraints or engineering resource constraints would limit product availability to consumers in the timeframe of the amended standard compliance date (2028).

d. Impacts on Subgroups of Manufacturers

Using average cost assumptions to develop industry cash-flow estimates may not capture the differential impacts among subgroups of manufacturers. Small manufacturers, niche players, or manufacturers exhibiting a cost structure that differs substantially from the industry average could be affected disproportionately. DOE investigated small businesses as a manufacturer subgroup that could be disproportionally impacted by energy conservation standards and could merit additional analysis. DOE did not identify any other adversely impacted manufacturer subgroups for this proposed rulemaking based on the results of the industry characterization.

DOE analyzes the impacts on small businesses in a separate analysis in section VI.B of this document as part of the Regulatory Flexibility Analysis. In summary, the Small Business Administration (SBA) defines a ''small business'' as having 1,500 or employees

or less for North American Industry Classification System (NAICS) 335210, ''Small Electrical Appliance Manufacturing'' and 1,250 employees or less for NAICS 333415, ''Air Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing.'' For a discussion of the impacts on the small business manufacturer subgroup, see the Regulatory Flexibility Analysis in section VI.B of this document and chapter 12 of the NOPR TSD.

e. Cumulative Regulatory Burden

One aspect of assessing manufacturer burden involves looking at the cumulative impact of multiple DOE standards and the product-specific regulatory actions of other Federal agencies that affect the manufacturers of a covered product or equipment. While any one regulation may not impose a significant burden on manufacturers, the combined effects of several existing or impending regulations may have serious consequences for some manufacturers, groups of manufacturers, or an entire industry. Assessing the impact of a single regulation may overlook this cumulative regulatory burden. In addition to energy conservation standards, other regulations can significantly affect manufacturers' financial operations. 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. For these reasons, DOE conducts an analysis of cumulative regulatory burden as part of its rulemakings pertaining to appliance efficiency.

DOE evaluates product-specific regulations that will take effect approximately three years before or after the estimated 2028 compliance date of any amended energy conservation standards for dehumidifiers. This information is presented in Table V.20.

TABLE V.20—COMPLIANCE DATES AND EXPECTED CONVERSION EXPENSES OF FEDERAL ENERGY CONSERVATION STANDARDS AFFECTING DEHUMIDIFIER ORIGINAL EQUIPMENT MANUFACTURERS

Federal energy conservation standard	Number of OEMs *	Number of OEMs affected by today's rule **	Approx. standards compliance year	Industry conversion costs (millions $)	Industry conversion costs/product revenue *** (%)
Consumer Furnaces † 87 FR 40590 (July 7, 2022).	15	3	2029	$150.6 (2020$)	1.4
Consumer Clothes Dryers,† 87 FR 51734 (August 23, 2022).	15	3	2027	$149.7 (2020$)	1.8
Microwave Ovens 88 FR 39912 (June 20, 2023)	18	1	2026	$46.1 (2021$)	0.7
Consumer Conventional Cooking Products 88 FR 6818 † (February 1, 2023).	34	1	2027	$183.4 (2021$)	1.2
Residential Clothes Washers † 88 FR 13520 (March 3, 2023).	19	3	2027	$690.8 (2021$)	5.2
Refrigerators, Freezers, and Refrigerator-Freezers † 88 FR 12452 (February 27, 2023).	49	3	2027	$1,323.6 (2021$)	3.8
Room Air Conditioners 88 FR 34298 (May 26, 2023).	8	4	2026	$24.8 (2021$)	0.4
Consumer Air Cleaners ‡ 88 FR 21752 (April 11, 2023).	43	2	2024 and 2026 ‡	$57.3 (2021$)	1.3
Miscellaneous Refrigeration Products † 88 FR 19382 (March 31, 2023).	38	3	2029	$126.9 (2021$)	3.1
Dishwashers † 88 FR 32514 (May 19, 2023)	22	3	2027	$125.6 (2021$)	2.1
Consumer Water Heaters † 88 FR 49058 (July 28, 2023).	22	3	2030	$228.1 (2022$)	1.3

* This column presents the total number of OEMs identified in the energy conservation standard rule subject to cumulative regulatory burden.

** This column presents the number of OEMs producing dehumidifiers that are also listed as OEMs in the identified energy conservation standard subject to cumulative regulatory burden.

*** This column presents industry conversion costs as a percentage of product revenue during the conversion period. Industry conversion costs are the upfront investments manufacturers must make to sell compliant products/equipment. The revenue used for this calculation is the revenue from just the covered product/equipment associated with each row. The conversion period is the time frame over which conversion costs are made and lasts from the publication year of the final rule to the compliance year of the energy conservation standard. The conversion period typically ranges from 3 to 5 years, depending on the rulemaking.

† These rulemakings are at the NOPR stage, and all values are subject to change until finalized through publication of a final rule.

‡ The Direct Final Rule for Consumer Air Cleaners adopts an amended standard in 2024 and a higher amended standard in 2026. The conversion costs are spread over a 3-year conversion period ending in 2025, with over 50 percent of the conversion costs occurring between 2024 and 2025.

DOE requests information regarding the impact of cumulative regulatory burden on manufacturers of dehumidifiers associated with multiple DOE standards or product-specific regulatory actions of other Federal agencies.

Refrigerant Regulations

DOE evaluated the potential impacts of State and Federal refrigerant regulations, such as CARB's rulemaking prohibiting the use of refrigerants with a GWP of 750 or greater starting January 1, 2023 for self-contained, residential dehumidifiers and starting January 1, 2025 for whole-home dehumidifiers [61] and EPA's final rule issued on October 5, 2023, which restricts the use of HFCs that have a GWP of 700 or greater for residential dehumidifiers beginning January 1, 2025.[62] Based on market research and information from manufacturer interviews, DOE expects that dehumidifier manufacturers will transition to flammable refrigerants (*e.g.,* R–32) in response to refrigerant GWP restrictions. DOE understands that switching from non-flammable to flammable refrigerants requires time and investment to redesign dehumidifiers and upgrade production facilities to accommodate the additional structural and safety precautions required. DOE tentatively expects manufacturers will need to transition to an A2L refrigerant to comply with upcoming refrigerant regulations, prior to the expected 2028 compliance date of any potential energy conservation standards.

Investments required to transition to flammable refrigerants in response to State regulations or EPA's final rule, necessitates a level of investment beyond typical annual R&D and capital expenditures. DOE considers the cost associated with the refrigerant transition in its GRIM to be independent of DOE actions related to any amended energy conservation standards. DOE accounted for the costs associated with redesigning dehumidifiers to make use of flammable refrigerants and retrofitting production facilities to accommodate flammable refrigerants in the GRIM in the no-new-standards case and standards cases to reflect the cumulative regulatory burden from State and Federal refrigerant regulation.[63] DOE relied on manufacturer feedback in confidential interviews and a report prepared for EPA [64] to estimate the industry refrigerant transition costs. Based on feedback, DOE assumed that the transition to low-GWP refrigerants would require industry to invest approximately $3.6 million in R&D and $7.1 million in capital expenditures (*e.g.,* investments in new charging equipment, leak detection systems, *etc.*).

DOE requests comments on the magnitude of costs associated with transitioning dehumidifier products and production facilities to accommodate low-GWP refrigerants that would be incurred between the publication of this NOPR and the proposed compliance date of amended standards. Quantification and categorization of these costs, such as engineering efforts, testing lab time, certification costs, and capital investments (*e.g.,* new charging equipment), would enable DOE to refine its analysis.

3. National Impact Analysis

This section presents DOE's estimates of the national energy savings and the NPV of consumer benefits that would result from each of the TSLs considered as potential amended standards.

a. Significance of Energy Savings

To estimate the energy savings attributable to potential amended standards for dehumidifiers, DOE compared their energy consumption under the no-new-standards case to their anticipated energy consumption under each TSL. The savings are measured over the entire lifetime of products purchased in the 30-year period that begins in the year of anticipated compliance with amended standards (2028–2057). Table V.21 presents DOE's projections of the national energy savings for each TSL considered for dehumidifiers. The savings were calculated using the approach described in section IV.H of this document.

TABLE V.21—CUMULATIVE NATIONAL ENERGY SAVINGS FOR DEHUMIDIFIERS; 30 YEARS OF SHIPMENTS

[2028–2057]

	Trial standard level			
	1	2	3	4
	quads			
Primary energy	0.00	0.02	0.32	0.97
FFC energy	0.00	0.02	0.33	0.99

OMB Circular A–4 [65] 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 proposed rulemaking, DOE undertook a sensitivity analysis using 9 years, 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

[61] State of California Air Resource Board, ''Prohibitions on Use of Certain Hydrofluorocarbons in Stationary Refrigeration, Chillers, Aerosols-Propellants, and Foam End-Uses Regulation.'' Amendments effective January 1, 2022. *ww2.arb.ca.gov/sites/default/files/barcu/regact/2020/hfc2020/frorevised.pdf* (last accessed March 4, 2023).

[62] The final rule was issued on October 5, 2023 and is pending publication in the **Federal Register**. A pre-publication version of the EPA final rule is available at: *www.epa.gov/system/files/documents/2023-10/technology-transitions-final-rule-2023-pre-publication.pdf.* Once published, the final rule will be available at: *www.regulations.gov/docket/EPA-HQ-OAR-2021-0643.*

[63] Although State regulations, such as CARB's, required the use low-GWP refrigerants in California starting January 1, 2023, for portable dehumidifiers, DOE assumed the refrigerant transition costs would be incurred over the same time period as whole-home dehumidifiers (2023 to 2024) since manufacturers likely waited for EPA SNAP approval before investing in the transition to low-GWP refrigerants for dehumidifiers. 88 FR 26382.

[64] Report prepared for the U.S. Environmental Protection Agency, prepared by RTI International, ''Global Non-CO2 Greenhouse Gas Emission Projections & Marginal Abatement Cost Analysis: Methodology Documentation'' (2019). Available at *www.epa.gov/sites/default/files/2019-09/documents/nonco2_methodology_report.pdf.*

[65] U.S. Office of Management and Budget. *Circular A–4: Regulatory Analysis.* September 17, 2003. Available at *https://www.whitehouse.gov/wp-content/uploads/legacy_drupal_files/omb/circulars/A4/a-4.pdf.*

standards.[66] The review 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.22. The impacts are counted over the lifetime of dehumidifiers purchased in 2028–2036.

TABLE V.22—CUMULATIVE NATIONAL ENERGY SAVINGS FOR DEHUMIDIFIERS; 9 YEARS OF SHIPMENTS
[2028–2036]

	Trial standard level			
	1	2	3	4
	quads			
Primary energy	0.00	0.01	0.12	0.28
FFC energy	0.00	0.01	0.12	0.29

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 TSLs considered for dehumidifiers. In accordance with OMB's guidelines on regulatory analysis,[67] DOE calculated NPV using both a 7-percent and a 3-percent real discount rate. Table V.23 shows the consumer NPV results with impacts counted over the lifetime of products purchased in 2028–2057.

TABLE V.23—CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR DEHUMIDIFIERS; 30 YEARS OF SHIPMENTS
[2028–2057]

Discount rate	Trial standard level			
	1	2	3	4
	Billion 2022$			
3 percent	0.02	0.07	2.61	2.21
7 percent	0.01	0.03	1.26	0.50

The NPV results based on the aforementioned 9-year analytical period are presented in Table V.24. The impacts are counted over the lifetime of products purchased in 2028–2036. 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.24—CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR DEHUMIDIFIERS; 9 YEARS OF SHIPMENTS (2028–2036)

Discount rate	Trial standard level			
	1	2	3	4
	Billion 2022$			
3 percent	0.01	0.04	1.16	0.55
7 percent	0.00	0.02	0.71	0.09

The previous 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 NOPR 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 estimates that that amended energy conservation standards for

[66] EPCA requires DOE to review its standards at least once every 6 years, and requires, for certain products, a 3-year period after any new standard is promulgated before compliance is required, except that in no case may any new standards be required within 6 years of the compliance date of the previous standards. (42 U.S.C. 6295(m)) While adding a 6-year review to the 3-year compliance period adds up to 9 years, DOE notes that it may undertake reviews at any time within the 6-year period and that the 3-year compliance date may yield to the 6-year backstop. A 9-year analysis period may not be appropriate given the variability that occurs in the timing of standards reviews and the fact that for some products, the compliance period is 5 years rather than 3 years.

[67] U.S. Office of Management and Budget. *Circular A–4: Regulatory Analysis.* September 17, 2003. Available at *https://www.whitehouse.gov/wp-content/uploads/legacy_drupal_files/omb/circulars/A4/a-4.pdf.*

dehumidifiers would reduce energy expenditures 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. 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 (2028–2032), where these uncertainties are reduced.

The results suggest that the proposed standards would be 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 NOPR TSD presents detailed results regarding anticipated indirect employment impacts.

4. Impact on Utility or Performance of Products

As discussed in section IV.C.1.b of this document, DOE has tentatively concluded that the standards proposed in this NOPR would not lessen the utility or performance of the dehumidifiers under consideration in this rulemaking. Manufacturers of these products currently offer units that meet or exceed the proposed standards.

5. Impact of Any Lessening of Competition

DOE considered any lessening of competition that would be likely to result from new or amended standards. As discussed in section III.E.1.e of this document, the Attorney General determines the impact, if any, of any lessening of competition likely to result from a proposed standard, and transmits such determination in writing to the Secretary, together with an analysis of the nature and extent of such impact. To assist the Attorney General in making this determination, DOE has provided DOJ with copies of this NOPR and the accompanying TSD for review. DOE will consider DOJ's comments on the proposed rule in determining whether to proceed to a final rule. DOE will publish and respond to DOJ's comments in that document. DOE invites comment from the public regarding the competitive impacts that are likely to result from this proposed rule. In addition, stakeholders may also provide comments separately to DOJ regarding these potential impacts. See the **ADDRESSES** section for information to send comments to DOJ.

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. Chapter 15 in the NOPR TSD presents the estimated impacts on electricity generating capacity, relative to the no-new-standards case, for the TSLs that DOE considered in this rulemaking.

Energy conservation resulting from potential energy conservation standards for dehumidifiers is expected to yield environmental benefits in the form of reduced emissions of certain air pollutants and greenhouse gases. Table V.25 provides DOE's estimate of cumulative emissions reductions expected to result from the TSLs considered in this rulemaking. The emissions were calculated using the multipliers discussed in section IV.K of this document. DOE reports annual emissions reductions for each TSL in chapter 13 of the NOPR TSD.

TABLE V.25—CUMULATIVE EMISSIONS REDUCTION FOR DEHUMIDIFIERS SHIPPED IN 2028–2057

	Trial standard level			
	1	2	3	4
Power Sector Emissions				
CO_2 (*million metric tons*)	0.07	0.31	6.37	18.68
CH_4 (*thousand tons*)	0.00	0.02	0.41	1.19
N_2O (*thousand tons*)	0.00	0.00	0.06	0.16
NO_X(*thousand tons*)	0.03	0.14	2.97	8.50
SO_2 *(thousand tons*)	0.02	0.08	1.72	5.00
Hg (*tons*)	0.000	0.001	0.011	0.033
Upstream Emissions				
CO_2 (*million metric tons*)	0.01	0.03	0.57	1.69
CH_4 (*thousand tons*)	0.59	2.51	51.53	153.02
N_2O (*thousand tons*)	0.00	0.00	0.00	0.01
NO_X (*thousand tons*)	0.10	0.43	8.84	26.25
SO_2 (*thousand tons*)	0.00	0.00	0.04	0.10
Hg (*tons*)	0.000	0.000	0.000	0.000
Total FFC Emissions				
CO_2 (*million metric tons*)	0.08	0.34	6.94	20.36
CH_4 (*thousand tons*)	0.60	2.53	51.94	154.20
N_2O (*thousand tons*)	0.00	0.00	0.06	0.17
NO_X (*thousand tons*)	0.14	0.57	11.81	34.74
SO_2 (*thousand tons*)	0.02	0.09	1.76	5.10
Hg (*tons*)	0.000	0.001	0.012	0.034

As part of the analysis for this rulemaking, DOE estimated monetary benefits likely to result from the reduced emissions of CO_2 that DOE estimated for each of the considered TSLs for dehumidifiers. Section IV.L of this document discusses the SC–CO_2 values that DOE used. Table V.26 presents the value of CO_2 emissions reduction at each TSL for each of the SC–CO_2 cases. The time-series of annual values is presented for the proposed TSL in chapter 14 of the NOPR TSD.

TABLE V.26—PRESENT VALUE OF CO_2 EMISSIONS REDUCTION FOR DEHUMIDIFIERS SHIPPED IN 2028–2057

TSL	SC–CO_2 case			
	Discount rate and statistics			
	5%	3%	2.5%	3%
	Average	Average	Average	95th percentile
	Billion 2022$			
1	0.00	0.00	0.01	0.01
2	0.00	0.02	0.02	0.05
3	0.08	0.32	0.50	0.98
4	0.22	0.92	1.43	2.79

As discussed in section IV.L.2 of this document, DOE estimated the climate benefits likely to result from the reduced emissions of methane and N_2O that DOE estimated for each of the considered TSLs for dehumidifiers. Table V.27 presents the value of the CH_4 emissions reduction at each TSL, and Table V.28 presents the value of the N_2O emissions reduction at each TSL. The time-series of annual values is presented for the proposed TSL in chapter 14 of the NOPR TSD.

TABLE V.27—PRESENT VALUE OF METHANE EMISSIONS REDUCTION FOR DEHUMIDIFIERS SHIPPED IN 2028–2057

TSL	SC–CH_4 case			
	Discount rate and statistics			
	5%	3%	2.5%	3%
	Average	Average	Average	95th percentile
	Million 2022$			
1	0.31	0.88	1.21	2.33
2	1.28	3.65	5.04	9.66
3	26.43	75.40	104.13	200.00
4	74.88	219.14	304.41	579.67

TABLE V.28—PRESENT VALUE OF NITROUS OXIDE EMISSIONS REDUCTION FOR DEHUMIDIFIERS SHIPPED IN 2028–2057

TSL	SC–N_2O case			
	Discount rate and statistics			
	5%	3%	2.5%	3%
	Average	Average	Average	95th percentile
	Million 2022$			
1	0.00	0.01	0.02	0.03
2	0.01	0.05	0.07	0.12
3	0.25	0.96	1.47	2.56
4	0.69	2.71	4.17	7.20

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 global and U.S. economy continues to evolve rapidly. DOE, together with other Federal agencies, will continue to review 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. DOE notes that the proposed standards would be economically justified even without inclusion of monetized benefits of reduced GHG emissions.

DOE also estimated the monetary value of the health benefits associated with NO_X and SO_2 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.29 presents the present value for NO_X emissions reduction for each TSL calculated using 7-percent and 3-percent discount rates, and Table V.30 presents similar results for SO_2 emissions reductions. The results in these tables reflect application of EPA's low dollar-per-ton values, which DOE used to be conservative. The time-series of annual values is presented for the proposed TSL in chapter 14 of the NOPR TSD.

TABLE V.29—PRESENT VALUE OF NO_X EMISSIONS REDUCTION FOR DEHUMIDIFIERS SHIPPED IN 2028–2057

TSL	3% Discount rate	7% Discount rate
	Million 2022$	
1	7.26	3.33
2	29.32	13.09
3	610.43	270.11
4	1,716.52	716.08

TABLE V.30—PRESENT VALUE OF SO_2 EMISSIONS REDUCTION FOR DEHUMIDIFIERS SHIPPED IN 2028–2057

TSL	3% Discount rate	7% Discount rate
	Million 2022$	
1	1.51	0.71
2	6.11	2.78
3	126.15	56.92
4	352.00	149.67

Not all the public health and environmental benefits from the reduction of greenhouse gases, NO_X, and SO_2 are captured in the values above, and additional unquantified benefits from the reductions of those pollutants as well as from the reduction of direct PM and other co-pollutants may be significant. DOE has not included monetary benefits of the reduction of Hg emissions because the amount of reduction is very small.

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 Economic Impacts

Table V.31 presents the NPV values that result from adding the estimates of the potential economic benefits resulting from reduced GHG and NO_X and SO_2 emissions to the NPV of consumer benefits calculated for each TSL considered in this rulemaking. The consumer benefits are domestic U.S. monetary savings that occur as a result of purchasing the covered products, and are measured for the lifetime of products shipped in 2028–2057. The climate benefits associated with reduced GHG emissions resulting from the adopted standards are global benefits, and are also calculated based on the lifetime of dehumidifiers shipped in 2028–2057.

TABLE V.31—CONSUMER NPV COMBINED WITH PRESENT VALUE OF CLIMATE BENEFITS AND HEALTH BENEFITS

Category	TSL 1	TSL 2	TSL 3	TSL 4
Using 3% discount rate for Consumer NPV and Health Benefits (billion 2022$)				
5% Average SC–GHG case	0.03	0.11	3.45	4.57
3% Average SC–GHG case	0.03	0.13	3.75	5.42
2.5% Average SC–GHG case	0.03	0.14	3.95	6.02
3% 95th percentile SC–GHG case	0.04	0.16	4.53	7.65
Using 7% discount rate for Consumer NPV and Health Benefits (billion 2022$)				
5% Average SC–GHG case	0.01	0.05	1.69	1.66
3% Average SC–GHG case	0.02	0.07	1.99	2.50
2.5% Average SC–GHG case	0.02	0.08	2.19	3.10
3% 95th percentile SC–GHG case	0.03	0.10	2.77	4.74

C. Conclusion

When considering new or amended energy conservation standards, the 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))

For this NOPR, 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 forgo 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. This approach includes changes to future shipments and INPV but does not include the forgone value to consumers who are no longer expected to purchase a dehumidifier in the standards case. Second, DOE accounts for energy savings attributable only to products actually used by consumers in the standards case; if a standard 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 NOPR 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.[68]

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.[69] 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.32 and Table V.33 summarize the quantitative impacts estimated for each TSL for dehumidifiers. The national impacts are measured over the lifetime of dehumidifiers purchased in the 30-year period that begins in the anticipated year of compliance with amended standards (2028–2057). The energy savings, emissions reductions, and value of emissions reductions refer to full-fuel-cycle results. The efficiency levels contained in each TSL are described in section V.A of this document.

TABLE V.32—SUMMARY OF ANALYTICAL RESULTS FOR DEHUMIDIFIER TSLS: NATIONAL IMPACTS

Category	TSL 1	TSL 2	TSL 3	TSL 4
Cumulative FFC National Energy Savings				
Quads	0.00	0.02	0.33	0.99
Cumulative FFC Emissions Reduction				
CO_2 (*million metric tons*)	0.08	0.34	6.94	20.36
CH_4 (*thousand tons*)	0.60	2.53	51.94	154.20
N_2O (*thousand tons*)	0.00	0.00	0.06	0.17
NO_X (*thousand tons*)	0.14	0.57	11.81	34.74
SO_2 (*thousand tons*)	0.02	0.09	1.76	5.10
Hg (*tons*)	0.00	0.00	0.01	0.03

[68] P.C. Reiss and M.W. White. Household Electricity Demand, Revisited. *Review of Economic Studies.* 2005. 72(3): pp. 853–883. doi: *10.1111/0034–6527.00354.*

[69] Sanstad, A.H. *Notes on the Economics of Household Energy Consumption and Technology Choice.* 2010. Lawrence Berkeley National Laboratory. Available at *www1.eere.energy.gov/buildings/appliance_standards/pdfs/consumer_ee_theory.pdf* (last accessed February 22, 2023).

TABLE V.32—SUMMARY OF ANALYTICAL RESULTS FOR DEHUMIDIFIER TSLS: NATIONAL IMPACTS—Continued

Category	TSL 1	TSL 2	TSL 3	TSL 4
Present Value of Benefits and Costs (3% discount rate, billion 2022$)				
Consumer Operating Cost Savings	0.03	0.13	2.75	7.80
Climate Benefits*	0.00	0.02	0.40	1.14
Health Benefits**	0.01	0.04	0.74	2.07
Total Benefits†	0.05	0.19	3.89	11.01
Consumer Incremental Product Costs‡	0.02	0.06	0.14	5.59
Consumer Net Benefits	0.02	0.07	2.61	2.21
Total Net Benefits	0.03	0.13	3.75	5.42
Present Value of Benefits and Costs (7% discount rate, billion 2022$)				
Consumer Operating Cost Savings	0.02	0.07	1.34	3.59
Climate Benefits*	0.00	0.02	0.40	1.14
Health Benefits**	0.00	0.02	0.33	0.87
Total Benefits†	0.03	0.10	2.07	5.59
Consumer Incremental Product Costs‡	0.01	0.03	0.08	3.09
Consumer Net Benefits	0.01	0.03	1.26	0.50
Total Net Benefits	0.02	0.07	1.99	2.50

Note: This table presents the costs and benefits associated with dehumidifiers shipped in 2028–2057. These results include benefits to consumers which accrue after 2057 from the products shipped in 2028–2057.

* Climate benefits are calculated using four different estimates of the SC–CO_2, SC–CH_4 and SC–N_2O. Together, these represent the global SC–GHG. For presentational purposes of this table, the climate benefits associated with the average SC–GHG at a 3-percent discount rate are shown, but DOE does not have a single central SC–GHG point estimate. To monetize the benefits of reducing GHG emissions this analysis uses the interim estimates presented in the Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates Under Executive Order 13990 published in February 2021 by the Interagency Working Group on the Social Cost of Greenhouse Gases (IWG).

** Health benefits are calculated using benefit-per-ton values for NO_X and SO_2. DOE is currently only monetizing (for NO_X and SO_2) $PM_{2.5}$ precursor health benefits and (for NO_X) ozone precursor health benefits, but will continue to assess the ability to monetize other effects such as health benefits from reductions in direct $PM_{2.5}$ emissions. The health benefits are presented at real discount rates of 3 and 7 percent. See section IV.L of this document for more details.

† Total and net benefits include consumer, climate, and health benefits. For presentation purposes, total and net benefits for both the 3-percent and 7-percent cases are presented using the average SC–GHG with 3-percent discount rate, but DOE does not have a single central SC–GHG point estimate and emphasizes the importance and value of considering the benefits calculated using all four sets of SC–GHG estimates.

‡ Costs include incremental equipment costs as well as installation costs.

TABLE V.33—SUMMARY OF ANALYTICAL RESULTS FOR DEHUMIDIFIER TSLS: MANUFACTURER AND CONSUMER IMPACTS

Category	TSL 1*	TSL 2*	TSL 3*	TSL 4*
Manufacturer Impacts				
Industry NPV (*million 2022$*) (No-new-standards case INPV = $158.3)	157.8 to 158.0	157.4 to 158.1	153.1 to 155.0	73.0 to 121.6
Industry NPV (*% change*)	(0.3) to (0.2)	(0.6) to (0.2)	(3.3) to (2.1)	(53.9) to (23.2)
Consumer Average LCC Savings (*2022$*)				
PC 1: Portable Dehumidifiers ≤25.00 Pints/Day	$0	$46	$42	($9)
PC 2: Portable Dehumidifiers 25.01–50.00 Pints/Day	$0	$0	$81	$14
PC 3: Portable Dehumidifiers >50.00 Pints/Day	$31	($4)	$31	($52)
PC 4: Whole-Home Dehumidifiers ≤8.0 cu. ft. Case Volume	$63	$63	$56	$12
PC 5: Whole-Home Dehumidifiers >8.0 cu. ft. Case Volume	$53	$179	$146	$81
Shipment-Weighted Average*	$1	$13	$71	$7
Consumer Simple PBP (years)				
PC 1: Portable Dehumidifiers ≤25.00 Pints/Day	1.0	0.9	0.9	6.3
PC 2: Portable Dehumidifiers 25.01–50.00 Pints/Day	0.7	0.8	0.6	5.3
PC 3: Portable Dehumidifiers >50.00 Pints/Day	4.8	8.7	4.8	11.2
PC 4: Whole-Home Dehumidifiers ≤8.0 cu. ft. Case Volume	6.9	6.9	6.4	7.2
PC 5: Whole-Home Dehumidifiers >8.0 cu. ft. Case Volume	5.6	2.9	5.7	7.8
Shipment-Weighted Average*	0.9	1.0	0.8	5.6
Percent of Consumers That Experience a Net Cost				
PC 1: Portable Dehumidifiers ≤25.00 Pints/Day	0%	1%	3%	65%
PC 2: Portable Dehumidifiers 25.01–50.00 Pints/Day	0%	0%	0%	60%
PC 3: Portable Dehumidifiers >50.00 Pints/Day	33%	65%	33%	74%
PC 4: Whole-Home Dehumidifiers ≤8.0 cu. ft. Case Volume	4%	4%	8%	56%
PC 5: Whole-Home Dehumidifiers >8.0 cu. ft. Case Volume	19%	7%	38%	53%
Shipment-Weighted Average*	0%	1%	1%	61%

Parentheses indicate negative (−) values.

* Weighted by shares of each product class in total projected shipments in 2022.

DOE first considered TSL 4, which represents the max-tech efficiency levels. At this TSL, all product classes would require the most efficient compressor found in DOE's physical teardowns of commercially available models, an ECM blower fan with associated variable-speed driver, controls with lower inactive mode power consumption, and the largest heat exchangers observed from DOE's physical teardowns of commercially available models in each product class. TSL 4 would save an estimated 0.99 quads of energy, an amount DOE considers significant. Under TSL 4, the NPV of consumer benefit would be $0.50 billion using a discount rate of 7 percent, and $2.21 billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 4 are 20.36 Mt of CO_2, 5.10 thousand tons of SO_2, 34.74 thousand tons of NO_X, 0.03 tons of Hg, 154.20 thousand tons of CH_4, and 0.17 thousand tons of N_2O. The estimated monetary value of the climate benefits from reduced GHG emissions (associated with the average SC–GHG at a 3-percent discount rate) at TSL 4 is $1.14 billion. The estimated monetary value of the health benefits from reduced SO_2 and NO_X emissions at TSL 4 is $0.87 billion using a 7-percent discount rate and $2.07 billion using a 3-percent discount rate.

Using a 7-percent discount rate for consumer benefits and costs, health benefits from reduced SO_2 and NO_X emissions, and the 3-percent discount rate case for climate benefits from reduced GHG emissions, the estimated total NPV at TSL 4 is $2.50 billion. Using a 3-percent discount rate for all benefits and costs, the estimated total NPV at TSL 4 is $5.42 billion. The estimated total NPV is provided for additional information, however DOE primarily relies upon the NPV of consumer benefits when determining whether a proposed standard level is economically justified.

Portable dehumidifiers in the CCD range in capacity from 1.7 to 104.3 pints per day and account for 98 percent of the current dehumidifier shipments.[70] Within the portable segment of the market, there are three product classes differentiated by capacity range. Portable dehumidifiers with capacities greater than 25.0 pints per day and less than or equal to 50.0 pints per day (PC 2) have the largest market share accounting for approximately 73 percent of portable dehumidifier shipments. Portable dehumidifiers with capacities less than or equal to 25.0 pints per day (PC 1) account for approximately 26 percent of portable dehumidifier shipments. Portable dehumidifiers with capacities greater than 50.0 pints per day (PC 3) account for the remaining 1 percent of portable dehumidifier shipments. Whole-home dehumidifiers are categorized into two product classes based on case volume and correspond to 2 percent of the total dehumidifier market. Whole-home units range in case volume between 1.7 cu. ft. and 9.5 cu. ft. Whole-home dehumidifiers with case volumes less than or equal to 8.0 cu. ft. (PC 4) account for 85 percent of whole-home dehumidifier shipments in 2022.

For portable dehumidifiers at TSL 4, the average LCC impact is a savings of $14 for PC 2, a net cost of $9 for PC 1 and $52 for PC 3. The simple payback period is 6.3 years for PC 1, 5.3 years for PC 2, and 11.2 years for PC 3. Notably, the simple payback period for PC 3 exceeds the expected average lifetime of 10 years for portable dehumidifiers. The fraction of consumers experiencing a net LCC cost is 65 percent for PC 1, 60 percent for PC 2, and 74 percent for PC 3. For whole-home dehumidifiers, the average LCC impact is a savings of $12 for PC 4 and $81 for PC 5. The simple payback is 7.2 years for PC 4 and 7.8 years for PC 5. The fraction of consumers experiencing a net LCC cost is 56 percent for PC 4 and 53 percent for PC 5. Weighted across the market share for all five product classes, a majority of dehumidifier consumers (61 percent) would experience a net cost.

An analysis of RECS 2020 indicates that 97 percent of low-income households that own a dehumidifier own a portable unit. Assuming the low-income sample has a similar market distribution in portable dehumidifier capacities as the national sample, DOE estimates that approximately 25 percent of low-income dehumidifier consumers purchase units in PC 1 and 71 percent in PC 2. At TSL 4, low-income households experience an average net LCC cost of $37 for PC 1 and $21 for PC 2. The percentage of low-income consumers who experience a net LCC cost is 73 percent for PC 1 and 68 percent for PC 2. Low-income households will experience an installed cost increase of $169 for PC 1 (60 percent price increase relative to baseline unit) and $179 for PC 2 (57 percent price increase relative to baseline unit). The simple payback period for low-income households is 7.6 years for PC 1 and 6.4 years for PC 2.

At TSL 4, the projected change in INPV ranges from a decrease of $85.3 million to a decrease of $36.8 million, which corresponds to decreases of 53.9 percent and 23.2 percent, respectively. DOE estimates that industry must invest $73.9 million to completely redesign nearly all models to accommodate larger heat exchangers and new chassis designs.

Overall, DOE estimates that less than 1 percent of current industry shipments meet the efficiencies required at TSL 4. A max-tech standard would require significant investment. Most manufacturers would need to incorporate larger heat exchangers, which would necessitate increasing chassis dimensions of both portable and whole-home units since most dehumidifiers cannot accommodate a larger heat exchanger within the existing cabinet structure. For the portable dehumidifier classes, which together account for nearly 98 percent of industry shipments, most manufacturers would need to make significant investments to adjust equipment and tooling to accommodate new dimensions across their entire product portfolio. DOE estimates that no portable dehumidifier shipments currently meet the max-tech efficiencies. Of the 15 portable dehumidifier OEMs, none currently offer any models that meet the max-tech efficiencies. Whole-home dehumidifiers account for the remaining 2 percent of industry shipments. DOE estimates that approximately 3 percent of whole-home dehumidifier shipments meet max-tech efficiencies. DOE identified only three OEMs producing whole-home dehumidifiers for the U.S. market. Of those three whole-home OEMs, only one currently offers a PC 4 model that meets the max-tech level. The other two OEMs would therefore need to dedicate significant engineering resources to redesign their entire product portfolio to include larger heat exchangers, which would necessitate a change in dimensions and chassis designs. For product class 5, only one OEM manufacturers whole-home dehumidifiers greater than 8.0 cu. ft. (PC 5). This OEM does not currently offer any models that meet the max-tech efficiency required. Given the limited number of whole-home OEMs, the limited number of models currently available that meet the max-tech efficiency levels, and the extent of the redesign required for the OEMs without any max-tech product offerings, there is uncertainty whether whole-home products would remain sufficiently available to meet consumer demand at

[70] Current shipments estimates refer to the 2022 shipments distribution in the no-new-standards case. See section IV.F.8 of this document for details on the energy efficiency distribution in the no-new-standards case.

the compliance date of amended standards set at TSL 4. At this TSL, DOE expects an estimated 23-percent drop in shipments compared to the no-new-standards case shipments in the year the standard takes effect (2028), as some consumers may forgo or delay purchasing a new dehumidifier due to the increased upfront cost of standards-compliant models.

The Secretary tentatively 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 emissions reductions would be outweighed by the economic burden on a majority of consumers, and the impacts on manufacturers, including the large conversion costs, profit margin impacts that could result in a large reduction in INPV, and the lack of manufacturers currently offering products meeting the efficiency levels required at this TSL. Across all product classes, a majority of dehumidifier consumers (61 percent) would experience a net LCC cost. Additionally, the average LCC savings would be negative for PC 1 and PC 3. DOE's consumer subgroup analysis indicates that both low-income and senior-only households would experience larger economic burdens compared to the national population. All portable dehumidifier product classes, which account for 97 percent of dehumidifiers in low-income households and 98 percent in senior-only households, have a negative average LCC savings and majority of consumers experience a net cost. For PC 2 which accounts for 71 percent of the low-income market share of all dehumidifiers, the average net LCC cost is $21 and 68 percent of the low-income consumers would experience a net cost. Weighted across all product classes, the average low-income consumer would experience a net LCC cost of $23 and 69 percent of low-income consumers would experience a net cost at TSL 4. The average senior-only household would experience a net LCC cost of $8 and 66 percent of consumers experiencing a net cost. The potential reduction in INPV could be as high as 53.9 percent. The drop in industry value and reduction in free cash flow after the compliance year is driven by a range of factors, but most notably the changes are driven by conversion cost investments manufacturers must make to redesign and produce more efficient products. Most manufacturers would need to dedicate significant capital and engineering resources to develop new chassis designs to accommodate larger heat exchangers. Due to the limited amount of engineering resources each manufacturer has, it is unclear if most manufacturers will be able to redesign their entire product offerings of dehumidifiers covered by this rulemaking in the 3-year compliance period. Consequently, the Secretary has tentatively concluded that TSL 4 is not economically justified.

DOE then considered TSL 3, which represents efficiency level 3 for PC 1, PC 2, and PC 5, efficiency level 1 for PC 3, and efficiency level 2 for PC 4. At this level, DOE expects that all product classes would incorporate a higher efficiency compressor. For PC 4 and 5, technology options include the addition of an ECM blower and a larger heat exchanger. TSL 3 would save an estimated 0.33 quads of energy, an amount DOE considers significant. Under TSL 3, the NPV of consumer benefit would be $1.26 billion using a discount rate of 7 percent, and $2.61 billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 3 are 6.94 Mt of CO_2, 1.76 thousand tons of SO_2, 11.81 thousand tons of NO_X, 0.01 tons of Hg, 51.94 thousand tons of CH_4, and 0.06 thousand tons of N_2O. The estimated monetary value of the climate benefits from reduced GHG emissions (associated with the average SC–GHG at a 3-percent discount rate) at TSL 3 is $0.40 billion. The estimated monetary value of the health benefits from reduced SO_2 and NO_X emissions at TSL 3 is $0.33 billion using a 7-percent discount rate and $0.74 billion using a 3-percent discount rate.

Using a 7-percent discount rate for consumer benefits and costs, health benefits from reduced SO_2 and NO_X emissions, and the 3-percent discount rate case for climate benefits from reduced GHG emissions, the estimated total NPV at TSL 3 is $1.99 billion. Using a 3-percent discount rate for all benefits and costs, the estimated total NPV at TSL 3 is $3.75 billion. The estimated total NPV is provided for additional information, however DOE primarily relies upon the NPV of consumer benefits when determining whether a proposed standard level is economically justified.

For portable dehumidifiers at TSL 3, the average LCC impact is a savings of $42 for PC 1, $81 for PC 2, and $31 for PC 3. The simple payback period is 0.9 years for PC 1, 0.6 years for PC 2, and 4.8 years for PC 3. The fraction of consumers experiencing a net LCC cost is 3 percent for PC 1, 0 percent for PC 2, and 33 percent for PC 3. For whole-home dehumidifiers, the average LCC savings is $56 for PC 4 and $146 for PC 5. The simple payback period is 6.4 years for PC 4 and 5.7 years for PC 5. The fraction of consumers experiencing a net LCC cost is 8 percent for PC 4 and 38 percent for PC 5. Weighting across all product classes, 1 percent of dehumidifier consumers would experience a net cost. The average LCC savings are positive for all product classes for the national consumer samples as well as for the low-income and senior-only consumer samples. At TSL 3, the percentage of low-income households that experience a net LCC cost is 7 percent for PC 1 and 0 percent for PC 2.

At TSL 3, the projected change in INPV ranges from a decrease of $5.2 million to a decrease of $3.3 million, which correspond to decreases of 3.3 percent and 2.1 percent, respectively. DOE estimates that industry must invest $6.9 million to comply with standards set at TSL 3. DOE estimates that approximately 3 percent of industry shipments currently meet the efficiency levels analyzed at TSL 3.

DOE estimates that approximately 2 percent of portable dehumidifier shipments currently meet the TSL 3 efficiency levels. At this level, manufacturers would likely incur product conversion costs to qualify, source, and test more efficient compressors. However, DOE does not expect portable dehumidifier manufacturers would need to adopt new or larger chassis designs because the proposed levels may be met through component swaps in existing chassis designs. Thus, DOE does not expect manufacturers would incur notable capital conversion costs to meet the efficiencies required. For whole-home dehumidifiers, DOE expects some manufacturers would need to adopt new or larger chassis designs to accommodate larger heat exchangers but not to the extent required at max-tech. For whole-home dehumidifier designs, DOE expects that the size differences would not necessitate capital investment since existing machinery could likely still be used. DOE estimates that 78 percent of PC 4 shipments (which account for 85 percent of whole-home dehumidifier shipments) meet the efficiency level required. Of the three whole-home dehumidifier OEMs, two OEMs currently offer PC 4 models that meet the efficiency required. As with TSL 4, whole-home dehumidifier manufacturers would likely need to completely redesign models that do not meet the required efficiencies. However, approximately 60 percent of PC 4 basic model listings (around 32 unique basic models), representing the full range of

existing sizes of PC 4 models (1.7 to 6.6 cu. ft.), already meet the efficiency level required.

After considering the analysis and weighing the benefits and burdens, the Secretary has tentatively concluded that a standard set at TSL 3 for dehumidifiers would be economically justified. At this TSL, the average LCC savings for all product classes are positive. An estimated 1 percent of portable dehumidifier (PC 1, PC 2, and PC 3) and 13 percent of whole-home dehumidifier (PC 4 and PC 5) consumers experience a net cost. The FFC national energy savings are significant and the NPV of consumer benefits is positive using both a 3-percent and 7-percent discount rate. Notably, the benefits to consumers vastly outweigh the cost to manufacturers. At TSL 3, the NPV of consumer benefits, even measured at the more conservative discount rate of 7 percent, is approximately 242 times higher than the maximum estimated manufacturers' loss in INPV. The standard levels at TSL 3 are economically justified even without weighing the estimated monetary value of emissions reductions. When those emissions reductions are included—representing $0.40 billion in climate benefits (associated with the average SC–GHG at a 7-percent discount rate), and $0.74 billion (using a 3-percent discount rate) or $0.33 billion (using a 7-percent discount rate) in health benefits—the rationale becomes stronger still.

As stated, DOE conducts the walk-down analysis to determine the TSL that represents the maximum improvement in energy efficiency that is technologically feasible and economically justified as required under EPCA. The walk-down is not a comparative analysis, as a comparative analysis would result in the maximization of net benefits instead of energy savings that are technologically feasible and economically justified, which would be contrary to the statute. 86 FR 70892, 70908. Although DOE has not conducted a comparative analysis to select the proposed energy conservation standards, DOE notes that as compared to TSL 4, TSL 3 has shorter payback periods, smaller percentages of consumer experiencing a net cost, higher LCC savings for all product classes, a lower maximum decrease in INPV, and lower manufacturer conversion costs.

Although DOE considered proposed amended standard levels for dehumidifiers by grouping the efficiency levels for each product class into TSLs, DOE evaluates all analyzed efficiency levels in its analysis. For portable dehumidifiers with capacities less than or equal to 50.0 pints per day, which account for 97 percent of the dehumidifier market, TSL 3 represents the maximum energy savings that does not result in a large percentage of consumers experiencing a net LCC cost. Efficiency levels above the proposed standard have lower LCC savings and a significantly larger percentage of consumers that experience a net cost. For portable dehumidifiers with capacities greater than 50.0 pints per day, which accounts for 1.1 percent of the dehumidifier market, TSL 3 corresponds to EL 1, the only efficiency level with positive LCC savings and a majority of consumers either not impacted or positively impacted by the proposed standard. For whole-home dehumidifiers, which represent 1.6 percent of the dehumidifier market, TSL 3 corresponds to efficiency levels one level below the max-tech efficiency level. For PC 4, which accounts for approximately 85 of the whole-home dehumidifier shipments, one OEM (out of the three whole-home OEMs) currently offers one model that meets the max-tech level. Given the limited number of whole-home OEMs, the limited number of models currently available that meet the max-tech efficiency level, and the extent of the redesign required for the OEMs without any max-tech product offerings, there is a risk that the 3-year period between the announcement of the final rule and the compliance date of the amended energy conservation standard might be insufficient to design, test, and manufacture the necessary number of whole-home products to meet consumer demand. For PC 5, a majority of consumers would experience negative LCC savings at the max-tech efficiency level. At the proposed TSL, the LCC savings are higher and the percent negatively impacted consumers are lower compared to the max-tech efficiency level.

Therefore, based on the previous considerations, DOE proposes to adopt the energy conservation standards for dehumidifiers at TSL 3. The proposed amended energy conservation standards for dehumidifiers, which are expressed as IEF, are shown in Table V.34.

TABLE V.34—PROPOSED AMENDED ENERGY CONSERVATION STANDARDS FOR DEHUMIDIFIERS

Product class	Minimum integrated energy factor (L/kWh)
	TSL 3
PC 1: Portable Dehumidifiers ≤25.00 Pints/Day	1.70
PC 2: Portable Dehumidifiers 25.01–50.00 Pints/Day	2.01
PC 3: Portable Dehumidifiers >50.00 Pints/Day	3.10
PC 4: Whole-Home Dehumidifiers ≤8.0 cu. ft. Case Volume	2.22
PC 5: Whole-Home Dehumidifiers >8.0 cu. ft. Case Volume	3.81

2. Annualized Benefits and Costs of the Proposed Standards

The benefits and costs of the proposed standards can also be expressed in terms of annualized values. The annualized net benefit is (1) the annualized national economic value (expressed in 2022$) 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), and (2) the annualized monetary value of the climate and health benefits from emission reductions.

Table V.35 shows the annualized values for dehumidifiers under TSL 3, expressed in 2022$. The results under the primary estimate are as follows.

Using a 7-percent discount rate for consumer benefits and costs and NO_X and SO_2 reduction benefits, and a 3-percent discount rate case for GHG social costs, the estimated cost of the proposed standards for dehumidifiers is $8.55 million per year in increased equipment costs, while the estimated annual benefits are $142.04 million from reduced equipment operating

costs, $22.85 million from GHG reductions, and $34.54 million from reduced NO_X and SO_2 emissions. In this case, the net benefit amounts to $190.89 million per year.

Using a 3-percent discount rate for all benefits and costs, the estimated cost of the proposed standards for dehumidifiers is $7.89 million per year in increased equipment costs, while the estimated annual benefits are $157.99 million in reduced operating costs, $22.85 million from GHG reductions, and $42.30 million from reduced NO_X and SO_2 emissions. In this case, the net benefit amounts to $215.24 million per year.

TABLE V.35—ANNUALIZED BENEFITS AND COSTS OF PROPOSED ENERGY CONSERVATION STANDARDS FOR DEHUMIDIFIERS

[TSL 3]

	Million 2022$/year		
	Primary estimate	Low-net-benefits estimate	High-net-benefits estimate
3% discount rate			
Consumer Operating Cost Savings	157.99	153.04	163.15
Climate Benefits *	22.85	22.66	22.93
Health Benefits **	42.30	41.95	42.42
Total Benefits †	223.14	217.65	228.50
Consumer Incremental Product Costs ‡	7.89	7.94	7.77
Net Benefits	215.24	209.71	220.74
Change in Producer Cashflow (INPV ‡‡)	(0.5)–(0.3)	(0.5)–(0.3)	(0.5)–(0.3)
7% discount rate			
Consumer Operating Cost Savings	142.04	138.10	146.50
Climate Benefits * (3% discount rate)	22.85	22.66	22.93
Health Benefits **	34.54	34.31	34.64
Total Benefits †	199.44	195.07	204.06
Consumer Incremental Product Costs ‡	8.55	8.58	8.44
Net Benefits	190.89	186.49	195.62
Change in Producer Cashflow (INPV ‡‡)	(0.5)–(0.3)	(0.5)–(0.3)	(0.5)–(0.3)

Note: This table presents the costs and benefits associated with dehumidifiers shipped in 2028–2057. These results include benefits to consumers which accrue after 2057 from the products shipped in 2028 − 2057. The Primary, Low Net Benefits, and High Net Benefits Estimates utilize projections of energy prices from the AEO2023 Reference case, Low Economic Growth case, and High Economic Growth case, respectively. In addition, incremental equipment costs reflect a medium decline rate in the Primary Estimate, a low decline rate in the Low Net Benefits Estimate, and a high decline rate in the High Net Benefits Estimate. The methods used to derive projected price trends are explained in sections IV.F.1 and IV.H.3 of this document. Note that the Benefits and Costs may not sum to the Net Benefits due to rounding.

* Climate benefits are calculated using four different estimates of the global SC–GHG (see section IV.L of this document). For presentational purposes of this table, the climate benefits associated with the average SC–GHG at a 3-percent discount rate are shown, but DOE does not have a single central SC–GHG point estimate and emphasizes the importance and value of considering the benefits calculated using all four sets of SC–GHG estimates. To monetize the benefits of reducing GHG emissions this analysis uses the interim estimates presented in the Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates Under Executive Order 13990 published in February 2021 by the Interagency Working Group on the Social Cost of Greenhouse Gases (IWG).

** Health benefits are calculated using benefit-per-ton values for NO_X and SO_2. DOE is currently only monetizing (for SO_2 and NO_X) $PM_{2.5}$ precursor health benefits and (for NO_X) ozone precursor health benefits, but will continue to assess the ability to monetize other effects such as health benefits from reductions in direct $PM_{2.5}$ emissions. See section IV.L of this document for more details.

† Total benefits for both the 3-percent and 7-percent cases are presented using the average SC–GHG with 3-percent discount rate, but DOE does not have a single central SC–GHG point estimate.

‡ Costs include incremental equipment costs as well as installation costs.

‡‡ Operating Cost Savings are calculated based on the life cycle costs analysis and national impact analysis as discussed in detail below. *See* sections IV.F and IV.H of this document. DOE's national impacts analysis includes all impacts (both costs and benefits) along the distribution chain beginning with the increased costs to the manufacturer to manufacture the product and ending with the increase in price experienced by the consumer. DOE also separately conducts a detailed analysis on the impacts on manufacturers (*i.e.,* manufacturer impact analysis, or ''MIA''). *See* section IV.J of this document. In the detailed MIA, DOE models manufacturers' pricing decisions based on assumptions regarding investments, conversion costs, cashflow, and margins. The MIA produces a range of impacts, which is the rule's expected impact on the INPV. The change in INPV is the present value of all changes in industry cash flow, including changes in production costs, capital expenditures, and manufacturer profit margins. The annualized change in INPV is calculated using the industry weighted average cost of capital value of 8.4 percent that is estimated in the manufacturer impact analysis (*see* chapter 12 of the NOPR TSD for a complete description of the industry weighted average cost of capital). For dehumidifiers, the annualized change in INPV ranges from −$0.5 million to −$0.3 million. DOE accounts for that range of likely impacts in analyzing whether a trial standard level is economically justified. *See* section V.C of this document. DOE is presenting the range of impacts to the INPV under two markup scenarios: the Preservation of Gross Margin scenario, which is the manufacturer markup scenario used in the calculation of Consumer Operating Cost Savings in this table; and the Preservation of Operating Profit Markup scenario, where DOE assumed manufacturers would not be able to increase per-unit operating profit in proportion to increases in manufacturer production costs. DOE includes the range of estimated annualized change in INPV in the above table, drawing on the MIA explained further in section IV.J of this document to provide additional context for assessing the estimated impacts of this proposal to society, including potential changes in production and consumption, which is consistent with OMB's Circular A–4 and E.O. 12866. If DOE were to include the INPV into the annualized net benefit calculation for this proposed rule, the annualized net benefits would range from $214.8 million to $214.9 million at 3-percent discount rate and would range from $190.4 million to $190.6 million at 7-percent discount rate.

D. Reporting, Certification, and Sampling Plan

Manufacturers, including importers, must use product-specific certification templates to certify compliance to DOE. For dehumidifiers, the certification template reflects the general certification requirements specified at 10 CFR 429.12. As discussed in the previous paragraphs, DOE is not proposing to amend the product-specific certification requirements for these products.

VI. Procedural Issues and Regulatory Review

A. Review Under Executive Orders 12866, 13563 and 14094

E.O. 12866, ''Regulatory Planning and Review,'' as supplemented and reaffirmed by E.O. 13563, ''Improving Regulation and Regulatory Review,'' 76 FR 3821 (Jan. 21, 2011) and amended by E.O. 14094, ''Modernizing Regulatory Review,'' 88 FR 21879 (April 11, 2023), requires agencies, to the extent permitted by law, 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 E.O. 13563 requires agencies to use the best available techniques to quantify anticipated present and future benefits and costs as accurately as possible. In its guidance, the Office of Information and Regulatory Affairs (''OIRA'') in the Office of Management and Budget (''OMB'') has emphasized that such techniques may include identifying changing future compliance costs that might result from technological innovation or anticipated behavioral changes. For the reasons stated in the preamble, this proposed regulatory action is consistent with these principles.

Section 6(a) of E.O. 12866 also requires agencies to submit ''significant regulatory actions'' to OIRA for review. OIRA has determined that this proposed regulatory action constitutes a ''significant regulatory action'' within the scope of section 3(f)(1) of E.O. 12866. Accordingly, pursuant to section 6(a)(3)(C) of E.O. 12866, DOE has provided to OIRA an assessment, including the underlying analysis, of benefits and costs anticipated from the proposed 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 are summarized in this preamble and further detail can be found in the technical support document for this rulemaking.

B. Review Under the Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) requires preparation of an initial regulatory flexibility analysis (''IRFA'') for any rule that by law must be proposed for public comment, unless the agency certifies that the rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. As required by E.O. 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 website (*www.energy.gov/gc/office-general-counsel*). DOE has prepared the following IRFA for the products that are the subject of this rulemaking.

For manufacturers of dehumidifiers, the SBA has set a size threshold, which defines those entities classified as ''small businesses'' for the purposes of the statute. DOE used the SBA's small business size standards to determine whether any small entities would be subject to the requirements of the rule. (*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/document/support--table-size-standards.* Manufacturing of portable dehumidifiers is classified under NAICS 335210, ''Small Electrical Appliance Manufacturing'' and manufacturing of whole-home dehumidifiers is classified under NAICS 333415, ''Air Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing.'' For NAICS 335210, the SBA sets a threshold of 1,500 employees or less and for NAICS 333415, the SBA sets a threshold of 1,250 employees or less, for an entity to be considered as a small business for these categories. For the purpose of this IRFA, DOE used the higher employee limit of 1,500 in order to establish a more inclusive threshold for what determines a ''small business.''

1. Description of Reasons Why Action Is Being Considered

DOE is proposing amended energy conservation standards for dehumidifiers. EPCA authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment. Title III, Part B of EPCA established the Energy Conservation Program for Consumer Products Other Than Automobiles. These products include dehumidifiers, the subject of this document. (42 U.S.C. 6295(cc)) In a final rule published on June 13, 2016, DOE prescribed the current energy conservation standards for dehumidifiers manufactured on and after June 13, 2019. 81 FR 38338. EPCA provides that, not later than 6 years after the 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 NOPR including new proposed energy conservation standards (proceeding to a final rule, as appropriate). (42 U.S.C. 6295(m)(1)) This propose rulemaking is in accordance with DOE's obligations under EPCA.

2. Objectives of, and Legal Basis for, Rule

EPCA authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment. Title III, Part B of EPCA established the Energy Conservation Program for Consumer Products Other Than Automobiles. These products include dehumidifiers, the subject of this document. (42 U.S.C. 6295(cc)) EPCA prescribed energy conservation standards for these products. *Id.* EPCA further provides that, not later than 6 years after the 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 NOPR including new proposed energy conservation standards (proceeding to a final rule, as appropriate). (42 U.S.C. 6295(m)(1))

3. Description on Estimated Number of Small Entities Regulated

DOE conducted a market assessment using public information and subscription-based company reports to identify potential small manufacturers. DOE began its assessment by compiling a product database of dehumidifier models available in the United States. To develop a comprehensive product database of dehumidifier basic models, DOE reviewed its Compliance Certification Database (CCD),[71] supplemented by information from California Energy Commission's Modernized Appliance Efficiency Database System (MAEDbS),[72] EPA's ENERGY STAR Product Finder data set,[73] individual company websites, and prior dehumidifier rulemakings. DOE then reviewed the comprehensive product database to identify the original equipment manufacturers (OEMs) of the dehumidifier models identified. DOE consulted publicly available data, such as manufacturer websites, manufacturer specifications and product literature, import/export logs (*e.g.,* bills of lading from Panjiva [74]), and basic model numbers, to identify OEMs of covered dehumidifiers. DOE further relied on public data and subscription-based market research tools (*e.g.,* Dun & Bradstreet reports [75]) to determine company, location, headcount, and annual revenue. DOE screened out companies that do not offer products covered by this rulemaking, do not meet the SBA's definition of a ''small business,'' or are foreign-owned and operated.

Based on its review, DOE identified 20 OEMs that sell dehumidifiers in the United States. DOE then determined that of the 20 OEMs, 19 were either large OEMs or are foreign owned and operated. Therefore, DOE tentatively determined that one company is a small, domestic manufacturer that meets the SBA's definition of a ''small business'' (*i.e.,* the company has 1,500 employees or less) and manufactures products covered by this rulemaking. This small business manufactures whole-home dehumidifiers ≤8.0 cubic feet (Product Class 4).

DOE reached out to this small business and invited them to participate in voluntary interviews. However, this small business did not consent to participate in the voluntary interviews conducted in support of the NOPR analysis. DOE also requested information about small businesses and potential impacts on small businesses while interviewing larger manufacturers.

4. Description and Estimate of Compliance Requirements Including Differences in Cost, if Any, for Different Groups of Small Entities

DOE reviewed its product database and identified 35 basic models of whole-home dehumidifiers with a capacity of under 8.0 cubic feet (Product Class 4) manufactured by this small, domestic OEM. Of those 35 models, 23 models currently meet the TSL 3 efficiency level. Should this small business choose to redesign the 12 models that do not currently meet the proposed amended standard, DOE estimates that the small business would need to invest $337,000 in product conversion costs to redesign all 12 models to incorporate higher efficiency compressors, ECM blowers, and larger heat exchangers. Product conversion costs are investments in research, development, testing, marketing, and other non-capitalized costs necessary to make product designs comply with amended energy conservation standards. DOE's engineering analysis indicates manufacturers would likely be able to produce compliant products with existing machinery, and, therefore, DOE tentatively does not expect meeting the proposed standard would require new equipment or tooling. DOE's analysis focused on the investments associated with amended standards; investments associated with changes in regulations by other State or Federal agencies (*i.e.,* refrigerant regulations) are not attributed to amended standards. Based on annual revenue estimates from Dun & Bradstreet, DOE estimated the company's annual revenue to be $221 million. The total conversion costs of $337,000 are less than 0.1 percent of company revenue over the 3-year conversion period.

DOE seeks comments, information, and data on the number of small businesses in the industry, the names of those small businesses, and their market shares by product class. DOE also requests comment on the potential impacts of the proposed standards on small manufacturers.

5. Duplication, Overlap, and Conflict With Other Rules and Regulations

DOE is not aware of any rules or regulations that duplicate, overlap, or conflict with the proposed rule.

6. Significant Alternatives to the Rule

The discussion in the previous section analyzes impacts on small businesses that would result from DOE's proposed rule, represented by TSL 3. In reviewing alternatives to the proposed rule, DOE examined energy conservation standards set at lower efficiency levels. While TSL 1 and TSL 2 would reduce the impacts on small business manufacturers, it would come at the expense of a reduction in energy savings. TSL 1 achieves 98 percent lower energy savings compared to the energy savings at TSL 3. TSL 2 achieves 95 percent lower energy savings compared to the energy savings at TSL 3.

Based on the presented discussion, establishing standards at TSL 3 balances the benefits of the energy savings at TSL 3 with the potential burdens placed on dehumidifier manufacturers, including small business manufacturers. Accordingly, DOE does not propose one of the other TSLs considered in the analysis, or the other policy alternatives examined as part of the regulatory impact analysis and included in chapter 17 of the NOPR TSD.

Additional compliance flexibilities may be available through other means. 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. (42 U.S.C. 6295(t)) Additionally, manufacturers subject to DOE's energy efficiency standards may apply to DOE's Office of Hearings and Appeals for exception relief under certain circumstances. Manufacturers should refer to 10 CFR part 430, subpart E, and 10 CFR part 1003 for additional details.

[71] U.S. Department of Energy's Compliance Certification Database is available at: *www.regulations.doe.gov/certification-data/#q=Product_Group_s%3A** (Last accessed February 21, 2023).

[72] California Energy Commission's Modernized Appliance Efficiency Database System is available at: *cacertappliances.energy.ca.gov/Pages/Search/AdvancedSearch.aspx.* (Last accessed February 21, 2023.)

[73] U.S. Environmental Protection Agency's ENERGY STAR Product Finder data set is available at: *www.energystar.gov/productfinder/* (Last accessed February 21, 2023.)

[74] S&P Global. Panjiva Market Intelligence is available at: *panjiva.com/import-export/United-States* (Last accessed May 5, 2022).

[75] The Dun & Bradstreet Hoovers subscription login is available at *app.dnbhoovers.com.* (Last accessed March 23, 2023).

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 35 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

DOE is analyzing this proposed regulation in accordance with the National Environmental Policy Act of 1969 (''NEPA'') and DOE's NEPA implementing regulations (10 CFR part 1021). DOE's regulations include a categorical exclusion for rulemakings that establish energy conservation standards for consumer products or industrial equipment. 10 CFR part 1021, subpart D, appendix B5.1. DOE anticipates that this rulemaking qualifies for categorical exclusion B5.1 because it is a rulemaking that establishes energy conservation standards for consumer products or industrial equipment, none of the exceptions identified in categorical exclusion B5.1(b) apply, no extraordinary circumstances exist that require further environmental analysis, and it otherwise meets the requirements for application of a categorical exclusion. See 10 CFR 1021.410. DOE will complete its NEPA review before issuing the final rule.

E. Review Under Executive Order 13132

E.O. 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 proposed rule and has tentatively 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 proposed 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 E.O. 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 E.O. 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 proposed rule meets the relevant standards of E.O. 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, section 201 (codified at 2 U.S.C. 1531). For a proposed 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 proposed ''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 *www.energy.gov/sites/prod/files/gcprod/documents/umra_97.pdf.*

This rule does not contain a Federal intergovernmental mandate, nor is it expected to require expenditures of $100 million or more in any one year by the private sector. As a result, the analytical requirements of UMRA do not apply.

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

Section 654 of the Treasury and General Government Appropriations Act, 1999 (Pub. L. 105–277) requires

Federal agencies to issue a Family Policymaking Assessment for any rule that may affect family well-being. This rule would not have any impact on the autonomy or integrity of the family as an institution. Accordingly, DOE has concluded that it is not necessary to prepare a Family Policymaking Assessment.

I. Review Under Executive Order 12630

Pursuant to E.O. 12630, ''Governmental Actions and Interference with Constitutionally Protected Property Rights,'' 53 FR 8859 (Mar. 15, 1988), DOE has determined that this proposed 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). Pursuant to OMB Memorandum M–19–15, Improving Implementation of the Information Quality Act (April 24, 2019), DOE published updated guidelines which are available at *www.energy.gov/sites/prod/files/2019/12/f70/DOE%20Final%20Updated%20IQA%20Guidelines%20Dec%202019.pdf.* DOE has reviewed this NOPR 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

E.O. 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 proposed 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 proposed 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 tentatively concluded that this regulatory action, which proposes amended energy conservation standards for dehumidifiers, is not a significant energy action because the proposed 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 proposed rule.

L. Information Quality

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

In response to OMB's Bulletin, DOE conducted formal peer reviews of the energy conservation standards development process and the analyses that are typically used and has prepared a report describing that peer review.[76] 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. Because available data, models, and technological understanding have changed since 2007, DOE has engaged with the National Academy of Sciences to review DOE's analytical methodologies to ascertain whether modifications are needed to improve DOE's analyses. DOE is in the process of evaluating the resulting report.[77]

VII. Public Participation

A. Participation in the Webinar

The time and date the webinar meeting are listed in the **DATES** section at the beginning of this document. Webinar registration information, participant instructions, and information about the capabilities available to webinar participants will be published on DOE's website: *www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=24.* Participants are responsible for ensuring their systems are compatible with the webinar software.

B. Procedure for Submitting Prepared General Statements for Distribution

Any person who has an interest in the topics addressed in this proposed rule, or who is representative of a group or class of persons that has an interest in these issues, may request an opportunity to make an oral presentation at the webinar. Such persons may submit to *ApplianceStandardsQuestions@ee.doe.gov.* Persons who wish to speak should include with their request a computer file in WordPerfect, Microsoft Word, PDF, or text (ASCII) file format that briefly describes the nature of their interest in this proposed rulemaking and the topics they wish to discuss. Such persons should also provide a daytime telephone number where they can be reached.

C. Conduct of the Webinar

DOE will designate a DOE official to preside at the webinar/public meeting and may also use a professional facilitator to aid discussion. The meeting will not be a judicial or evidentiary-type public hearing, but DOE will conduct it in accordance with section 336 of EPCA (42 U.S.C. 6306). A court reporter will be present to record the proceedings and prepare a transcript. DOE reserves the right to schedule the order of presentations and to establish the procedures governing the conduct of the webinar. There shall not be discussion of proprietary information, costs or prices, market

[76] The 2007 ''Energy Conservation Standards Rulemaking Peer Review Report'' is available at *energy.gov/eere/buildings/downloads/energy-conservation-standards-rulemaking-peer-review-report-0* (last accessed **DATE**).

[77] The report is available at *www.nationalacademies.org/our-work/review-of-methods-for-setting-building-and-equipment-performance-standards.*

share, or other commercial matters regulated by U.S. anti-trust laws. After the webinar and until the end of the comment period, interested parties may submit further comments on the proceedings and any aspect of the proposed rulemaking.

The webinar will be conducted in an informal, conference style. DOE will a general overview of the topics addressed in this rulemaking, allow time for prepared general statements by participants, and encourage all interested parties to share their views on issues affecting this propose rulemaking. Each participant will be allowed to make a general statement (within time limits determined by DOE), before the discussion of specific topics. DOE will permit, as time permits, other participants to comment briefly on any general statements.

At the end of all prepared statements on a topic, DOE will permit participants to clarify their statements briefly. Participants should be prepared to answer questions by DOE and by other participants concerning these issues. DOE representatives may also ask questions of participants concerning other matters relevant to this propose rulemaking. The official conducting the webinar/public meeting will accept additional comments or questions from those attending, as time permits. The presiding official will announce any further procedural rules or modification of the above procedures that may be needed for the proper conduct of the webinar.

A transcript of the webinar will be included in the docket, which can be viewed as described in the *Docket* section at the beginning of this document. In addition, any person may buy a copy of the transcript from the transcribing reporter.

D. Submission of Comments

DOE will accept comments, data, and information regarding this proposed rule before or after the public meeting, but no later than the date provided in the **DATES** section at the beginning of this proposed rule. Interested parties may submit comments, data, and other information using any of the methods described in the **ADDRESSES** section at the beginning of this document.

Submitting comments via *www.regulations.gov.* The *www.regulations.gov* web page will require you to provide your name and contact information. Your contact information will be viewable to DOE Building Technologies staff only. Your contact information will not be publicly viewable except for your first and last names, organization name (if any), and submitter representative name (if any). If your comment is not processed properly because of technical difficulties, DOE will use this information to contact you. If DOE cannot read your comment due to technical difficulties and cannot contact you for clarification, DOE may not be able to consider your comment.

However, your contact information will be publicly viewable if you include it in the comment itself or in any documents attached to your comment. Any information that you do not want to be publicly viewable should not be included in your comment, nor in any document attached to your comment. Otherwise, persons viewing comments will see only first and last names, organization names, correspondence containing comments, and any documents submitted with the comments.

Do not submit to *www.regulations.gov* information for which disclosure is restricted by statute, such as trade secrets and commercial or financial information (hereinafter referred to as Confidential Business Information (''CBI'')). Comments submitted through *www.regulations.gov* cannot be claimed as CBI. Comments received through the website will waive any CBI claims for the information submitted. For information on submitting CBI, see the Confidential Business Information section.

DOE processes submissions made through *www.regulations.gov* before posting. Normally, comments will be posted within a few days of being submitted. However, if large volumes of comments are being processed simultaneously, your comment may not be viewable for up to several weeks. Please keep the comment tracking number that *www.regulations.gov* provides after you have successfully uploaded your comment.

Submitting comments via email, hand delivery/courier, or postal mail. Comments and documents submitted via email, hand delivery/courier, or postal mail also will be posted to *www.regulations.gov.* If you do not want your personal contact information to be publicly viewable, do not include it in your comment or any accompanying documents. Instead, provide your contact information in a cover letter. Include your first and last names, email address, telephone number, and optional mailing address. The cover letter will not be publicly viewable as long as it does not include any comments.

Include contact information each time you submit comments, data, documents, and other information to DOE. If you submit via postal mail or hand delivery/courier, please provide all items on a CD, if feasible, in which case it is not necessary to submit printed copies. No telefacsimiles (''faxes'') will be accepted.

Comments, data, and other information submitted to DOE electronically should be provided in PDF (preferred), Microsoft Word or Excel, WordPerfect, or text (ASCII) file format. Provide documents that are not secured, that are written in English, and that are free of any defects or viruses. Documents should not contain special characters or any form of encryption and, if possible, they should carry the electronic signature of the author.

Campaign form letters. Please submit campaign form letters by the originating organization in batches of between 50 to 500 form letters per PDF or as one form letter with a list of supporters' names compiled into one or more PDFs. This reduces comment processing and posting time.

Confidential Business Information. Pursuant to 10 CFR 1004.11, any person submitting information that he or she believes to be confidential and exempt by law from public disclosure should submit via email two well-marked copies: one copy of the document marked ''confidential'' including all the information believed to be confidential, and one copy of the document marked ''non-confidential'' with the information believed to be confidential deleted. DOE will make its own determination about the confidential status of the information and treat it according to its determination.

It is DOE's policy that all comments may be included in the public docket, without change and as received, including any personal information provided in the comments (except information deemed to be exempt from public disclosure).

E. Issues on Which DOE Seeks Comment

Although DOE welcomes comments on any aspect of this proposal, DOE is particularly interested in receiving comments and views of interested parties concerning the following issues:

(1) DOE requests comment on the effects of EPA and CARB regulations on refrigerant choices and on whether changes in refrigerant will affect manufacturer's ability to achieve the efficiency levels in the NOPR analysis and the availability of high-efficiency R–32 compressors.

(2) DOE requests comment regarding consumer's dehumidifier usage patterns and whether consumers typically purchase multiple smaller dehumidifiers to meet dehumidification

requirements as opposed to a single, higher capacity dehumidifier.

(3) DOE requests comment on whether limiting needed chassis size increases are sufficient to preserve consumer utility at the max-tech level.

(4) DOE requests comment on the incremental MPCs from the NOPR engineering analysis.

(5) DOE seeks available data on installation costs for baseline and more efficient units.

(6) DOE seeks comment on the assumption that dehumidifier consumers are most likely to replace a broken unit rather than repair it. DOE also seeks available data on the repair frequency.

(7) DOE seeks data and comment on its efficiency distribution estimate and the assumption of an annual efficiency improvement of 0.25 percent and the expected market respond to updated ENERGY STAR 6.0 specifications.

(8) DOE requests comment on its tentative conclusion that refrigerant desiccant dehumidifier manufacturers would be similarly impacted by potential amended standards and therefore would not warrant a separate subgroup analysis.

(9) DOE requests comment on how to address the climate benefits and other effects of the proposal.

(10) DOE seeks comments, information, and data on the capital conversion costs and product conversion costs estimated for each TSL.

(11) DOE seeks comment on whether manufacturers expect manufacturing capacity constraints or engineering resource constraints would limit product availability to consumers in the timeframe of the amended standard compliance date (2028).

(12) DOE requests information regarding the impact of cumulative regulatory burden on manufacturers of dehumidifiers associated with multiple DOE standards or product-specific regulatory actions of other Federal agencies.

(13) DOE requests comments on the magnitude of costs associated with transitioning dehumidifier products and production facilities to accommodate low-GWP refrigerants that would be incurred between the publication of this NOPR and the proposed compliance date of amended standards. Quantification and categorization of these costs, such as engineering efforts, testing lab time, certification costs, and capital investments (*e.g.,* new charging equipment), would enable DOE to refine its analysis.

(14) DOE seeks comments, information, and data on the number of small businesses in the industry, the names of those small businesses, and their market shares by product class. DOE also requests comment on the potential impacts of the proposed standards on small manufacturers.

(15) Additionally, DOE welcomes comments on other issues relevant to the conduct of this rulemaking that may not specifically be identified in this document.

VIII. Approval of the Office of the Secretary

The Secretary of Energy has approved publication of this notice of proposed rulemaking and announcement of public meeting.

List of Subjects in 10 CFR Part 430

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

Signing Authority

This document of the Department of Energy was signed on October 27, 2023, by Jeffrey Marootian, Principal Deputy Assistant Secretary for Energy Efficiency and Renewable Energy, pursuant to delegated authority from the Secretary of Energy. That document with the original signature and date is maintained by DOE. For administrative purposes only, and in compliance with requirements of the Office of the Federal Register, the undersigned DOE Federal Register Liaison Officer has been authorized to sign and submit the document in electronic format for publication, as an official document of the Department of Energy. This administrative process in no way alters the legal effect of this document upon publication in the **Federal Register**.

Signed in Washington, DC, on October 27, 2023.

Treena V. Garrett,

Federal Register Liaison Officer, U.S. Department of Energy

For the reasons stated in the preamble, DOE is proposing to amend part 430 of Chapter II of Title 10, Code of Federal Regulations as set forth below:

PART 430—ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS

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

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

■ 2. Amend § 430.32 by revising paragraph (v) to read as follows:

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

* * * * *

(v) *Dehumidifiers.* (1) Dehumidifiers manufactured on or after June 13, 2019, and before [*date 3 years after date of publication of the final rule*], shall have an integrated energy factor that meets or exceeds the following values:

Portable dehumidifier product capacity (pints/day)	Minimum integrated energy factor (liters/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) Dehumidifiers manufactured on or after [*date 3 years after date of publication of the final rule*], shall have an integrated energy factor that meets or exceeds the following values:

Portable dehumidifier product capacity (pints/day)	Minimum integrated energy factor (liters/kWh)
25.00 or less	1.70
25.01–50.00	2.01
50.01 or more	3.10
Whole-home dehumidifier product case volume (cubic feet)	
8.0 or less	2.22
More than 8.0	3.81

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