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[6450-01-P]

DEPARTMENT OF ENERGY

10 CFR Parts 429 and 430

[EERE-2014-BT-STD-0059]

RIN 1904-AD97

Energy Conservation Program: Energy Conservation Standards for Room Air Conditioners

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

ACTION: Final rule.

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 room air conditioners**.** 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 final rule, DOE is adopting amended energy conservation standards for room air conditioners. It has determined that the amended energy conservation standards for these products would result in significant conservation of energy, and are technologically feasible and economically justified.

DATES: The effective date of this final rule is **[INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]**. Compliance with the amended standards established for room air conditioners in this final rule is required on and after **[INSERT DATE 3 YEARS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*].**

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

The docket web page can be found at *www.regulations.gov/docket??D=EERE-2014-BT-STD-0059*. The docket web page contains instructions on how to access all documents, including public comments, in the docket.

For further information on how to review the docket, contact the Appliance and Equipment Standards Program staff at (202) 287-1445 or by email: *ApplianceStandardsQuestions@ee.doe.gov*.

FOR FURTHER INFORMATION CONTACT:

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SUPPLEMENTARY INFORMATION:

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I. Synopsis of the Final Rule

The Energy Policy and Conservation Act, Pub. L. 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 room air conditioners, the subject of this 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 significant conservation of energy. (42 U.S.C. 6295(o)(3)(B)) EPCA also provides that not later than 6 years after issuance of any final rule establishing or amending a standard, DOE must publish either a notice of determination that standards for the product do not need to be amended, or a notice of proposed rulemaking including new proposed energy conservation standards (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 is adopting amended energy conservation standards for room air conditioners. The adopted standards, which are expressed in the amount of cooling provided per amount of energy consumed, measured in British thermal units per watt-hour ("Btu/Wh") are shown in Table I.1.

[1] All references to EPCA in this document refer to the statute as amended through the Energy Act of 2020, Pub. L. 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.

These standards apply to all room air conditioners listed in Table I.1 and manufactured in, or imported into, the United States starting on [INSERT DATE].

Table I.1 Energy Conservation Standards for Room Air Conditioners (Compliance Starting [INSERT DATE])

Equipment Class	CEER (*Btu/Wh*)
1. Without reverse cycle, with louvered sides, and less than 6,000 Btu/h	13.1
2. Without reverse cycle, with louvered sides and 6,000 to 7,900 Btu/h	13.7
3. Without reverse cycle, with louvered sides and 8,000 to 13,900 Btu/h	16.0
4. Without reverse cycle, with louvered sides and 14,000 to 19,900 Btu/h	16.0
5a. Without reverse cycle, with louvered sides and 20,000 to 27,900 Btu/h	13.8
5b. Without reverse cycle, with louvered sides and 28,000 Btu/h or more	13.2
6. Without reverse cycle, without louvered sides, and less than 6,000 Btu/h	12.8
7. Without reverse cycle, without louvered sides and 6,000 to 7,900 Btu/h	12.8
8a. Without reverse cycle, without louvered sides and 8,000 to 10,900 Btu/h	14.1
8b. Without reverse cycle, without louvered sides and 11,000 to 13,900 Btu/h	13.9
9. Without reverse cycle, without louvered sides and 14,000 to 19,900 Btu/h	13.7
10. Without reverse cycle, without louvered sides and 20,000 Btu/h or more	13.8
11. With reverse cycle, with louvered sides, and less than 20,000 Btu/h	14.4
12. With reverse cycle, without louvered sides, and less than 14,000 Btu/h	13.7
13. With reverse cycle, with louvered sides, and 20,000 Btu/h or more	13.7
14. With reverse cycle, without louvered sides, and 14,000 Btu/h or more	12.8
15. Casement-Only	13.9
16. Casement-Slider	15.3

A. Benefits and Costs to Consumers

Table I.2 summarizes DOE's evaluation of the economic impacts of the adopted standards on consumers of room air conditioners, as measured by the average life-cycle cost ("LCC") savings and the simple payback period ("PBP").[3] The average LCC savings are

[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).

positive for all product classes, and the PBP is less than the average lifetime of room air conditioners, which is estimated to be 9.3 years (see section IV.F of this document).

Table I.2 Impacts of Adopted Energy Conservation Standards on Consumers of Room Air Conditioners

Room Air Conditioner Product Class	Average LCC Savings (*2021$*)	Simple Payback Period (*years*)
1. Without reverse cycle, with louvered sides, and less than 6,000 Btu/h	65	0.8
2. Without reverse cycle, with louvered sides and 6,000 to 7,900 Btu/h	72	1.5
3. Without reverse cycle, with louvered sides and 8,000 to 13,900 Btu/h	100	2.9
4. Without reverse cycle, with louvered sides and 14,000 to 19,900 Btu/h	92	3.0
5a. Without reverse cycle, with louvered sides and 20,000 Btu/h to 27,900 Btu/h	148	2.5
5b. Without reverse cycle, with louvered sides and 28,000 Btu/h or more	284	2.3
8a. Without reverse cycle, without louvered sides and 8,000 to 10,900 Btu/h	84	3.2
8b. Without reverse cycle, without louvered sides and 11,000 to 13,900 Btu/h	119	2.4
9. Without reverse cycle, without louvered sides and 14,000 to 19,900 Btu/h	165	2.9
11. With reverse cycle, with louvered sides, and less than 20,000 Btu/h	134	3.2
12. With reverse cycle, without louvered sides, and less than 14,000 Btu/h	124	2.6
16. Casement-Slider	84	4.0

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

B. Impact on Manufacturers

The industry net present value ("INPV") is the sum of the discounted cash flows to the industry from the announcement of the standard through the end of the analysis period (2023-2055). Using a real discount rate of 7.2 percent, DOE estimates that the INPV for manufacturers of room air conditioners in the case without amended standards is $1.20 billion.[4] Under the adopted standards, DOE estimates the change in INPV to range from -4.8 percent to 7.1 percent, which is approximately -$57.7 million to $85.6 million. In order to bring products into compliance with amended standards, it is estimated that industry will incur total conversion costs of $24.8 million.

DOE's analysis of the impacts of the adopted standards on manufacturers is described in section IV.J and section V.B.2 of this document.

C. National Benefits and Costs

DOE's analyses indicate that the adopted energy conservation standards for room air conditioners would save a significant amount of energy. Relative to the case without amended standards, the lifetime energy savings for room air conditioners purchased in the 30-year period that begins in the anticipated year of compliance with the amended standards (2026-2055), amount to 1.41 quadrillion British thermal units ("Btu"), or quads.[5] This represents a savings of 12 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 standards for room air conditioners ranges from $5.39 billion (at a 7-percent discount rate) to $11.46 billion (at a 3-percent discount rate). This NPV expresses the estimated total value of future operating-cost

[4] All monetary values in this document are expressed in 2021 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.1 of this document.

savings minus the estimated increased product costs for room air conditioners purchased in 2026-2055.

In addition, the adopted standards for room air conditioners are projected to yield significant environmental benefits. DOE estimates that the standards will result in cumulative emission reductions (over the same period as for energy savings) of 48.5 million metric tons ("Mt")[6] of carbon dioxide ("CO_2"), 20.1 thousand tons of sulfur dioxide ("SO_2"), 74.2 thousand tons of nitrogen oxides ("NO_X"), 325.6 thousand tons of methane ("CH_4"), 0.5 thousand tons of nitrous oxide ("N_2O"), and 0.1 tons of mercury ("Hg").[7] The estimated cumulative reduction in CO_2 emissions through 2030 amounts to 4.4 Mt, which is equivalent to the emissions resulting from the annual electricity use of more than 856,000 homes.

DOE estimates the value of climate benefits from a reduction in greenhouse gases (GHG) using four different estimates of the social cost of 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). [8] DOE used interim SC-GHG values developed by an

[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 2022* ("*AEO[2022]*"). *AEO2022* represents current federal and state legislation and final implementation of regulations as of the time of its preparation. See section IV.K of this document for further discussion of *AEO2022* assumptions that effect air pollutant emissions

[8] On March 16, 2022, the Fifth Circuit Court of Appeals (No. 22-30087) granted the federal government's emergency motion for stay pending appeal of the February 11, 2022, preliminary injunction issued in Louisiana v. Biden, No. 21-cv-1074-JDC-KK (W.D. La.). As a result of the Fifth Circuit's order, the preliminary injunction is no longer in effect, pending resolution of the federal government's appeal of that injunction or a further court order. Among other things, the preliminary injunction enjoined the defendants in that case from "adopting, employing, treating as binding, or relying upon" the interim estimates of the social cost of greenhouse gases—which were issued by the Interagency Working Group on the Social Cost of Greenhouse Gases on February 26, 2021—to monetize the benefits of reducing greenhouse gas emissions. As reflected in this rule, DOE has reverted to its approach prior to the injunction and presents monetized greenhouse gas abatement benefits where appropriate and permissible under law.

Interagency Working Group on the Social Cost of Greenhouse Gases (IWG).[9] The derivation of these values is discussed in section IV.L.1 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 $2.51 billion. DOE does not have a single central SC-GHG point estimate and it 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 NOx emissions reductions, using benefit per ton estimates from the scientific literature, as discussed in section IV.L of this document. DOE estimated the present value of the health benefits would be $2.02 billion using a 7-percent discount rate, and $4.39 billion using a 3-percent discount rate.[10] 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.

Table I.3 summarizes the economic benefits and costs expected to result from the adopted standards for room air conditioners. There are other important unquantified effects, including certain unquantified climate benefits, unquantified public health benefits from the reduction of

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[9] See Interagency Working Group on Social Cost of Greenhouse Gases, Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide. Interim Estimates Under Executive Order 13990, Washington, D.C., February 2021 ("February 2021 SC-GHG TSD"*).* *www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf.*

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

toxic air pollutants and other emissions, unquantified energy security benefits, and distributional effects, among others.

Table I.3 Summary of Economic Benefits and Costs of Adopted Energy Conservation Standards for Room Air Conditioners

	Billion $2021
3% discount rate	
Consumer Operating Cost Savings	14.63
Climate Benefits*	2.51
Health Benefits**	4.39
Total Benefits†	21.54
Consumer Incremental Product Costs‡	3.17
Net Benefits	18.37
7% discount rate	
Consumer Operating Cost Savings	7.46
Climate Benefits* (3% discount rate)	2.51
Health Benefits**	2.02
Total Benefits†	12.00
Consumer Incremental Product Costs‡	2.08
Net Benefits	9.92

Note: This table presents the costs and benefits associated with room air conditioners shipped in 2026–2055. These results include benefits to consumers which accrue after 2055 from the products shipped in 2026–2055.
* 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 3 percent discount rate) (see section IV.L of this notice). 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. On March 16, 2022, the Fifth Circuit Court of Appeals (No. 22-30087) granted the federal government's emergency motion for stay pending appeal of the February 11, 2022, preliminary injunction issued in Louisiana v. Biden, No. 21-cv-1074-JDC-KK (W.D. La.). As a result of the Fifth Circuit's order, the preliminary injunction is no longer in effect, pending resolution of the federal government's appeal of that injunction or a further court order. Among other things, the preliminary injunction enjoined the defendants in that case from "adopting, employing, treating as binding, or relying upon" the interim estimates of the social cost of greenhouse gases—which were issued by the Interagency Working Group on the Social Cost of Greenhouse Gases on February 26, 2021—to monetize the benefits of

reducing greenhouse gas emissions. As reflected in this rule, DOE has reverted to its approach prior to the injunction and presents monetized greenhouse gas abatement benefits where appropriate and permissible under law.
** 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. DOE 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.

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 room air conditioners shipped in 2026–2055. The benefits associated with reduced emissions achieved as a result of the adopted standards are also calculated based on the lifetime of room air conditioners shipped in 2026–2055. Total benefits for both the 3-percent and 7-percent cases are presented using the average GHG social costs with 3-percent discount rate. Estimates of SC-GHG values are presented for all four discount rates in section V.B.6 of this document.

[11] To convert the time-series of costs and benefits into annualized values, DOE calculated a present value in 2022, the year used for discounting the NPV of total consumer costs and savings. For the benefits, DOE calculated a present value associated with each year's shipments in the year in which the shipments occur (*e.g.*, 2020 or 2030), and then discounted the present value from each year to 2022. Using the present value, DOE then calculated the fixed annual payment over a 30-year period, starting in the compliance year, that yields the same present value.

Table 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 NOx and SO_2 emissions, and the 3-percent discount rate case for climate benefits from reduced GHG emissions, the estimated cost of the standards adopted in this rule is $205.2 million per year in increased equipment costs, while the estimated annual benefits are $736.9 million in reduced equipment operating costs, $140.1 million in climate benefits, and $199.9 million in health benefits. In this case, the net benefit would amount to $871.7 million per year.

Using a 3-percent discount rate for all benefits and costs, the estimated cost of the standards is $176.8 million per year in increased equipment costs, while the estimated annual benefits are $815.8 million in reduced operating costs, $140.1 million in climate benefits, and $244.8 million in health benefits. In this case, the net benefit would amount to $1,023.9 million per year.

Table I.4 Annualized Benefits and Costs of Adopted Standards for Room Air Conditioners

	Million 2021$/year		
	Primary Estimate	**Low-Net-Benefits Estimate**	**High-Net-Benefits Estimate**
3% discount rate			
Consumer Operating Cost Savings	815.8	784.9	851.9
Climate Benefits*	140.1	137.6	142.5
Health Benefits**	244.8	240.6	248.9
Total Benefits†	1,200.6	1,163.2	1,243.3
Consumer Incremental Product Costs‡	176.8	199.0	152.2
Net Benefits	1,023.9	964.1	1,091.1
7% discount rate			
Consumer Operating Cost Savings	736.9	712.3	765.4
Climate Benefits* (3% discount rate)	140.1	137.6	142.5
Health Benefits**	199.9	196.8	203.0
Total Benefits†	1,076.9	1,046.7	1,111.0
Consumer Incremental Product Costs‡	205.2	227.0	181.0
Net Benefits	871.7	819.7	930.0

Note: This table presents the costs and benefits associated with room air conditioners shipped in 2026−2055. 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 AEO2022 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 notice). For presentational purposes of this table, the climate benefits associated with the average SC-GHG at a 3 percent discount rate are shown, but the Department does not have a single central SC-GHG point estimate, and it emphasizes the importance and value of considering the benefits calculated using all four sets of SC-GHG estimates. On March 16, 2022, the Fifth Circuit Court of Appeals (No. 22-30087) granted the federal government's emergency motion for stay pending appeal of the February 11, 2022, preliminary injunction issued in *Louisiana v. Biden*, No. 21-cv-1074-JDC-KK (W.D. La.). As a result of the Fifth Circuit's order, the preliminary injunction is no longer in effect, pending resolution of the federal government's appeal of that injunction or a further court order. Among other things, the preliminary injunction enjoined the defendants in that case from "adopting, employing, treating as binding, or relying upon" the interim estimates of the social cost of greenhouse gases—which were issued by the Interagency Working Group on the Social Cost of Greenhouse Gases on February 26, 2021—to monetize the benefits of reducing greenhouse gas emissions. As reflected in this rule, DOE has reverted to its approach prior to the injunction and presents monetized greenhouse gas abatement benefits where appropriate and permissible under law.

** Health benefits are calculated using benefit-per-ton values for NO_X and SO_2. DOE is currently only monetizing (for SO2 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. 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 the Department does not have a single central SC-GHG point estimate.
‡ Costs include incremental equipment costs as well as installation costs.

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

D. Conclusion

DOE concludes that the standards adopted in this final rule 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 standards exceed, to a great extent, the burdens of the standards.

Using a 7-percent discount rate for consumer benefits and costs and NOx and SO_2 reduction benefits, and a 3-percent discount rate case for GHG social costs, the estimated cost of the standards for room air conditioners is $205.2 million per year in increased product costs, while the estimated annual benefits are $736.9 million in reduced product operating costs, $140.1 million in climate benefits, and $199.9 million in health benefits. The net benefit amounts to $871.7 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 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.

As previously mentioned, the standards are projected to result in estimated national energy savings of 1.41 quad FFC, the equivalent of the primary annual energy use of 15 million homes. In addition, they are projected to reduce CO_2 emissions by 48.5 Mt. Based on these findings, DOE has determined the energy savings from the standard levels adopted in this final rule are "significant" within the meaning of 42 U.S.C. 6295(o)(3)(B). A more detailed discussion of the basis for these conclusions is contained in the remainder of this document and the accompanying TSD.

II. Introduction

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

[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).

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 room air conditioners, the subject of this document. (42 U.S.C. 6292(a)(2)) EPCA prescribed energy conservation standards for these products (42 U.S.C. 6295(c)(1)), and directs DOE to conduct future rulemakings to determine whether to amend these standards. (42 U.S.C. 6295(c)(2)) 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 in limited instances for particular State laws or regulations, in accordance with the procedures and other provisions set forth under EPCA. (See 42 U.S.C. 6297(d))

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 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 room air conditioners appear at title 10 of the Code of Federal Regulations ("CFR") part 430, subpart B, appendix F.

DOE must follow specific statutory criteria for prescribing new or amended standards for covered products, including room air conditioners. 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) and 42 U.S.C. 6295(o)(3)(B)) Furthermore, DOE may not adopt any standard that would not result in the significant conservation of energy. (42 U.S.C. 6295(o)(3)) Moreover, DOE may not prescribe a standard (1) for certain products, including room air conditioners, 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, as codified, establishes a rebuttable presumption that a standard is economically justified if the Secretary finds that the additional cost to the consumer of purchasing a product complying with an energy conservation standard level will be less than three times the value of the energy savings during the first year that the consumer will receive as a result of the standard, as calculated under the applicable test procedure. (42 U.S.C. 6295(o)(2)(B)(iii))

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

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

Finally, pursuant to the amendments contained in the Energy Independence and Security Act of 2007 (EISA 2007), Pub. L. 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 and standards for room air conditioners address standby mode and off mode energy use, as do the amended standards adopted in this final rule.

B. Background

1. Current Standards

DOE prescribed the current energy conservation standards in a direct final rule published on April 21, 2011 ("April 2011 Direct Final Rule"), which apply to room air conditioners manufactured on and after April 21, 2014. 76 FR 22454. These standards are set forth in DOE's regulations at 10 CFR 430.32(b) and are repeated in Table II.1.

Table II.1 Federal Energy Efficiency Standards for Room Air Conditioners

Room Air Conditioner Product Class	**Minimum CEER** (*Btu/Wh)*
1. Without reverse cycle, with louvered sides, and less than 6,000 Btu/h	11.0
2. Without reverse cycle, with louvered sides and 6,000 to 7,999 Btu/h	11.0
3. Without reverse cycle, with louvered sides and 8,000 to 13,999 Btu/h	10.9
4. Without reverse cycle, with louvered sides and 14,000 to 19,999 Btu/h	10.7
5a. Without reverse cycle, with louvered sides and 20,000 Btu/h to 27,999 Btu/h	9.4
5b. Without reverse cycle, with louvered sides and 28,000 Btu/h or more	9.0
6. Without reverse cycle, without louvered sides, and less than 6,000 Btu/h	10.0
7. Without reverse cycle, without louvered sides and 6,000 to 7,999 Btu/h	10.0
8a. Without reverse cycle, without louvered sides and 8,000 to 10,999 Btu/h	9.6
8b. Without reverse cycle, without louvered sides and 11,000 to 13,999 Btu/h	9.5
9. Without reverse cycle, without louvered sides and 14,000 to 19,999 Btu/h	9.3
10. Without reverse cycle, without louvered sides and 20,000 Btu/h or more	9.4
11. With reverse cycle, with louvered sides, and less than 20,000 Btu/h	9.8
12. With reverse cycle, without louvered sides, and less than 14,000 Btu/h	9.3
13. With reverse cycle, with louvered sides, and 20,000 Btu/h or more	9.3
14. With reverse cycle, without louvered sides, and 14,000 Btu/h or more	8.7
15. Casement-Only	9.5
16. Casement-Slider	10.4

2. History of Standards Rulemaking for Room Air Conditioners

EPCA prescribed initial energy conservation standards for room air conditioners and further directed DOE to conduct two cycles of rulemakings to determine whether to amend these standards. (42 U.S.C. 6295(c)(1)–(2)) DOE completed the first of these rulemaking cycles on September 24, 1997, by adopting amended performance standards for room air conditioners manufactured on or after October 1, 2000. 62 FR 50122. Additionally, DOE completed a second rulemaking cycle to amend the standards for room air conditioners by issuing the April 2011 Direct Final Rule, in which DOE prescribed the current energy conservation standards for room air conditioners manufactured on or after April 21, 2014. 76 FR 22454 (April 21, 2011). DOE subsequently published a final rule amending the compliance date for the current room air conditioner standards to June 1, 2014. 76 FR 52852 (Aug. 24, 2011). In a separate notice, also published on August 24, 2011, DOE confirmed the adoption of these energy conservation standards in a notice of effective date and compliance dates for the April 2011 Direct Final Rule. 76 FR 52854.

As part of the current analysis, on June 18, 2015, DOE prepared a Request for Information ("June 2015 RFI"), which solicited information from the public to help DOE determine whether amended standards for room air conditioners would result in a significant amount of additional energy savings and whether those standards would be technologically feasible and economically justified.[13] 80 FR 34843.

DOE published a notice of public meeting and availability of the preliminary technical support document ("TSD") on June 17, 2020 ("June 2020 Preliminary Analysis"). 85 FR 36512.

Comments received following the publication of the June 2020 Preliminary Analysis helped DOE identify and resolve issues related to the subsequent NOPR analysis.[14] DOE published a notice of proposed rulemaking on April 7, 2022 ("April 2022 NOPR"). 87 FR 20608. DOE subsequently held a public meeting on May 3, 2022, to discuss and receive comments on the NOPR. The NOPR TSD that presented the methodology and results of the NOPR analysis is available at: *www.regulations.gov/document/EERE-2014-BT-STD-0059-0030*.

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[13] Pursuant to amendments to appendix A to 10 CFR part 430, subpart C ("appendix A") DOE generally will issue an early assessment request for information announcing that DOE is considering initiating a rulemaking proceeding. Section 6(a)(1) of appendix A; *see also* 85 FR 8626, 8637 (Feb. 14, 2020) and 86 FR 70892 (Dec. 13, 2021). Section 6(a)(2) of appendix A provides that if the DOE 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 be a Framework Document and Preliminary Analysis, or an Advance Notice of Proposed Rulemaking. Because this rulemaking was already in progress at the time the relevant amendments to appendix A were published, DOE did not reinitiate the entire rulemaking process. Additionally, the June 2015 RFI presented the issues, analyses, and processes relevant to consideration of amended standards for room air conditioners.

[14] Comments are available at www.regulations.gov/document/EERE-2014-BT-STD-0059-0031/comment.

DOE received 17 written comments in response to the April 2022 NOPR from the interested parties listed in Table II.2.

Table II.2 April 2022 NOPR Written Comments

Commenter(s)	Abbreviation	Comment No. in the Docket	Commenter Type
A. Krishna[1]	Krishna	32	Individual
Anonymous Individual	University of Massachusetts Amherst Student	34	Individual
L. Adelman	University of Massachusetts Amherst Student	35	Individual
G. Larsen	University of Massachusetts Amherst Student	37	Individual
People's Republic of China	P.R. China	39	Government
Treua Inc. (DBA Gradient)	Gradient	40	Manufacturer
New York State Energy Research and Development Authority	NYSERDA	41	Efficiency Organization
Center for Law and Social Policy	CLASP	42	Efficiency Organization
Association of Home Appliance Manufacturers	AHAM	43	Trade Association
Friedrich Air Conditioning	Friedrich	44	Manufacturer
Appliance Standards Awareness Project (ASAP), American Council for an Energy-Efficient Economy (ACEEE), CLASP, Consumer Federation of America (CFA), National Consumer Law Center (NCLC)	Joint Commenters	45	Efficiency Organizations
Consumer Federation of America (CFA), National Consumer Law Center (NCLC)	CFA and NCLC	46	Efficiency Organizations
Pacific Gas and Electric Company (PG&E), San Diego Gas and Electric (SDG&E), Southern California Edison (SCE)	California IOUs	47	Utilities
Keith Rice	Rice	48	Individual
GE Appliances	GEA	49	Manufacturer
Northwest Energy Efficiency Alliance (NEEA), Northwest Power and Conservation Council (NWPCC)	NEEA and NWPCC	50	Efficiency Advocates
Center for Climate and Energy Solutions (C2ES), Institute for Policy Integrity (IPI), Natural Resources Defense Council (NRDC), Sierra Club, Union of Concerned Scientists	Climate Commenters	51	Efficiency Advocate Group

[1] The comment submitted by this individual did not pertain to room air conditioners.

A parenthetical reference at the end of a comment quotation or paraphrase provides the location of the item in the public record.[15]

III. General Discussion

DOE developed this final rule 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. Product Classes and Scope of Coverage

When evaluating and establishing energy conservation standards, DOE divides covered products into product classes by the type of energy used or by capacity or other performance-related features that justify differing standards. In making a determination whether a performance-related feature justifies a different standard, DOE must consider such factors as the utility of the feature to the consumer and other factors DOE determines are appropriate. (42 U.S.C. 6295(q)) DOE's NOPR analysis indicated that the current room air conditioner products classes are still appropriate. For further discussion and responses to comments received regarding product classes see section IV.A.1 of this document.

[15] The parenthetical reference provides a reference for information located in the docket of DOE's rulemaking to develop energy conservation standards for room air conditioners. (Docket No. EERE-2014-BT-STD-0059, which is maintained at *www.regulations.gov*). The references are arranged as follows: (commenter name, comment docket ID number, page of that document).

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 room air conditioners are expressed in terms of combined energy efficiency ratio (CEER), in Btu/Wh. (*See* 10 CFR 430.32(b) and 10 CFR part 430, subpart B, appendix F.)

C. Technological Feasibility

1. General

In each energy conservation standards rulemaking, DOE conducts a screening analysis based on information gathered on all current technology options and prototype designs that could improve the efficiency of the products or equipment that are the subject of the rulemaking. As the first step in such an analysis, DOE develops a list of technology options for consideration in consultation with manufacturers, design engineers, and other interested parties. DOE then determines which of those means for improving efficiency are technologically feasible. DOE considers technologies incorporated in commercially available products or in working prototypes to be technologically feasible. 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. Section 7(b)(2)–(5) of appendix A. Section IV.B of this document discusses the results of the screening analysis for room air conditioners, particularly the designs DOE considered, those it screened out, and those that are the basis for the standards considered in this rulemaking. For further details on the screening analysis for this rulemaking, see chapter 4 of the final rule technical support document ("TSD").

2. Maximum Technologically Feasible Levels

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

D. Energy Savings

1. Determination of Savings

For each trial standard level ("TSL"), DOE projected energy savings from application of the TSL to room air conditioners purchased in the 30-year period that begins in the year of compliance with the amended standards (2026–2055).[16] The savings are measured over the entire lifetime of products purchased in the 30-year analysis period. DOE quantified the energy

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

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 models to estimate national energy savings ("NES") from potential amended standards for room air conditioners. 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. For natural gas, the primary energy savings are considered to be equal to the site energy savings. DOE also calculates NES in terms of FFC" energy savings. The FFC metric includes the energy consumed in extracting, processing, and transporting primary fuels (*i.e.*, coal, natural gas, petroleum fuels), and thus presents a more complete picture of the impacts of energy conservation standards.[17] DOE's approach is based on the calculation of an FFC multiplier for each of the energy types used by covered products or equipment. For more information on FFC energy savings, see section IV.H.2 of this document.

[17] 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).

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. For example, the United States has now rejoined the Paris Agreement on February 19, 2021. As part of that agreement, the United States has committed to reducing GHG emissions in order to limit the rise in mean global temperature.[18] As such, energy savings that reduce GHG emission have taken on greater importance. Additionally, 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. In evaluating the significance of energy savings, DOE considers differences in primary energy and FFC effects for different covered products and equipment when determining whether energy savings are significant. FFC effects include the energy consumed in electricity production (depending on load shape), in distribution and transmission, and in extracting, processing, and transporting primary fuels (i.e., coal, natural gas, petroleum fuels), and thus present a more complete picture of the impacts of energy conservation standards. 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

[18] See Executive Order 14008, 86 FR 7619 (Feb. 1, 2021) ("Tackling the Climate Crisis at Home and Abroad").

cumulative FFC emissions reductions, and the need to confront the global climate crisis, among other factors.

As stated, the standard levels adopted in this final rule are projected to result in national energy savings of 1.41 quad, the equivalent of the electricity use of 15 million homes in one year. They are projected to reduce CO_2 emissions by 48.5 Mt. Based on these findings, DOE has determined the energy savings from the standard levels adopted in this final rule 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 rulemaking.

a. Economic Impact on Manufacturers and Consumers

In determining the impacts of potential amended standards on manufacturers, DOE conducts an MIA, as discussed in section IV.J. DOE first uses an annual cash-flow approach to determine the quantitative impacts. This step includes both a short-term assessment—based on the cost and capital requirements during the period between when a regulation is issued and when entities must comply with the regulation—and a long-term assessment over a 30-year period. The industry-wide impacts analyzed include (1) INPV, which values the industry on the basis of expected future cash flows; (2) cash flows by year; (3) changes in revenue and income;

and (4) other measures of impact, as appropriate. Second, DOE analyzes and reports the impacts on different types of manufacturers, including impacts on small manufacturers. Third, DOE considers the impact of standards on domestic manufacturer employment and manufacturing capacity, as well as the potential for standards to result in plant closures and loss of capital investment. Finally, DOE takes into account cumulative impacts of various DOE regulations and other regulatory requirements on manufacturers.

For individual consumers, measures of economic impact include the changes in LCC and payback period ("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 cost (including energy, maintenance, and repair expenditures) discounted over the lifetime of the product. The LCC analysis requires a variety of inputs, such as product prices, product energy consumption, energy prices, maintenance and repair costs, product lifetime, and discount rates appropriate for consumers. To account for uncertainty and variability in specific inputs, such as product lifetime and discount rate, DOE uses a distribution of values, with probabilities attached to each value.

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

For its LCC and PBP analysis, DOE assumes that consumers will purchase the covered products in the first year of compliance with 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.

c. Energy Savings

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

d. Lessening of Utility or Performance of Products

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

e. Impact of Any Lessening of Competition

EPCA directs DOE to consider the impact of any lessening of competition, as determined in writing by the Attorney General, that is likely to result from a standard. (42 U.S.C. 6295(o)(2)(B)(i)(V)) It also directs the Attorney General to determine the impact, if any, of any lessening of competition likely to result from a standard and to transmit such determination to the Secretary within 60 days of the publication of a proposed rule, together with an analysis of the nature and extent of the impact. (42 U.S.C. 6295(o)(2)(B)(ii)) To assist the Department of Justice ("DOJ") in making such a determination, DOE transmitted copies of its proposed rule and the NOPR TSD to the Attorney General for review, with a request that the DOJ provide its determination on this issue. In its assessment letter responding to DOE, DOJ concluded that the proposed energy conservation standards for room air conditioners are unlikely to have a significant adverse impact on competition. DOE is publishing the Attorney General's assessment at the end of this final rule.

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 adopted standards are likely to provide improvements to the security and reliability of the Nation's energy system. Reductions in the demand for electricity also may result in reduced costs for maintaining the reliability of the Nation's electricity system. DOE conducts a utility impact analysis to estimate how standards may affect the Nation's needed power generation capacity, as discussed in section IV.M.

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 adopted standards are likely to result in environmental benefits in the form of reduced emissions of air pollutants and greenhouse gases ("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.J.3; 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.

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 effect potential amended energy conservation standards would have on the payback period for consumers. These analyses include, but are not limited to, the 3-year payback period contemplated under the rebuttable-presumption test. In addition, DOE routinely conducts an economic analysis that considers the full range of impacts to consumers, manufacturers, the Nation, and the environment, as required under 42 U.S.C. 6295(o)(2)(B)(i). The results of this analysis serve as the basis for DOE's evaluation of the economic justification for a potential standard level (thereby supporting or rebutting the results of any preliminary determination of economic justification). The rebuttable presumption payback calculation is discussed in section IV.F of this final rule.

IV. Methodology and Discussion of Related Comments

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

DOE used several analytical tools to estimate the impact of the standards considered in this document. The first tool is a spreadsheet that calculates the LCC savings and PBP of potential amended or new energy conservation standards. The national impacts analysis uses a second spreadsheet set that provides shipments 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 rulemaking: *www.regulations.gov/docket??D=EERE-2014-BT-STD-0059*. Additionally, DOE used output from the latest version of the Energy Information Administration's ("EIA's") *Annual Energy Outlook* ("*AEO*") for the emissions and utility impact analyses.

A. Market and Technology Assessment

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

1. Scope of Coverage and Product Classes

In the April 2022 NOPR, DOE did not propose any substantive changes to the room air conditioner scope of coverage or product classes, but did propose making clarifying amendments to the product class descriptions. Specifically, DOE proposed to revise the threshold values of cooling capacity in the product class descriptions to the nearest hundred Btu/h that would not exceed the existing thresholds, which is consistent with the cooling capacity delineation used in practice due to the rounding instruction at 10 CFR 429.15(a)(3) so would not impact compliance with current energy conservation standards. The proposed change to the product class delineation would add clarity and consistency amongst two existing regulatory provisions. 87 FR 20608. DOE requested comment on the room air conditioner scope of coverage and product classes.

Currently, reversible and one-way products are in separate product classes and are therefore not compared in any analysis conducted by DOE. However, according to the Center for Law and Social Policy ("CLASP"), taking the efficiency of alternate heating methods into account would allow DOE to treat the reverse cycle in both room and central air conditioners not as a feature meriting its own product class, but as a technology/design option to reduce energy consumption and high energy bills. In this manner, a one-way air conditioner would have the energy consumption of typical furnaces and boilers factored into its annual performance metric, while a reversible air conditioner could eliminate this energy consumption depending on its heating capacity and cold-climate performance potentially leading to energy conservation standards that require the use of reversing capabilities in all air conditioners. (CLASP, No. 42 at p. 2)

Room air conditioner energy conservation standards are currently based on the CEER metric, determined in accordance with the DOE test procedure for room air conditioners at appendix F to 10 CFR 430 ("appendix F"). Appendix F does not currently account for the energy consumption during heating operation, and therefore the CEER metric reflects the energy efficiency of a room air conditioner during cooling mode, and other low power modes. In order to account for the energy cost of alternate heating methods for non-reverse cycle room air conditioners, a test procedure amendment would be necessary to address heating mode performance, which is outside of the scope of this energy conservation standards rulemaking.

The Public Utilities recommended that DOE establish new product classes for room air conditioners with reverse cycle and <8,000 British thermal units per hour ("Btu/h") and to consider less stringent standards for such product classes so as to not preclude the introduction of such equipment and deprive consumers of any potential consumer utility. The Public Utilities also provided options for potential standards in these suggested product classes, noting that generally efficiencies for room air conditioners with reverse cycle are lower than those without reverse cycle. (Public Utilities, No. 47 at pp. 2–4)

DOE is not aware of any room air conditioners currently sold on the market, or any prototypes in development, that meet the criteria outlined by the Public Utilities. DOE is unaware of any data suggesting that the current energy conservation standards preclude the introduction of room air conditioners with reverse cycle capabilities and capacity less than 8,000 Btu/h to the market. Furthermore, the lack of extant products that meet these criteria leaves DOE without the information needed to analyze whether a new product class is necessary. Therefore, DOE is not amending the product class structure at this time to specifically address room air conditioners with reverse cycle capabilities and capacity less than 8,000 Btu/h. DOE is, however, adopting the clarifying amendments to the product class descriptions, originally proposed in the April 2022 NOPR, to align with the rounding instruction at 10 CFR 429.15(a)(3).

2. Technology Options

In the NOPR market analysis and technology assessment, DOE identified 22 technology options initially determined to improve the efficiency of room air conditioners, as measured by the DOE test procedure:

Table IV.1 Technology Options for Room Air Conditioners

Increased Heat Transfer Surface Area
1. 1. Increased heat exchanger surface area (frontal area, fin density and depth of coil) 2.
3. 2. Condenser coil subcooler 4.
5. 3. Suction line heat exchanger 6.
Increased Heat Transfer Coefficient
7. 4. Improved fin and tube design 8.
9. 5. Hydrophilic coating on fins 10.
11. 6. Microchannel heat exchangers 12.
13. 7. Spray condensate on condenser coil 14.
Component Improvements
15. 8. Improved indoor blower and outdoor fan blade design 16.
17. 9. Improved blower/fan motor design 18.
19. 10. Improved compressor efficiency 20.
Improved Installation, Insulation, and Airflow
21. 11. Improved installation materials 22.
23. 12. Reduced evaporator air recirculation 24.
25. 13. Reduced thermal bridging and internal air leakage 26.
Part-load Performance
27. 14. Variable-speed compressors 28.
29. 15. Variable-speed drive fans and blowers

30.
31. 16. Thermostatic or electronic expansion valves 32.
33. 17. Thermostatic cyclic controls 34.
35. 18. Air and water economizers 36.
Standby Power Improvements
37. 19. Low standby-power electronics 38.
39. 20. High frequency switching power supply 40.
Alternative Refrigerants
41. 21. SNAP-approved refrigerants (R-32, R-441A, and R-290) 42.
Other Improvements
43. 22. Washable air filters 44.

a. Alternative Refrigerants

In the April 2022 NOPR, DOE analyzed R-32 (difluoromethane or HFC-32), R-441A (hydrocarbon blend), and R-290 (propane or HC-290) as potential design options to replace R-410A to improve unit efficiency. DOE also analyzed the potential impact of implementing these alternative refrigerants on overall system cost and component efficiency. As discussed in chapter 3 of the NOPR TSD, while DOE did find efficiency benefits associated with R-441A and R-290 refrigerants relative to R410A, DOE did not rely upon those alternative refrigerants in the engineering analysis due to practical concerns regarding flammability and availability. DOE did not find reliable evidence of significant efficiency benefits from a change to R-32 refrigerant. However, based on DOE's expectation that manufacturers are likely to change the primary refrigerant used in room air conditioners to R-32 in response to recent California refrigerant regulations,[19] DOE analyzed the efficiency of compressors that use R-32 as part of the technology analysis and implemented these compressors in the engineering analysis in the April 2022 NOPR.

NEEA and NWPCC supported the inclusion of R-32 in the engineering analysis because of the potential energy savings, the number of products already using R-32, and the new California refrigerant requirements. In particular, NEEA agreed with the approached used by DOE to incorporate R-32 compressors into the design options used to achieve EL 3. (NEEA and NWPCC, No. 50 at pp. 4–5) NYSERDA also supported DOE's incorporation of R-32 refrigerants and variable speed compressors across the analysis, and urged DOE to move swiftly toward finalizing this standard to lock in the beneficial impacts as soon as possible. (NYSERDA, No. 41 at p. 3)

In this final rule analysis, DOE has maintained its approach to incorporating R-32 from the NOPR analysis.

Larsen requested that DOE include calculations on the impacts of alternate refrigerants in room air conditioners in updating the standards of room air conditioners as well as changing DOE's priorities to include environmental impact and quality of life. Larsen referenced challenges to DOE's decision not to include refrigerants (R-32, R441A, R-290) approved by the Environmental Protection Agency (EPA) Significant New Alternatives Policy ("SNAP") in its

[19] The California Air Resources Board (CARB) finalized its rulemaking on Prohibitions on Use of Certain Hydrofluorocarbons in Stationary Refrigeration, Chillers, Aerosols-Propellants, and Foam End-Uses Regulation. See https://ww2.arb.ca.gov/rulemaking/2020/hfc2020. This regulation prohibits the sale of new room air conditioners with refrigerants with a GWP of 750 or greater in California beginning on January 1, 2023. See chapter 3 of this final rule TSD for additional discussion.

engineering analysis, and stated that technological feasibility, predicted costs in the wake of increased value in climate and health benefits, reduced global warming potential compared to the proposed refrigerant R-410A, and findings by the Oak Ridge National Laboratory that showed increased efficiency by around 3 percent warrant the inclusion of these calculations of benefits associated with alternative refrigerants, specifically R-32. (G. Larsen, No. 37 at pp. 1–4)

EPCA requires that DOE focus on the efficiency impacts of various design options, rather than the overall environmental impact. (42 U.S.C. 6295(o)(2)(A)) DOE does consider adverse effects on consumer utility when evaluating technology options. As discussed in chapter 3 of the final rule TSD, DOE found varying reports of the efficiency benefits attributable from the change-over from R-410A to R-32, and as discussed in chapter 5 of the NOPR TSD, opted not to include R-32 specifically as an efficiency option but did include inherent efficiency differences between R-32 compressors and R-410A compressors in the analysis. Due to the varying reports of efficiency impacts and the limitation of scope for this energy conservations standards rulemaking, DOE maintains the same approach as the NOPR, to analyze a change over to R-32 refrigerant so as to utilize the compressor efficiency benefits of R-32 compressors relative to R-410A compressors, without considering specific efficiency benefits attributable to the refrigerant itself.

The Association of Home Appliance Manufacturers (AHAM) requested that DOE consider the recent safety testing challenges and safety concerns associated with the charge size of hydrocarbon refrigerants such as R-290 as, according to AHAM, DOE and the Electric Power Research Institute ("EPRI") study projecting that use of R-290 would yield significant efficiency gains fail to take into account the practical considerations that prevent the use of R-290 in room air conditioners. AHAM stated that the safety standard UL 60335-2-40 will likely limit the charge size of hydrocarbon refrigerants such as R-290 to 114 grams due to lab safety concerns, significantly less than the 200–300 grams required for the smallest capacities of room air conditioners according to AHAM. Additionally, AHAM requested that DOE take the concerns of groups representing firefighters and fire services into account and should not rely on R-290 refrigerant to achieve efficiency gains in its analysis. (AHAM, No. 43 at p. 26)

In chapter 3 of the NOPR TSD, DOE noted that researchers have observed efficiency benefits associated with using R-290 as a refrigerant. However, DOE understands that this design option is still new to the room air conditioner industry and poses substantial design challenges to meet UL safety standards. DOE did not propose to rely on R-290 refrigerant as a design option in the NOPR analysis and maintained that approach in this final rule.

Systemair requested clarification regarding whether R-454B was included in the analysis. (Systemair, Public Meeting Transcript, No. 38 at pp. 15–16)[20] AHAM disagreed with the potential use of R-454B as a refrigerant as mentioned by Systemair because of considerable cost increases as it is a more expensive refrigerant than R-32, lower efficiency than R-32 compressors, and lack of availability. AHAM recommended that DOE reject the use of R-454B as a technology option. (AHAM, No. 43 at p. 27) Additionally, UL stated that for any refrigerant

[20] A notation in the form "Systemair, Public Meeting Transcript, No. 38 at pp. 15–16" identifies an oral comment that DOE received on May 3, 2022 during the public meeting, and was recorded in the public meeting transcript in the docket for this test procedure rulemaking (Docket No. EERE-2014-BT-STD-0059-0030). This particular notation refers to a comment (1) made by Systemair during the public meeting; (2) recorded in document number 38, which is the public meeting transcript that is filed in the docket of this energy conservations standards rulemaking; and (3) which appears on pages 15 through 16 of document number 38.

considered in DOE's analysis, SNAP approval would be required. (UL, Public Meeting Transcript, No. 38 at pp. 16–17)

SNAP approved R-454B for use in residential air conditioning applications, subject to certain use conditions, in a final rule published on May 6, 2021. 86 FR 24444. Therefore, DOE investigated R-454B as a design option for this final rule analysis. DOE did find some efficiency benefit associated with implementation of R-454B but noted the additional costs associated with the technology and the design and supply challenges that AHAM discussed. The full design option analysis of R-454B can be found in the technology assessment in chapter 3 of the final rule TSD.

b. Product Weight

AHAM stated that DOE did not sufficiently evaluate the impact of its proposals with respect to product weight, and requested that DOE consider design parameters of 50 or 150 pound weight thresholds for one or two person lifts set by manufacturers for worker safety standards, consumer utility, and other distribution requirements. According to information collected by AHAM from members on their models' weight and dimension characteristics, AHAM stated that there is a strong relationship between product weight and cooling capacity and claimed that DOE is underestimating the change in weight associated with technology options and design required to meet DOE's proposed standards for a significant number of models in the market. According to AHAM member data, there will likely be significant increase to product weight that exceeds DOE's identified acceptable limits, and that by generalizing the increase in product weight by product class, DOE is overlooking a significant portion of the market. According to AHAM, this increase in product weight is an ongoing consideration as products are often removed from windows seasonally, and senior citizens who rely on these products will have more difficulty with heavier products. According to member data, AHAM estimated that product weight increases of up to 14.6 pounds for Product Classes 1-3 would be required to meet the proposed standards, with each estimated resulting product weight above the 51-pound threshold determined by DOE as a reasonable upper limit for single-person portability. For Product Class 1, AHAM predicted product weight increases between 21 and 56 percent, compared to DOE's estimate of 17 to 46 percent. AHAM further estimated weight increases between 7 and 22 percent for Product Classes 3, 4, 5a, 8a, and 16. (AHAM, No. 43 at pp. 19–21)

DOE understands that product weight is a concern to consumers, which is why DOE considered the effect on product weight when conducting the engineering analysis. DOE considered weight restrictions only for Product Class 1 because units in Product Class 2 already commonly exceed the 50-pound OSHA recommendation for a single-person lift, implying that single-person lifts are not an important consumer attribute for Product Class 2 or for larger units. DOE modeled the potential increases in product weight due to more efficient compressors using compressor weight data from product teardowns. Based on this analysis, DOE expects that manufacturers will be able to preserve single-person lift capability for those products for which it is important to consumers (*i.e.,* units within Product Class 1), as DOE predicts a unit weight increase between 17 and 46 percent for the models in DOE's teardown sample to achieve the max-tech efficiency level, but in no instance would unit weight exceed 51 pounds. DOE's analysis indicates that unit weights resulting from higher efficiency level design options that exceed a 150-pound two-person carry threshold were limited to two product classes, PC 5b and PC 11, where existing units either nearly or already exceed 150 pounds. DOE expects that these large units are already installed primarily with the assistance of professional installers, limiting the impact of increased weight on the consumer utility of these units.

B. Screening Analysis

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

1) *Technological feasibility*. Technologies that are not incorporated in commercial products or in 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 commerical 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 significant 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, that technology will not be considered further due to the potential for monopolistic concerns.

Sections 6(b)(3) and 7(b) of appendix A.

In sum, 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 April 2022 NOPR, DOE proposed screening out air and water economizers and suction-line heat exchangers in the screening analysis, based on their negative impacts on product utility to consumers and on manufacturing impracticality.

AHAM requested that DOE screen out installation materials like accordion side-curtains as there is no way to account for the energy savings according to the existing test procedure given that these features are not installed in the calorimeter during efficiency testing. AHAM also requested that DOE screen out the use of an extended polystyrene (EPS) panel as a technology option as the test procedure will not capture any efficiency gains given that calorimeters are balanced to avoid high differential pressure, which is the source of efficiency gains for this technology option. Additionally, AHAM stated that an EPS panel may conflict with the effectiveness of other technology options such as the condenser coil subcooler and increased heat transfer area. Further, AHAM stated that as most units on the market already use washable air filters, this technology option will not result in significant energy savings or efficiency gains. (AHAM, No. 43 at pp. 27–28)

While the DOE test procedure does not account for the efficiency effects of installation materials (*e.g.,* side-curtains, EPS panels, washable air filters), the technologies still meet the screening criteria, in that they are technically feasible, widely used and not a barrier to availability, manufacturing, installation, or service, do not pose a risk to health, and are not a proprietary technology. Therefore, DOE did not screen out installation materials at this stage. DOE notes that, as discussed in chapter 5 of the NOPR TSD, installation materials were not a design option used to construct efficiency levels for this analysis.

2. Remaining Technologies

Through a review of each technology, DOE concluded that all of the other identified technologies listed in section IV.B.2 met all five screening criteria to be examined further as design options in DOE's final rule analysis. In summary, DOE did not screen out the following technology options:

Table IV.2 displays the design options retained for the engineering analysis.

Table IV.2: Retained Design Options

Increased Heat Transfer Surface Area
1. Increased heat exchanger surface area (frontal area, fin density and depth of coil)
2. Condenser coil subcooler
Increased Heat Transfer Coefficient
3. Improved fin and tube design
4. Hydrophilic coating on fins
5. Microchannel heat exchangers
6. Spray condensate on condenser coil
Component Improvements
7. Improved indoor blower and outdoor fan blade design
8. Improved blower/fan motor design
9. Improved compressor efficiency
Improved Installation, Insulation, and Airflow
10. Improved installation materials
11. Reduced evaporator air recirculation
12. Reduced thermal bridging and internal air leakage
Part-load Performance
13. Variable-speed compressors
14. Variable-speed drive fans and blowers
15. Thermostatic or electronic expansion valves
16. Thermostatic cyclic controls
Standby Power Improvements
17. Low standby-power electronics
18. High-frequency switching power supply
Alternative Refrigerants
19. SNAP-approved refrigerants (R-32, R-441A and R-290)
Other Improvements
20. Washable air filters

DOE 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). For additional details, see chapter 4 of the final rule TSD.

C. Engineering Analysis

The purpose of the engineering analysis is to establish the relationship between the efficiency and cost of room air conditioners. 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/equipment 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 interpolate to define “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 rulemaking, DOE relied on a combination of these two approaches. 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 physically disassembling commercially available products, reviewing publicly available cost information, and modeling equipment cost. From this information, DOE estimated the manufacturer production costs (“MPCs”) for a range of products currently available on the market. DOE then considered the design options manufacturers would likely rely on to improve product efficiencies. From this information, DOE estimated the cost and efficiency impacts of incorporating specific design options at each efficiency level.

DOE analyzed six efficiency levels as part of the engineering analysis: (1) The current DOE standard (baseline); (2) an intermediate level above the baseline but below the ENERGY STAR level, either halfway between the two or at a level where a number of models were certified (EL 1); (3) the ENERGY STAR efficiency criterion (EL 2); (4) the efficiency attainable by a unit with the most efficient R-32 single-speed compressor on the market (EL 3); (5) an intermediate level representing the efficiency of variable-speed units on the market, as tested by DOE using the recently amended test procedure (EL 4); and (6) the maximum technologically feasible (max-tech) efficiency (EL 5).

In evaluating the technologies manufacturers could use to achieve the analyzed efficiency levels, DOE considered design options which made the largest impact on unit efficiency and for which the cost-efficiency relationship was well defined. Accordingly, DOE implemented increased heat exchanger area, condenser coil subcoolers, improved blower motor efficiency, improved compressor efficiency, variable-speed compressors, and low standby-power electronic controls as design options, some or all of which were used to estimate the cost required to reach each efficiently level. DOE did not consider in its analysis certain technologies that met the screening criteria but that DOE was unable to evaluate for one or more of the following reasons: (1) Data were not available to evaluate the energy efficiency characteristics of the technology, (2) available data suggested that the efficiency benefits of the technology are negligible, and (3) certain technologies cannot be measured according to the conditions and methods specified in the existing test procedure. Further information on how the design options were chosen and implemented in the engineering analysis is available in chapter 5 of the final rule TSD.

a. Baseline Efficiency/Energy Use

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.

Of the 48 total units DOE selected for analysis in this rulemaking, 19 of them were baseline units that fell within 12 of the 16 room air conditioner product classes and served as reference points for each analyzed product class. DOE used these reference points to assess the effects of amended energy conservation standards, which in turn support the engineering, LCC, and PBP analyses. The baseline units in each of the analyzed product classes represent the basic characteristics of equipment in that class.

b. Higher Efficiency Levels

DOE considered five efficiency levels ("ELs") above the baseline for this analysis. As discussed in chapter 5 of the final rule TSD, DOE modeled EL 1, EL 2, and EL 3 by analyzing the cost and efficiency impacts of implementing improved single-speed compressors. DOE also analyzed the impact of implementing tube-only or tube-and-fin subcoolers at EL 3 if the analyzed unit did not already have one. At EL 4, DOE considered the efficiency impacts of variable-speed compressors already available on the market and replacing permanent split capacitor ("PSC") fan motors with more efficient electronically commutated motors ("ECMs").

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. As discussed in chapter

5 of the final rule TSD, for the max-tech level, DOE modeled replacing single-speed compressors with the maximum efficiency variable-speed compressors available, reducing standby power to the minimum observed in DOE's teardown sample, and increasing the cabinet and heat exchanger to the largest feasible sizes to improve efficiency. For all product classes, the max-tech level identified for EL 5 exceeds any other regulatory or voluntary efficiency criteria currently in effect in the United States.

The max-tech level is based entirely on modeled combinations of design options that have not yet been combined in a commercially available room air conditioner. Notably, while the key design option implemented at max-tech, variable-speed compressors, is also considered at EL 4, the significant difference between the two is the level of variable-speed compressor efficiency being considered. At EL 4, DOE considers the variable-speed compressors currently implemented in room air conditioners on the market today, for which performance has been characterized through testing. At EL 5, DOE is considering the highest efficiency variable-speed compressor identified in compressor catalogs, which are not currently implemented in room air conditioner models on the market today or in prototypes. Therefore, the efficiency level at max-tech, EL 5, for each product class is a numerical estimation for the theoretical implementation of the highest efficiency variable-speed compressors. Furthermore, the DOE room air conditioner test procedure measures variable-speed unit performance differently than test procedures for other air conditioning products, so limited performance and efficiency data are available for the most efficient examples of this emergent technology for room air conditioners.

Additionally, the most efficient variable-speed compressors that DOE identified in compressor catalogs that were implemented in the analysis at the max-tech efficiency level are manufactured by one manufacturer and have rated Energy Efficiency Ratios ("EERs") between 11.2 and 11.7 Btu/Wh, with a range of rated capacities between 4,705 Btu/h and 16,170 Btu/h. Given the lack of information regarding availability of these highest efficiency variable-speed compressors, and the limited number of variable-speed compressors rated at or near the compressors considered for the max-tech efficiency level, there may not be widespread availability of these high-efficiency variable-speed compressors.

Gradient stated that EL 4 accurately represents an intermediate efficiency level that represents the efficiency of variable-speed units on the market. According to Gradient, variable-speed compressors for room air conditioners with a capacity greater than 8,000 Btu/h are at this time a mature technology that is available from most manufacturers, and the technology needed for implementing variable-speed drives is no longer specialized. Therefore, Gradient strongly supported the proposal of EL 4 as the minimum efficiency level for room air conditioners with a capacity greater than 8,000 Btu/h. (Gradient, No. 40 at p. 2) NEEA and NWPCC also supported the new EL 4 level representing the efficiency of variable-speed units on the market below max tech. (NEEA and NWPCC, No. 50 at p. 5)

DOE agrees with Gradient that multiple units with cooling capacities greater than 8,000 Btu/h from several manufacturers employing variable-speed compressors are now available on the market. Further, DOE concludes that variable-speed compressors with efficiencies higher than those currently observed on the market are technically feasible, but there is uncertainty as to whether they would be available in the quantities that would be required to implement them on the necessary scale at the time that compliance with the standards being adopted in this final rule will be required.

In their comments, NEEA and NWPCC expressed disappointment in the reduction of EL 3 CEER from the preliminary analysis to the NOPR analysis because of the significant cost-effective national energy savings achievable by using high efficiency single-speed compressors. However, they agreed with the methodology used to reach the change, as they recognize that the reduction in maximum single-speed compressor efficiency to 12.7 Btu/Wh was based on a comprehensive survey of available compressors and accounted for the changeover to R-32 refrigerant. (NEEA and NWPCC, No. 50 at p. 5)

DOE is not making any changes to EL 3 in this final rule analysis, retaining the reduction in maximum single-speed compressor efficiency to 12.7 Btu/Wh as discussed in the NOPR.

AHAM requested clarification regarding DOE's conclusion that some of the technology options would not result in changes to chassis size and weight. (AHAM, Public Meeting Transcript, No. 38 at pp. 26–27) P.R. China stated that the proposed increases to efficiency ranging from 20 to 50 percent depending on the product class are unreasonable due to size, weight, and cost concerns and instead recommended controlling the increase in standards of each product class to about 15 percent. According to P.R. China, the upgrading technology paths introduced in the April 2022 NOPR would lead to increased costs and size of chassis associated with the proposed energy efficiency levels, and can lead to increased burden on consumers, and increased carbon emissions in the production process. Therefore, P.R. China suggests optimizing the proposed standards to reduce potential impacts on the supply chain. (P.R. China, No. 39 at pp. 3–4) Friedrich also indicated that based on its industry experience, EL 3 would require room air conditioner chassis to be enlarged and become heavier, due, in substantial part, to increased heat exchanger cross-sectional area and compressor size. (Friedrich, No. 44 at p. 5)

According to AHAM, DOE underestimated the impacts that the considered technology options will have on chassis size, specifically with adoption of variable-speed compressors, feasible chassis width, and installation impacts/costs. AHAM stated that DOE should evaluate the space needed for compressor controls and transformers when considering the space needed for variable-speed compressors, as these additional components may not fit into existing sleeve sizes. Additionally, AHAM stated that at the proposed amended standard levels, chassis sizes will increase significantly to greater than DOE's estimated maximum feasible chassis width and therefore DOE is underestimating a significant portion of the market. AHAM presented percent changes to product dimensions based on member data that ranged from 6 to 15 percent in height, 2 to 19 percent in width, and 2 to 21 percent in depth across Product Classes 1, 2, 3, 4, and 16. AHAM indicated that these increased dimensions would lead to more efficient room air conditioners that are potentially incompatible with older buildings, and would require either reinstallation, changes to the building's infrastructure, or purchase of second-hand less efficient products that do fit windows in these older buildings leading to negative health impacts for low income consumers and those in underserved communities. AHAM also stated that with increased chassis sizes and weight, there will be the potential for an increase in packaging and structural robustness costs to ensure the product is not damaged during transport and to ensure the product passes the drop tests requirement outlined in UL 60335-2-40, Annex GG. AHAM requested that DOE update its analysis according to the information provided. (AHAM, No. 43 at pp. 21–23)

Friedrich disputed the technological feasibility of increasing compressor efficiency to the levels DOE used to model EL 3 and EL 4. Friedrich stated that it was unable to source a single-speed compressor that would achieve EL 3 with an EER of 12.7 Btu/h and that the most efficient single-speed compressor it was able to source has an EER of 10.8 Btu/h. Friedrich added that it was also unable to source a variable-speed compressor with an EER of 13.2 Btu/h, though Friedrich did not provide any information about the variable-speed compressors that are available to them. (Friedrich, No. 52 at p. 2)

DOE identified the highly efficient compressors used in the design analysis in rotary compressor catalogues from companies that typically provide compressors for room air conditioners. The highest efficiency compressors available on the market used R-32 refrigerant. DOE incorporated only those compressors rated at ASHRAE test conditions in this analysis. On this basis, DOE concluded that these higher efficiency compressors would be an available option for increasing the efficiency of room air conditioners subject to the amended standards, including those discussed in Friedrich's comments.

DOE's analysis indicates that manufacturers should not need to increase chassis sizes in order to implement variable-speed compressors at EL 4. DOE has observed that compressor controls and transformers do not require additional chassis size; room air conditioners with variable-speed compressors currently on the market have similar or smaller chassis sizes compared to their equivalent single-speed counterparts, as discussed further in chapter 5 of the final rule TSD. With respect to more robust packaging, DOE agrees that as chassis sizes increase, additional packaging is needed. Therefore, DOE has altered the NOPR analysis to incorporate an incremental cost for packaging into its engineering analysis at max-tech, where DOE modeled chassis size increases.

As a part of the engineering analysis, DOE considered the weight increases associated with each design option for which a substantive weight impact was expected. Those design options included changes to the compressor efficiency, implementation of variable-speed compressors, and adjustments to the heat exchangers (including subcoolers) and resulting chassis size changes, which are discussed in detail both in this document and in chapters 3 and 5 of the final rule TSD. DOE determined that there is sufficient room in the chassis to swap a more efficient compressor of similar overall size and configuration, and therefore would not impact the overall size of the room air conditioner, unlike increases to the heat exchanger which would necessarily increase the model's overall size. In that way, DOE considered the changes to a model's overall size and weight resulting from implementing design options at each efficiency level. GEA indicated that, in order to meet the EL 3 requirements, either a variable-speed compressor or a large chassis size increase would be required, while DOE modeled the cost of meeting this efficiency level using only component replacements and a single-speed compressor. (GEA, No. 49 at pp.1–2)

While manufacturers may elect to either implement variable-speed compressors or increase chassis size as a means to reach EL 3, DOE's analysis shows that the most efficient single-speed compressor alone can allow room air conditioners to reach EL 3. As DOE's analysis estimates that manufacturers are likely to use the most cost-effective design options, DOE modeled EL 3 using the most efficient single-speed compressors instead of other possible design options.

Friedrich suggested that compressor data found in catalogues would be better if averaged rather than selecting the most efficient data for DOE's analysis, given that manufacturers may not always be able to implement the best compressors in their products. (Friedrich, Public Meeting Transcript, No. 38 at pp. 18–19)

EPCA requires DOE to adopt the maximum standards that are both technically justified and economically feasible. (42 U.S.C. 6295(o)(2)(A)) When assessing efficiency levels, and in particular the maximum technologically feasible room air conditioner efficiency level, DOE considered the compressor with the maximum available efficiency, based on product literature, to determine the limits of technical feasibility in room air conditioner compressors. Using an average would not provide DOE with the maximum technologically feasible result, though DOE notes that when considering efficiency levels above baseline and below max-tech, compressors of various efficiency were assessed and implemented in the analysis.

Gradient requested clarification regarding the evaporating and condensing temperature test conditions used to characterize compressor efficiency in catalogue data surveyed by DOE. (Gradient, Public Meeting Transcript, No. 38 at pp. 17–18)

In developing the engineering analysis, DOE considered compressors for which performance data were available in accordance with ASHRAE or Air Conditioning, Heating, & Refrigeration Institute test conditions, which use a condenser temperature of 54.4 °C and an evaporation temperature of 7.2 °C. These compressor test conditions are an industry standard, and are commonly used in characterizing and determining relative compressor efficiency improvements.

Friedrich stated that most of the technology options in DOE's analysis, such as a suction line heat exchanger, do not offer any benefit for the refrigerant used, or have already been used to maximize efficiency like with condenser coil subcoolers, and DC fan and blower motors. Friedrich also stated that microchannel heat exchangers may not be appropriate for R-32 applications where minimizing leakage is paramount, as such heat exchangers have issues with galvanic corrosion. (Friedrich, No. 44 at p. 9)

As discussed in chapters 3 and 5 of the final rule TSD, DOE evaluates each technology option for its potential efficiency benefit. However, when developing the engineering analysis, DOE typically focuses on design options with substantial impact on efficiency that DOE expects manufacturers would implement in their designs to improve efficiency. In the case of condenser coil subcoolers, while DOE did find that most units implemented some form of this technology, DOE identified different types of subcoolers with varying efficiency benefits, and therefore retained subcoolers as a design option for those units for which efficiency improvements using a subcooler or improved subcooler design were feasible. In the case of fan and blower motors, DOE identified ECM motor technology as a potential improvement over the commonly implemented PSC motors, and considered the improvement at the two highest efficiency levels. DOE did not consider the implementation of microchannel heat exchangers as a design option for the engineering analysis due to the high cost and lack of room air conditioner application-specific efficiency data.

NEEA and NWPCC stated that they could provide data on the cost-effectiveness of high efficiency models. (NEEA and NWPCC, No. 50 at p. 4)

DOE did not receive any additional information from NEEA and NWPCC on high efficiency models ahead of this final rule.

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, 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 (available from manufacturer websites or appliance repair websites, for example) to develop the bill of materials for the product.

- Price surveys: If neither a physical nor catalog teardown is feasible (for example, for tightly integrated products such as fluorescent lamps, which are infeasible to disassemble and for which parts diagrams are unavailable) or cost-prohibitive and otherwise impractical (e.g. 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 ("BOM") provides the basis for the MPC estimates. DOE estimated the cost of the highest efficiency single-speed and variable-speed compressors implemented in EL3 and EL 5, respectively, by extrapolating the costs from price surveys of other compressors. DOE used this approach because, as discussed previously, DOE is not aware of these most efficient single-speed and variable-speed compressors being implemented in any available room air conditioners to date.

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 the annual Securities and Exchange Commission ("SEC") 10-K reports[21] filed by publicly-traded manufacturers primarily engaged in appliance manufacturing and whose combined product range includes room air conditioners. Chapter 12 of the final rule TSD provides additional information on the manufacturer markup.

3. Cost-Efficiency Relationship

The results of the engineering analysis are presented as cost-efficiency data for each of the efficiency levels for each of the product classes that were analyzed, as well as those extrapolated from a product class with similar cooling capacity and features. 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

[21] U.S. Securities and Exchange Commission, Electronic Data Gathering, Analysis, and Retrieval (EDGAR) system. Available at *www.sec.gov/edgar/search/* (last accessed September 7, 2022).

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 room air conditioners at each efficiency level compared to the baseline) are provided in Tables 5.5.5 and 5.5.6 in chapter 5 of the final rule TSD. See chapter 5 of the final rule TSD for additional detail on the engineering analysis.

Gradient agreed with the incremental cost for Product Classes 1 through 5b including the expected trend of increased cost for higher capacity units, but stated that the incremental cost for variable-speed compressor technology should depend only on the capacity of the system, and as such, Gradient recommended applying the incremental costs for Product Classes 1 through 5b to systems of similar capacity in other product classes. (Gradient, No. 40 at p. 2)

DOE based its incremental costs for each product class on data derived from teardowns of units in that product class and a design option analysis. The differences in incremental costs observed between non-louvered and louvered units are not due to differences in cost estimates for the variable-speed compressor design option, but inherent differences in incremental cost estimates for a particular configuration. These inherent differences in incremental costs are driven by differences in design and component types, as shown by DOE’s teardown analysis, as discussed in further detail in chapter 5 of the final rule TSD.

AHAM stated that reducing energy consumption in room air conditioners requires balancing multiple tradeoffs between cost, functional performance, and energy efficiency among numerous components, with different mixes of technology for each product platform. Accordingly, AHAM stated that manufacturers have therefore selected virtually all of the viable technologies across their product lines and requested that DOE recognize that there is limited new technology that would allow for significant per-unit reduction in energy consumption in room air conditioners and that the more radical or comprehensive the design change, the more likely that retooling is necessary and, thus, the greater the product cost increase and capital investment requirement. AHAM concluded that while there may be declining costs over time associated with energy efficient components, these are due to changes in productivity and/or value engineering that is independent of energy efficiency. (AHAM, No. 43 at pp. 18–19)

While DOE recognizes that manufacturers face tradeoffs regarding cost, performance, and efficiency, DOE identified several feasible technologies for improving product efficiency across product lines that have only been implemented in a few room air conditioner models to date, such as variable-speed compressors and ECM fan motors. DOE's analysis in this final rule takes into account costs associated with retooling and capital investments when determining economic justification. See section IV.J.2.c of this document for a description of the conversion cost methodology.

4. Consumer Utility

According to AHAM, consumers may elect to use window units in wall sleeves because higher capacity through-the-wall room air conditioners are already more costly, larger, and heavier than their window counterparts, which may limit efficiency gains and even lead to safety concerns due to inadequate cooling of high-pressure components. AHAM requested that DOE avoid this result not only because it undercuts energy conservation savings goals, but also because it increases safety risks for consumers, with a disproportionate burden on lower income and underserved communities. (AHAM, No. 43 at pp. 22–23)

In its analyses, DOE assumes that consumers will install products according to manufacturer instructions and that they will not install units in an unsafe manner. DOE has no information from which to estimate the potential efficiency effects of the incorrect installation described.

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.

In the April 2022 NOPR, DOE assumed the main party in the distribution chain after manufacturers was retailers.

Friedrich requested additional details regarding the assumption that 100 percent of room air conditioners sales occur through the retail distribution channel. (Friedrich, Public Meeting Transcript, No. 38 at p. 29)

Unlike other larger space cooling equipment that require additional ductwork or installation materials, DOE was unable to find data suggesting that room air conditioners require a general or mechanical contractor for installation. In the absence of data or additional comment provided by stakeholders, DOE maintains the assumption in this final rule that 100 percent of sales occur through the retail distribution channel.

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.[22]

DOE relied on economic data from the U.S. Census Bureau to estimate average baseline and incremental markups. Specifically, DOE used the 2017 Annual Retail Trade Survey for the "electronics and appliance stores" sector to develop retailer markups.[23]

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

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[22] Because the projected price of standards-compliant products is 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, 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.

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

E. Energy Use Analysis

The purpose of the energy use analysis is to determine the annual energy consumption of room air conditioners at different efficiencies in representative U.S. single-family homes, multi-family residences, and commercial buildings, and to assess the energy savings potential of increased room air conditioner efficiency. The energy use analysis estimates the range of energy use of room air conditioners 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.

To estimate annual room air conditioner usage and energy consumption in the April 2022 NOPR, DOE first calculated the number of operating hours in cooling mode for each room air conditioner in the residential and commercial samples using the reported energy use for room air conditioning in the EIA's Residential Energy Consumption Survey ("RECS") 2015[24] and Commercial Building Energy Consumption Survey ("CBECS") 2012[25], along with historical estimates of the EER of the room air conditioner(s) in each sample home or building. DOE based the latter on the reported age (or simulated age) of the unit and historical data on shipment-weighted average EER.

[24] U.S. Department of Energy–Energy Information Administration. Residential Energy Consumption Survey. 2015. *www.eia.gov/consumption/residential/data/2015/*

[25] U.S. Department of Energy–Energy Information Administration. Commercial Buildings Energy Consumption Survey. 2012. *www.eia.gov/consumption/commercial/data/2012/.*

AHAM questioned the accuracy of the RECS data more generally, pointing to several sources of potential error or uncertainty within the dataset. (AHAM, No. 43 at pp. 8–10)

RECS represents the largest available data-set of installed residential appliance stock that is designed to be nationally representative.[26] Although there may be error or uncertainty in household responses, as in any survey, there is no evidence that responses to any of the questions regarding room air conditioners suffers from a systematic bias that would impact the energy use or LCC analysis. Additionally, the RECS end use energy consumption data, used is the energy use analysis, is derived from household energy bills provided by respondents and is an exact measurement that is not subject to response error from the household. The RECS end-use estimates are based on an engineering approach and calibrated based on the relative uncertainties of and correlations between the end uses.[27] A study comparing field-energy estimates from the Pecan Street Project[28] to end-use estimates from RECS found good agreement between the air conditioning, water heating, and refrigerator consumption estimates as a fraction of the whole-home energy.[29] Although the authors found that the total energy consumption by end use was higher in RECS households, the authors attribute the difference to selection bias associated with the volunteer households within the Pecan Street dataset. For this final rule, DOE maintains that the RECS dataset provides the most reasonable, nationally representative estimate for room air conditioner energy consumption in the U.S.

[26] www.eia.gov/consumption/residential/reports/2015/comparison/index.php

[27] Energy Information Administration. *RECS 2015 Consumption and Expenditures Technical Documentation Summary*. www.eia.gov/consumption/residential/reports/2015/methodology/pdf/2015C&EMethodology.pdf (last Accessed September 12, 2022)

[28] www.pecanstreet.org/dataport/

[29] Brock Glasgo, Chris Hendrickson, Inês M.L. Azevedo. *Using advanced metering infrastructure to characterize residential energy use*. The Electricity Journal, Volume 30, Issue 3, 2017, Pages 64-70.

AHAM and Friedrich stated that it appears highly likely that DOE has overestimated the cooling hours substantially based on end-use energy consumption estimates from RECS 2015, and thus the energy usage and related potential savings from more efficient room air conditioners. (AHAM, No. 43, at p. 8; Friedrich, No. 44 at pp. 7–8) According to AHAM, in many, if not most cases, room air conditioners are not thermostat-driven, load-following but, rather, are turned on and off by users as required, and assuming a load-following pattern substantially overstates the number of hours a room air conditioner is actually on.[30] AHAM believes it to be more common that room air conditioners are turned on and off by user choice such as when it is especially hot or when a room is occupied, and that the usage hours in that control mode are likely to be much lower than estimates based on load modeling. In support of this point, AHAM stated that in the RECS data, nearly half the respondents report turning on their room air conditioners only when needed and an additional 17 percent adjust the temperature manually, while only 30 percent report setting one temperature and leaving the unit as is.

DOE acknowledges that the statistical nature of the RECS end-use load analysis includes some uncertainty, but maintains that the RECS end-use energy consumption estimates remain the best available dataset for determining the hours of operation associated with room air conditioners. DOE notes that the responses within the household survey portion of RECS for room air conditioner usage do not necessarily imply higher or lower usage relative to DOE's estimates from RECS energy consumption data. For example, respondents that turn their unit on

[30] RECS reports space cooling end-use energy consumption estimates based on calculated cooling load based on household characteristics and weather data.

and off manually could potentially use their unit more than expected based only on cooling load-based operation.

DOE performed a sensitivity analysis to estimate the potential impact of overestimating operating hours for households that turn their unit on and off as needed. For this sensitivity analysis, DOE reduced the operating hours by half for households reported in RECS as turning their unit on and off as needed. Although energy savings are reduced due to the overall lower operating hours in this sensitivity analysis, the average LCC savings remains positive for all product classes at the adopted TSL with a majority of consumers receiving a net benefit. The average shipment-weighted LCC savings are $62 (relative to $85 in the reference case) and 25% of consumers are impacted negatively (relative to 17 percent in the reference case). As noted above, the assumption of reduced usage associated with household that manually turn their unit on or off is a conservative assumption given that these households could potentially use their unit more than estimated based cooling-load based operation. See appendix 8F for the full results of the analysis.

AHAM and Friedrich stated that portable air conditioners are a more appropriate analog for room air conditioner usage rather than assuming a cooling load-driven model, since both products are used as a last resort to meet a specific need and suggested DOE base operating hours on a field-metering study of portable air conditioners. (AHAM, No. 43 at p. 13; Friedrich, No. 44 at p. 8)

The portable air conditioner field-metering study referenced by AHAM and Friedrich analyzed only 19 units for less than a full cooling season.[31] As stated in the report itself, given the limited number of test sites in two locations in the Northeast, the study was not intended to be statistically representative of portable AC users in the United States. Even if portable air conditioners were a good analog to room air conditioners, the limitations of this dataset in terms of sample size and representation of usage would preclude its application for the energy use analysis.

In the April 2022 NOPR, DOE accounted for the reduction in energy use of models with a variable-speed compressor during part load operation based on the methodology developed for the DOE test procedure. DOE accounted for geographic-dependent climate variability by calculating U.S. State-dependent performance adjustment factors ("PAFs") using historical climate data spanning the period from 2008–2016 from the National Oceanic and Atmospheric Administration. For each state in the United States, DOE performed a temperature bin analysis to calculate within the cooling season (June through August) the fraction of time the outdoor dry bulb temperature was in one of four temperature bins: 80–84 degrees Fahrenheit ("°F"), 85–89°F, 90–94°F, and 95–99°F. DOE then calculated the corresponding PAF for each state using the methodology developed for variable-speed drive units in the test procedure and applied the PAF to the EER at full load.

AHAM stated that before DOE assigns significant value to expensive variable speed/capacity compressors and related control and other systems in its engineering analysis, it

[31] Burke *et al.*, 2014. "Using Field-Metered Data to Quantify Annual Energy Use of Residential Portable Air Conditioners." LBNL, Berkeley, CA. LBNL Report LBNL-6469E. September 2014.

needs to validate its assumptions about room air conditioner operating conditions, operating hours, and the likelihood of part load operation. (AHAM, No. 43 at p. 17)

The methodology used in the April 2022 NOPR to estimate the energy savings associated with part-load operation is based on the DOE test procedure, as well as available data regarding room air conditioner usage. The development of the test procedure involved testing the performance of variable-speed units relative to single-speed units in a laboratory setting and measuring the relative efficiency gained by part-load operation. DOE is unaware of additional data that can be utilized to estimate the performance of variable-speed units. DOE's application of PAFs for variable-speed units used in the energy use analysis is consistent with the methodology used in DOE test procedure and represents DOE's best estimates to capture the efficiency gains of part load operation based on available data.

Rice stated that the energy use analysis in the April 2022 NOPR does not use the correct weighting factors to calculate RAC CEERs and performance adjustment factors ("PAFs"). Rice states that the weighting factors used by DOE were the fractional time spent in each bin, while the correct approach would be to use fractional cooling delivered, as done in the RAC test procedure final rule. Rice suggested DOE modify its approach in the final rule to use weighting factors derived by the fractional cooling delivered. (Rice, No. 48 at p. 2)

DOE clarifies that the calculated State-dependent CEERs and PAFs in the April 2022 NOPR were estimated on the fractional cooling delivered, as suggested by Rice, which are derived from the fractional time spent in each temperature bin. The description of the analysis has been updated in the final rule TSD to reflect this clarification.

In the April 2022 NOPR analysis, DOE included the impact of fan-only mode energy consumption in the total energy use, based on available data for portable ACs. Based on field metering data of portable air conditioners, fan-only mode is estimated at 30 percent of cooling mode hours. DOE assumed that models below ENERGY STAR efficiency level would operate in fan-only mode 30 percent of cooling mode hours.[32] For ELs that meet or exceed the ENERGY STAR level, DOE estimated the amount of time the unit spent in fan-only mode based on the ENERGY STAR Version 4.2 criterion for room air conditioners criterion requiring that the unit run in off-cycle fan mode less than 17 percent of the time spent in off-cycle mode. Thus, for ELs that meet or exceed the ENERGY STAR efficiency level, DOE assumed units would operate in fan-only mode 5 percent of cooling mode hours.

NEEA and NWPCC stated that DOE's assumption of fan-only mode being 30 percent of cooling mode hours for models below ENERGY STAR efficiency level is a reasonable assumption. Additionally, NEEA and NWPCC agree that more efficient units (those meet or exceed the ENERGY STAR level) would be less likely to operate in fan-only mode given their variable-speed fans and motors and support the assumed operation of fan-only model to be 5 percent of cooling mode hours for these units. (NEEA and NWPCC, No. 50 at p. 5)

In the April 2022 NOPR, DOE assumed that approximately half of room air conditioners are unplugged for half of the year. The ''unplugged'' time associated with these units is averaged over all units.

[32] Ibid.

The California IOUs provided data supporting DOE's assumption. In an online survey conducted on behalf of the California IOUs by Evergreen Economics, results show that 48 percent of households with a room air conditioner reported removing their unit and reinstalling their equipment each year. (California IOUs, No. 47 at pp. 4–5)

DOE appreciates the data provided by the California IOUs supporting its assumption. DOE maintains its assumption for this final rule.

P.R. China suggested DOE account for the degradation in energy efficiency over the lifetime of the product and in different operating environments in the energy use and LCC analyses. (P.R. China, No. 39 at p. 4)

DOE is unaware of data suggesting a decrease in product efficiency over the lifetime of room air conditioners. Moreover, there is no indication that the degradation would preferentially impact more efficient products over less efficient ones. As this effect would impact the energy use of units at various efficiency levels, it would likely have a small impact on the overall LCC savings results.

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

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 room air conditioners. 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 room air conditioners 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 housing units and commercial buildings. As stated previously, DOE developed household samples from the 2015 RECS and 2012 CBECS. For each sample household, DOE determined the energy consumption for room air conditioners 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 room air conditioners.

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

The computer model DOE uses to calculate the LCC and PBP 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 room air conditioner user samples. For this rulemaking, the Monte Carlo approach is implemented in MS Excel together with the Crystal Ball™ add-on.[33] The model calculated the LCC and PBP for products at each efficiency level for 10,000 housing units or commercial buildings 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.

[33] Crystal Ball™ is commercially-available software tool to facilitate the creation of these types of models by generating probability distributions and summarizing results within Excel, available at *www.oracle.com/technetwork/middleware/crystalball/overview/index.html* (last accessed September 6, 2022).

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 and PBP 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 all consumers of room air conditioners as if each were to purchase a new product in the first year of required compliance with new or amended standards. Amended standards apply to room air conditioners manufactured 3 years after the date on which any new or amended standard is published. (42 U.S.C. 6925(m)(4)(A)(i)) Therefore, DOE used 2026 as the first year of compliance with any amended standards for room air conditioners.

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 final rule TSD and its appendices.

Table IV.3 Summary of Inputs and Methods for the LCC and PBP Analysis*

Inputs	Source/Method
Product Cost	Derived by multiplying MPCs by manufacturer and retailer markups and sales tax, as appropriate. Used historical data to derive a price scaling index to project product costs.
Installation Costs	Baseline installation cost determined with data from RS Means 2022.
Annual Energy Use	The total annual energy use by operating mode multiplied by the hours per year in each mode. Variability: Based on the 2015 RECS and 2012 CBECS.
Energy Prices	Electricity: Based on Edison Electric Institute data for 2021. Variability: Regional energy prices determined for each Census Division.
Energy Price Trends	Based on *AEO2022* price projections by Census Division.
Repair and Maintenance Costs	Assumed no change with efficiency level for maintenance costs. Repair costs estimated for each product class and efficiency level.
Product Lifetime	Weibull probability distribution developed from historical shipments, *American Housing Survey* and *RECS*, with an average lifetime of 9 years.
Discount Rates	Approach involves identifying all possible debt or asset classes that might be used to purchase the considered appliances, or might be affected indirectly. Primary data source was the Federal Reserve Board's Survey of Consumer Finances.
Compliance Date	2026

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

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. To derive the learning rate parameter for room air conditioners that utilize single-speed compressors, DOE obtained historical Producer Price Index ("PPI") data for room air conditioners from the Bureau of Labor Statistics ("BLS"). A PPI specific to "room air-conditioners and dehumidifiers, except portable dehumidifiers" was available for the time period between 1990 and 2009.[34] After 2009, DOE used the primary products series of "air-conditioning, refrigeration and forced air heating equipment", which includes room air conditioners, spanning the years 2010–2021.[35] Inflation-adjusted price indices were calculated by dividing the PPI series by the gross domestic product index from Bureau of Economic Analysis for the same years. Using the combined data from 1990–2021, the estimated learning rate (defined as the fractional reduction in price expected from each doubling of cumulative production) is 24 percent. For efficiency levels that include variable-speed compressors, DOE applied a different price trend to the controls portion of the variable-speed compressors that contributes to the price increments moving from EL 3 (an efficiency level achieved with the highest efficiency single-speed compressor) to EL 4 and EL 5. DOE used PPI data on "semiconductors and related device manufacturing" between 1967 and 2021 to estimate the historic price trend of electronic components in the control. 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. See chapter 8 of the final rule TSD for further details on this topic.

2. Installation Cost

Installation cost includes labor, overhead, and any miscellaneous materials and parts needed to install the product. In the April 2022 NOPR, DOE assumed that the installation cost

[34] Room air-conditioners and dehumidifiers, except portable dehumidifiers PPI series ID: PCU3334153334156; *www.bls.gov/ppi/*.

[35] Air-conditioning, refrigeration, and forced air heating equipment manufacturing, Primary Products PPI series ID: PCU333415333415P; *www.bls.gov/ppi/*.

would be constant for all efficiency levels and, thus, did not include installation costs in the LCC calculation.

AHAM stated that even with minimal size increases in smaller room air conditioners, different chassis sizes will necessitate different installation brackets that do not cover louvers. AHAM requested that DOE analyze costs of necessary retrofits if chassis size changes and the increased installation costs due to heavier products. (AHAM, No. 43 at p. 23)

DOE agrees that a standard that changes the chassis size or weight of units may increase installation costs. For the final rule, DOE used data from RS MEANS 2022 to estimate the labor and material cost necessary for installing units at various capacities. DOE matched the RS MEANS installation costs derived by capacity to the corresponding baseline level within each product class. To account for additional labor hours in higher efficiency equipment with significantly larger dimensions and/or weight, DOE based the labor hour estimates on labor hours for higher capacity room air conditioners with similar dimensions/weight. DOE notes that chassis size only increases at the max-tech level and does not project an increased cost due to retrofits at the adopted TSL.

3. Annual Energy Consumption

For each sampled household or business, DOE determined the energy consumption for room air conditioners at different efficiency levels using the approach described previously in section IV.E of this document.

a. Rebound Effect

A direct rebound effect occurs when a product that is made more efficient is used more intensively, such that the expected energy savings from the efficiency improvement may not fully materialize. At the same time, consumers benefit from increased utilization of products due to rebound. Higher-efficiency room air conditioners reduce the operating costs for a consumer, which can lead to greater use of room air conditioners. Overall consumer welfare (taking into account additional costs and benefits of increased usage) is generally understood to increase from rebound. DOE did not find any data on the rebound effect that is specific to room air conditioners. In the April 2011 Direct Final Rule, DOE estimated a rebound of 15 percent for room air conditioners for the NIA but did not include rebound in the LCC analysis. 76 FR 22454, 22511. Given the uncertainty and lack of data specific to room air conditioners, DOE did not include the rebound effect in the LCC analysis for this final rule. DOE does include rebound in the NIA for a conservative estimate of national energy savings and the corresponding impact to consumer NPV. See section IV.H.2 and IV.H.3 of this document for further details on how the rebound effect is applied in the NIA.

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 2021 using data from 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).[36] For the commercial sector, DOE calculated electricity prices using the methodology described in Coughlin and Beraki (2019).[37]

DOE calculated weighted-average values for average and marginal price for the nine census divisions for both the residential and commercial sectors. As the EEI data are published separately for summer and winter, DOE calculated seasonal prices for each division and sector. See chapter 8 of the final rule TSD for details.

To estimate energy prices in future years, DOE multiplied the 2021 energy prices by the projection of annual average price changes for each of the nine census divisions from the Reference case in *AEO2022*, which has an end year of 2050.[38] To estimate price trends after 2050, DOE used a constant value based on the simple average between 2046 through 2050.

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

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

[37] Coughlin, K. and B. Beraki. 2019. Non-residential Electricity Prices: A Review of Data Sources and Estimation Methods. Lawrence Berkeley National Lab. Berkeley, CA. Report No. LBNL-2001203. *https://ees.lbl.gov/publications/non-residential-electricity-prices*

[38] U.S. Department of Energy–Energy Information Administration. *Annual Energy Outlook 2022 with Projections to 2050.* Washington, DC. Available at *www.eia.gov/forecasts/aeo/* (last accessed September 6, 2022).

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 this final rule analysis, DOE did not include maintenance costs in the LCC.

In the April 2022 NOPR, DOE assumed that repair frequencies are low and increase for the higher-capacity units due to more expensive equipment costs. DOE assumed that 1 percent of small-sized units (below 8,000 Btu/h), 2 percent of medium-sized units (8,000 to 20,000 Btu/h), and 3 percent of large-sized units (above 20,000 Btu/h) are maintained or repaired each year. DOE assumed that an average service call and repair/maintenance takes about 1 hour for small and medium-sized units and 2 hours for large units, and that the average material cost is equal to one-half of the incremental equipment cost.

Friedrich states that DOE failed to incorporate increased repairs costs to service room air conditioners with variable-speed compressors and increased heat exchanger sizes. According to Friedrich, the likelihood and repair cost will increase due to complexity of components with variable-speed compressors or additional braze joints for larger heat exchangers. (Friedrich, No. 44 at pp. 8–9)

DOE's analysis incorporates an increased repair cost due to the higher incremental costs associated with units with variable-speed compressors for more expensive components as suggested by Friedrich. DOE is unaware of any data indicating an increased likelihood of repair due to variable-speed compressors or increased heat exchanger sizes. A retrospective analysis of the April 2011 Direct Final Rule found that DOE's approach to estimating repair costs at each efficiency level based on the incremental equipment cost agreed with an analysis of consumer survey data.[39] DOE maintains its approach to estimating repair rates and costs for this final rule.

6. Product Lifetime

For room air conditioners, DOE developed a distribution of lifetimes from which specific values are assigned to the appliances in the samples. DOE conducted an analysis of actual lifetime in the field using a combination of historical shipments data, the stock of the considered appliances in the *American Housing Survey*, and responses in RECS on the age of the appliances in the homes. The data allowed DOE to estimate a survival function, which provides an average appliance lifetime. This analysis yielded a lifetime probability distribution with an average lifetime for room air conditioners of approximately 9 years.

Friedrich states that the increase in braze joints needed for larger heat exchangers may increase the potential for refrigerant leaks. Friedrich adds that in the event of a refrigerant leak, consumers are more likely to retire their unit early rather than repair the unit due to the high repair cost resulting in a short lifetime for efficiency levels with this technology. (Friedrich, No. 44 at p. 9)

As described in section IV.F.5, the April 2022 NOPR assumed a low repair rate (1-3 percent). Data was not provided by stakeholders during the rulemaking demonstrating the impact that larger heat exchangers would have on the repair rate or repair cost which could potentially

[39] 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.

lead to shorter product lifetimes. For this final rule, DOE maintained the same lifetime distribution for all efficiency levels.

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 room air conditioners 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.[40] 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, 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 aggregate impact of this rebalancing using the historical distribution of debts and assets.

[40] 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; 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.

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 Survey of Consumer Finances[41] ("SCF") for 1995, 1998, 2001, 2004, 2007, 2010, 2013, 2016, and 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 final rule 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).

DOE utilized confidential 2019 shipments data disaggregated by product class and efficiency provided by AHAM in response to the June 2020 Preliminary Analysis to estimate the

[41] U.S. Board of Governors of the Federal Reserve System. Survey of Consumer Finances. 1995, 1998, 2001, 2004, 2007, 2010, 2013, 2016, and 2019. (Last accessed September 6, 2022.) *www.federalreserve.gov/econresdata/scf/scfindex.htm*

efficiency distribution in 2019. In the April 2022 NOPR, DOE assumed an annual 0.25 percent increase in shipment-weighted CEER for each product class to develop the efficiency distribution in 2026. The efficiency trend is supported by a retrospective analysis of the April 2011 Direct Final Rule which used a similar efficiency trend for single-speed compressor units.[42] For this final rule, DOE assumed this trend applied to efficiency levels with single-speed compressors (EL 0, EL 1, EL 2, and EL 3).

In the 2022 NOPR, DOE assumed the adoption of variable-speed technologies would follow a Bass diffusion curve which describes how new technologies diffuse into the consumer market. DOE assumed that units with variable-speed technologies would account for 5 percent of shipments in each product class by 2026.

In response to the April 2022 NOPR, NEEA and NWPCC provided sales estimates for variable-speed units and all room air conditioners sold as part of the EPA ENERGY STAR® Retail Products Platform (ESRPP). NEEA and NWPCC encouraged DOE to use these data to calibrate the Bass diffusion curve for variable-speed models. (NEEA and NWPCC, No. 50 at pp. 2–4)

DOE thanks NEEA and NWPCC for the provided sales data needed to calibrate the Bass diffusion curve for the adoption of variable-speed technologies. The ESRPP data provided by NEEA and NWPCC indicated a faster adoption of variable-speed technologies than estimated in the April 2022 NOPR between 2018 and 2022, in particular for capacities greater than 8,000

[42] 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.

Btu/h. For this final rule, DOE calibrated its Bass diffusion curve model for variable-speed models to reach 7 percent of shipments in 2026 with faster adoption for capacities greater than 8,000 Btu/h based on the provided data.

The estimated market shares for the no-new-standards case for room air conditioners in 2026 are shown in Table IV.4 through Table IV.6. See chapter 8 of the final rule TSD for further information on the derivation of the efficiency distributions.

Table IV.4 Room Air Conditioners without Reverse Cycle and with Louvered Sides: No-New-Standards Case Market Shares in 2026

Efficiency Level	<6,000 Btu/h (PC1)		6,000−7,900 Btu/h (PC2)		8,000−13,900 Btu/h (PC3)	
	Efficiency *CEER*	Market Share %	Efficiency *CEER*	Market Share %	Efficiency *CEER*	Market Share %
Baseline	11.0	7.7%	11.0	0.0%	10.9	0.0%
1	11.4	85.2%	11.4	74.6%	11.4	30.3%
2	12.1	2.1%	12.1	18.3%	12.0	58.0%
3	13.1	0.0%	13.7	2.1%	14.3	0.9%
4	16.0	5.0%	16.0	5.0%	16.0	10.7%
5	20.2	0.0%	21.2	0.0%	21.9	0.0%
Efficiency Level	**14,000−19,900 Btu/h (PC4)**		**20,000−27,900 Btu/h (PC5a)**		**>=28,000 Btu/h (PC5b)**	
	Efficiency ***CEER***	**Market Share %**	**Efficiency** ***CEER***	**Market Share %**	**Efficiency** ***CEER***	**Market Share %**
Baseline	10.7	0.0%	9.4	0.0%	9.0	40.3%
1	11.1	0.0%	9.8	9.0%	9.4	45.7%
2	11.8	89.1%	10.3	80.3%	9.9	9.0%
3	14.0	0.1%	11.8	0.0%	10.3	0.0%
4	16.0	10.7%	13.8	10.7%	13.2	5.0%
5	19.8	0.0%	18.7	0.0%	16.3	0.0%

Table IV.5 Room Air Conditioners without Reverse Cycle and without Louvered Sides: No-New-Standards Case Market Shares in 2026

Efficiency Level	8,000−10,900 Btu/h (PC 8a)		11,000−13,900 Btu/h (PC8b)		14,000−19,900 Btu/h (PC9)	
	Efficiency *CEER*	**Market Share** *%*	**Efficiency** *CEER*	**Market Share** *%*	**Efficiency** *CEER*	**Market Share** *%*
Baseline	9.6	0.0%	9.5	0.0%	9.3	39.1%
1	10.1	11.4%	10.0	0.0%	9.7	46.9%
2	10.6	83.6%	10.5	94.3%	10.2	9.0%
3	12.3	0.0%	12.3	0.7%	10.9	0.0%
4	14.1	5.0%	13.9	5.0%	13.7	5.0%
5	18.7	0.0%	19.0	0.0%	16.8	0.0%

Table IV.6 Room Air Conditioners with Reverse Cycle, Casement-Slider: No-New-Standards Case Market Shares in 2026

Efficiency Level	w/ Louvers (PC11)		wo/ Louvers (PC12)		Casement-Slider (PC16)	
	<20,000 Btu/h		<14,000 Btu/h			
	Efficiency *CEER*	**Market Share** *%*	**Efficiency** *CEER*	**Market Share** *%*	**Efficiency** *CEER*	**Market Share** *%*
Baseline	9.8	50.7%	9.3	39.1%	10.4	34.4%
1	10.4	35.2%	9.7	46.9%	10.8	51.6%
2	10.8	9.0%	10.2	9.0%	11.4	9.0%
3	12.3	0.0%	11.3	0.0%	13.2	0.0%
4	14.4	5.0%	13.7	5.0%	15.3	5.0%
5	18.0	0.0%	16.4	0.0%	19.1	0.0%

9. Payback Period Analysis

The payback period is the amount of time it takes the consumer to recover the additional installed cost of more-efficient products, compared to baseline products, through energy cost savings. Payback periods are expressed in years. 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. The PBP calculation uses the same inputs as the LCC analysis, except that discount rates are not needed.

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.[43] 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.

Total shipments for room air conditioners are developed by considering the demand from replacements for units in stock that fail and the demand from first-time owners in existing homes. DOE calculated shipments due to replacements using the retirement function developed for the LCC analysis. DOE calculated shipments due to first-time owners in existing households using estimates from room air conditioner saturation in RECS 2015 and projections of housing stock from *AEO 2022*. See chapter 8 of the final rule TSD for details.

DOE considers the impacts on shipments from changes in product purchase price and operating cost associated with higher energy efficiency levels using a price elasticity and an efficiency elasticity. As in the April 2022 NOPR, DOE employs a 0.2-percent efficiency elasticity rate and a price elasticity of -0.45 in its shipments model. These values are based on analysis of aggregated data for five residential appliances including room air conditioners.[44] The

[43] 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.
[44] Fujita, K. (2015) Estimating Price Elasticity using Market-Level Appliance Data. Lawrence Berkeley National Laboratory, LBNL-188289.

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, and the product of the efficiency elasticity and the change in operating costs due to a standard level.

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 standards at specific efficiency levels.[45] ("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 room air conditioners sold from 2026 through 2055.

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

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

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

Table IV.7 Summary of Inputs and Methods for the National Impact Analysis

Inputs	Method
Shipments	Annual shipments from shipments model.
Compliance Date of Standard	2026
Efficiency Trends	Bass diffusion curve to allocate shipments to ELs with variable-speed technology and annual 0.25% increase in shipment-weighted CEER for ELs with single-speed technology.
Annual Energy Consumption per Unit	Calculated for each efficiency level based on inputs from energy use analysis.
Total Installed Cost per Unit	Calculated for each efficiency level based on inputs from the LCC analysis. 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	Calculated for each efficiency level on inputs from the LCC analysis.
Energy Price Trends	*AEO2022* projections (to 2050) and a constant value derived from simple average between 2046-2050 thereafter.
Energy Site-to-Primary and FFC Conversion	A time-series conversion factor based on *AEO2022*.
Discount Rate	Three and seven percent.
Present Year	2022

1. Product Efficiency Trends

A key component of the NIA is the trend in energy efficiency projected for the no-new-standards case and each of the standards cases. Section IV.F.8 of this document describes how DOE developed an energy efficiency distribution for the no-new-standards case (which yields a shipment-weighted average efficiency) for each of the considered product classes for the year of anticipated compliance with an amended or new standard. To project the trend in efficiency absent amended standards for room air conditioners over the entire shipments projection period, DOE assumed that market share for ELs with variable-speed technologies would follow a Bass diffusion curve, while the shipment-weighted CEER for ELs with single-speed compressors would increase annually by 0.25 percent in CEER based on historical trends in shipment-weighted efficiency.[46] The approach is further described in chapter 10 of the final rule TSD.

In its reference scenario, DOE assumed that variable-speed technologies would comprise 25 percent of the market by the end of the analysis period (2055). DOE also performed sensitivity scenarios assuming a low penetration of variable-speed technologies (10 percent of the market in 2055) and a high penetration of variable-speed technologies (50 percent of the market in 2055). The results of these scenarios can be found in appendix 10E of the final rule TSD.

For the standards cases, DOE used a "roll-up" scenario to establish the shipment-weighted efficiency for the year that standards are assumed to become effective in 2026. In the year of compliance, the market shares of products in the no-new-standards case that do not meet

[46] 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.

the standard under consideration would "roll up" to the minimum EL that meets the standard, and the market share of products above the standard would remain unchanged. As in the no-new-standards case, DOE assumed an annual increase of 0.25 percent in CEER over the analysis period for ELs with single-speed technology.

2. National Energy Savings

The national energy savings analysis involves a comparison of national energy consumption of the considered products between each potential standards case ("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 *AEO2022*. 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 room air conditioners, but it applied a direct rebound effect of 15 percent as suggested by Sorrell *et al.* for space cooling appliances.[47]

[47] Sorrell, S., J. Dimitropoulos, M. Sommerville. 2009. Empirical estimates of the direct rebound effect: A review. Energy Policy 37 (2009) 1356–1371.

The calculated NES at each efficiency level is therefore reduced by 15 percent in residential applications. DOE also included the rebound effect in the NPV analysis by accounting for the additional net benefit from increased room air conditioner usage as described in section IV.H.3 of this document.

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[48] 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 final rule TSD.

[48] For more information on NEMS, refer to *The National Energy Modeling System: An Overview 2018*, DOE/EIA-0581(2019), April 2019. Available *at www.eia.gov/outlooks/aeo/nems/documentation/* (last accessed September 7, 2022).

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 room air conditioner price trends based on combined historical PPI data of "room air-conditioners and dehumidifiers, except portable dehumidifiers" and primary air-conditioning, refrigeration and forced air heating equipment. DOE applied the same trends to project prices for each product class at each considered efficiency level. By 2055, the end date of the analysis period, the average single-speed compressor room air conditioner price is projected to drop 18 percent and the variable-speed compressor room air conditioner price is projected to drop about 31 percent relative to 2026. DOE's projection of product prices is described in appendix 10C of the final rule TSD.

To evaluate the effect of uncertainty regarding the price trend estimates, DOE investigated the impact of alternate product price projections on the consumer NPV for the considered TSLs for room air conditioners. In addition to the default price trend, DOE considered high and low product price sensitivity cases. In the high price scenario, DOE based the price decline of the non-variable speed controls portion on room air conditioner PPI data limited to the period 1990–2009, which shows a faster price decline relative to the full time series. For the variable-speed controls portion, DOE used a faster price decline derived from the exponential fit of "semiconductors and related device manufacturing" PPI series spanning between 1994 and 2021. In the low price decline scenario, DOE assumed a constant price for the non-variable-speed controls portion of the price and a slower price decline estimate for the variable-speed controls portion derived from the exponential fit of "semiconductors and related device manufacturing" PPI series spanning between 1967 and 1993. The derivation of these price trends and the results of these sensitivity cases are described in appendix 10C of the final rule TSD.

The operating cost savings are energy cost savings, which are calculated using the estimated energy savings in each year and the projected price of the appropriate form of energy. To estimate energy prices in future years, DOE multiplied the average regional energy prices by the projection of annual national-average residential energy price changes in the Reference case from *AEO2022*, which has an end year of 2050. To estimate price trends after 2050, DOE used a constant value derived from a simple average of the price trend between 2046 through 2050. As part of the NIA, DOE also analyzed scenarios that used inputs from variants of the *AEO2022* 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 final rule TSD.

As previously described, DOE assumed a 15 percent rebound from an increase in utilization of the product arising from the increase in efficiency (i.e., the direct rebound effect). In considering the consumer welfare gained due to the direct rebound effect, DOE accounted for change in consumer surplus attributed to additional cooling from the purchase of a more efficient unit. Overall consumer welfare is generally understood to be enhanced from rebound. The net consumer impact of the rebound effect is included in the calculation of operating cost savings in the consumer NPV results. See appendix 10F of the final rule TSD for details on DOE's treatment of the monetary valuation of the rebound effect.

In calculating the NPV, DOE multiplies the net savings in future years by a discount factor to determine their present value. For this final rule, DOE estimated the NPV of consumer benefits using both a 3-percent and a 7-percent real discount rate. DOE uses these discount rates in accordance with guidance provided by the Office of Management and Budget ("OMB") to Federal agencies on the development of regulatory analysis.[49] 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

[49] United States Office of Management and Budget. *Circular A-4: Regulatory Analysis*. September 17, 2003. Section E. Available at *www.whitehouse.gov/omb/memoranda/m03-21.html* (last accessed September 7, 2022).

particular consumers from alternative standard levels. For this final rule, 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 2015 sample composed of households that meet the criteria for the considered subgroups. DOE determined households in the low-income subgroup analysis using poverty thresholds from the U.S. Federal Poverty Guidelines which are based on household income and occupancy.[50] The subgroup, which represents a total of 12.1 million room ACs in 7.3 million low-income households across the U.S., is composed of 55 percent renters, 43 percent home-owners, 2 percent occupants living in homes without paying rent. Approximately 90 percent of the low-income sample have an annual household income of less than $20,000. Both the low-income and National consumer samples share a similar geographic distribution in ownership with a plurality (49 percent) of room AC units concentrated on the East Coast of the U.S. Based on an analysis of RECS 2015, low-income households were found to have 12 percent higher operating hours relative to the National sample. DOE used the LCC and PBP spreadsheet model to estimate the impacts of the considered efficiency levels on these subgroups. Chapter 11 in the final rule TSD describes the consumer subgroup analysis.

AHAM stated that many lower and middle-income households have negative discretionary income and requested that DOE change its approach towards sub-group analysis to take into account real limitations on purchasing capability and the effects of increased costs on discretionary income, credit ratings, and the ability of consumers to meet other necessary bills.

[50] Department of Health and Human Services, Poverty Thresholds. Available at https://aspe.hhs.gov/2015-poverty-guidelines (Last accessed September 7, 2022).

Additionally, AHAM stated that DOE does not take into account the 23 percent of households with incomes under $15,000 who are "unbanked" in its financial framework and therefore needs to rethink its approach to sub-groups and include a more comprehensive approach to impact analysis to ensure that traditionally marginalized subgroups are included in its analysis. (AHAM, No. 43 at pp. 5–8) AHAM and Friedrich commented that excessively stringent standards are likely to negatively impact the populations that use these and noted that it is particularly important not to price-out lower income and underserved communities from purchasing room air conditioners. (AHAM, No. 43 at pp. 3–4; Friedrich, No. 44 at pp. 2–4)

DOE's approach to the low-income consumer subgroup analysis includes households that do not have assets or debts included in the SCF. It is likely that a majority of these "unbanked" households primarily rely on cash to complete transactions and as a form of savings, which is included in the distribution of discount rates associated with low-income consumers. Consumers that rely entirely on cash are assigned a discount rate of 0 percent as there is no lost opportunity cost from alternative non-cash assets or debts. For households that utilize non-traditional, non-bank financing, DOE's methodology includes a distribution of high discount rates (> 10%) which are representative of the opportunity cost associated with non-bank lines of credit. Additionally, DOE's subgroup analysis for low-income households found that, at the adopted TSL, the estimated installed cost increase is $28 while the average discounted lifetime operating cost savings is $110. (See section V.B.1.b for results of the consumer subgroup analysis.) DOE also notes that its low-income subgroup analysis is a conservative estimate in that it assumes that renter households purchase the unit. In cases where the landlord purchases the unit but the renter pays the electricity bill, the renting household may not pay an increased purchase price due to a standard, but would benefit from reduced operating costs.

CFA and NCLC supported DOE's proposed TSL and noted that low-income consumers in particular would benefit from reduced operating costs associated with more efficient room air conditioners as low-income households pay a disproportionately higher percentage of their incomes on energy bills compared to other households. (CFA and NCLC, No. 46 at pp. 1–2)

J. Manufacturer Impact Analysis

1. Overview

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

The qualitative part of the MIA addresses manufacturer characteristics and market trends. Specifically, the MIA considers such factors as 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 final rule TSD.

DOE conducted the MIA for this rulemaking in three phases. In Phase 1 of the MIA, DOE prepared a profile of the room air conditioner manufacturing industry based on the market and technology assessment and publicly-available information. This included a top-down analysis of room air conditioner 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 room air conditioner manufacturing industry, including company filings of form 10-K from the SEC,[51]

[51] U.S. Securities and Exchange Commission, Electronic Data Gathering, Analysis, and Retrieval (EDGAR) system. Available at www.sec.gov/edgar/search/ (last accessed September 7, 2022).

corporate annual reports, April 2011 Direct Final Rule, the U.S. Census Bureau's *Annual Survey of Manufactures ("ASM")*,[52] and reports from Dun & Bradstreet.[53] 76 FR 22454.

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 room air conditioners 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,

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[52] U.S. Census Bureau, *Annual Survey of Manufactures*. "Summary Statistics for Industry Groups and Industries in the U.S (2020)." Available at: *www.census.gov/data/tables/time-series/econ/asm/2018-2020-asm.html* (last accessed September 7, 2022).

[53] The Dun & Bradstreet Hoovers login is available at: *app.dnbhoovers.com* (last accessed September 7, 2022).

manufacturing, procurement, and financial topics to validate assumptions used in the GRIM and to identify key issues or concerns. 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 ("LVMs"), 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 VII.B, "Review under the Regulatory Flexibility Act" and in chapter 12 of the final rule 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 2055. DOE calculated INPVs by summing the stream of annual discounted cash flows during this period. For manufacturers of room air conditioners, DOE used a real discount rate of 7.2 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 shipments analysis, and information gathered from industry stakeholders during the course of manufacturer interviews. The GRIM results are presented in section V.B.2. Additional details about the GRIM, the discount rate, and other financial parameters can be found in chapter 12 of the final rule TSD.

a. Manufacturer Production Costs

Manufacturing more efficient products is typically more expensive than manufacturing baseline products 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 models the relationship between efficiency and MPCs as a part of its engineering analysis. For a complete description of the MPCs, see chapter 5 of the final rule TSD or section IV.C of this document.

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 mix 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 2055 (the end year of the analysis period). See chapter 9 of the final rule TSD for additional details or section IV.G of this document for additional details.

c. Product and Capital Conversion Costs

Amended energy conservation standards could cause manufacturers to incur conversion costs to bring their production facilities and product 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) product conversion costs; and (2) capital conversion costs. 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. 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.

To calculate the MPCs for room air conditioners at and above the baseline, DOE performed teardowns for representative units. The data generated from these analyses were then used to estimate the capital investments in equipment, tooling, and conveyor required of original equipment manufacturers ("OEMs") at each efficiency level, taking into account such factors as product design, raw materials, purchased components, and fabrication method. Changes in equipment, tooling, and conveyer were used to estimate capital conversion costs. Additionally, capital conversion costs accounted for investments in appearance tooling made by manufacturers that are not OEMs.

DOE relied on feedback from industry to evaluate the product conversion costs industry would likely incur at the considered standard levels. DOE integrated feedback from manufacturers, both OEM and non-OEM, on redesign effort and staffing to estimate product conversion costs. Manufacturer numbers were aggregated to protect confidential information. DOE adjusted the conversion cost estimates developed in support of the April 2022 NOPR to 2021$ for this analysis.

The conversion cost figures used in the GRIM can be found in section V.B.2 of this document. For additional information on the capital and product conversion costs, see chapter 12 of the final rule TSD.

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 final rule 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 a manufacturer markup to the MPCs estimated in the engineering analysis for each product class and efficiency level. Modifying these 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 per-unit operating profit scenario. These scenarios lead to different 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" 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 MPCs increase with efficiency, this scenario implies that the absolute dollar markup will increase as well. DOE assumed a gross margin percentage of 21 percent for all product classes.[54] Manufacturers tend to believe it is optimistic to assume that they would be able to maintain the same gross margin percentage markup as their production costs increase, particularly for minimally efficient products. Therefore, DOE assumes that this scenario represents a high bound to industry profitability under an amended energy conservation standard.

In the preservation of per-unit operating profit scenario, as the cost of production goes up under a standards case, manufacturers are generally required to reduce their 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 compliance date of the amended standards. The implicit assumption behind this scenario is that

[54] The gross margin percentage of 21 percent is based on a manufacturer markup of 1.26.

the industry can only maintain its operating profit in absolute dollars after the standard. A comparison of industry financial impacts under the two scenarios is presented in section V.B.2.a of this document.

3. Discussion of MIA Comments

In response to the April 2022 NOPR, AHAM submitted written comments about the impact of supply chain constraints, tariffs, cumulative regulatory burden, and elevated shipping costs on manufacturers of room air conditioners. (AHAM, No. 43 at pp. 28–31)

AHAM noted that manufacturers continue to face global supply chain challenges—including procuring semiconductors and experiencing transportation delays—and urged DOE to further review the current situation manufacturers are facing and to account for this in the MIA. (AHAM, No. 43 at p. 31) Although DOE is appreciative of these recent challenges, in the-long term manufacturers of room air conditioners face both evolving challenges and evolving opportunities. DOE does not attempt the forecast the global supply chain challenges in the timeframe of compliance. Increased costs associated with recent supply chain issues have been implemented in the cost analysis by way of 5-year moving averages for materials, purchase parts, and shipping costs.

AHAM noted that room air conditioners as well as room air conditioner chassis are currently subject to United States Trade Representative ("USTR") China Section 301 tariffs at 25 percent and 10 percent, respectively. AHAM requested that DOE follow up with individual manufacturers to fully assess the impact of tariffs, as according to AHAM, these tariffs will likely remain in place. (AHAM, No. 43 at pp. 30–31) DOE contractors conducted manufacturer interviews during the NOPR phases of analysis to solicit information on manufacturer costs. Furthermore, DOE published its MPCs as part of the NOPR TSD. DOE's final rule analysis incorporates both confidential feedback and public comments from manufacturers on MPCs, which incorporates all costs and would include tariffs.

AHAM encouraged DOE to incorporate the financial results of the cumulative regulatory burden analysis into the MIA, stating that this could be done by adding the combined cost of complying with multiple regulations into the product conversion costs in the GRIM. (AHAM, No. 43 at pp. 28–29) AHAM noted other regulations impact room air conditioner manufacturers such as residential clothes washers, consumer clothes dryers, commercial clothes washers, consumer refrigerator/freezers, miscellaneous refrigeration products, cooking products, dishwashers, room air conditioners, dehumidifiers, portable air conditioners, and room air cleaner rulemakings. (AHAM, No. 43 at p. 29) Additionally, AHAM noted that DOE should not discount the time and resources needed for stakeholders to review test procedure and energy conservation standard rulemakings and assess their potential impacts. (AHAM, No. 43 at p. 28)

If DOE were to combine the conversion costs from multiple regulations, as requested, it would be appropriate to match the combined conversion costs against combined revenues of the regulated products. DOE expects that combined results would make it more difficult to discern the direct impact of this amended standard on room air conditioner manufacturers.

With regard to AHAM's request that DOE not discount the costs for stakeholders to review rulemakings, although appreciative that monitoring and responding to rulemakings does impose costs for stakeholders, DOE believes that this is outside the scope of analysis for individual product rulemakings. Because EPCA requires DOE to establish and maintain the energy conservation program for consumer products and to periodically propose new and amended standards and test procedures, DOE considers this rulemaking activity to be part of the analytical baseline. That is, these activities would exist regardless of the regulatory option that DOE adopts through a rulemaking and would be independent from the conversion costs required to adapt product designs and manufacturing facilitates to meet an amended standard. Nonetheless, DOE welcomes any available data on the costs of monitoring. As noted in the April 2022 NOPR, a summary of the job titles and annual hours per job title at a prototypical company would allow DOE to construct a detailed analysis of AHAM's monitoring costs and would help DOE assess whether these costs would materially affect future analyses.

AHAM noted that changes to room air conditioner chassis dimensions and product weight will increase shipping and transportation costs and requested that DOE account for this in its MIA through revision. (AHAM, No. 43 at p. 31)

As noted in section IV.A.2.b and IV.C.1.b, DOE evaluated the impact of design options on weight and chassis dimensions. DOE evaluated the impact of those changes in weight and dimensions on overseas container and domestic shipping rates. For efficiency levels below max-tech, DOE did not find increases in shipping costs at efficiency levels. At max-tech, there are increases in shipping costs that could affect downstream analyses. However, as discussed in the walk-down, DOE is not adopting max-tech for any product classes. Additional information about shipping costs is available in chapter 5 of the TSD.

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 in 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 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 final rule TSD. The analysis presented in this notice uses projections from *AEO2022*. Power sector emissions of CH_4 and N_2O from fuel combustion are estimated using Emission Factors for Greenhouse Gas Inventories published by the EPA.[55]

FFC upstream emissions, which include emissions from fuel combustion during extraction, processing, and transportation of fuels, and “fugitive” emissions (direct leakage to the

[55] Available at www.epa.gov/sites/production/files/2021-04/documents/emission-factors_apr2021.pdf (last accessed July 12, 2022).

atmosphere) of CH_4 and CO_2, are estimated based on the methodology described in chapter 15 of the final rule TSD.

The emissions intensity factors are expressed in terms of physical units per MWh or 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. *AEO2022* generally represents current legislation and environmental regulations, including recent government actions, that were in place at the time of preparation of *AEO2022*, including the emissions control programs discussed in the following paragraphs. [56]

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 ("D.C."). (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

[56] For further information, see the Assumptions to *AEO2022* report that sets forth the major assumptions used to generate the projections in the Annual Energy Outlook. Available at *www.eia.gov/outlooks/aeo/assumptions/* (last accessed September 6, 2022).

annual SO_2 emissions, and went into effect as of January 1, 2015.[57] *AEO 2022* 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, for states subject to SO_2 emissions limits under CSAPR, 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). The final rule establishes power plant emission standards for mercury, acid gases, and non-mercury metallic toxic pollutants. In order to continue operating, coal plants must have either flue gas desulfurization or dry sorbent injection systems installed. Both technologies, which are used to reduce acid gas emissions, also reduce SO_2 emissions. 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

[57] 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), and EPA issued the CSAPR Update for the 2008 ozone NAAQS. 81 FR 74504 (Oct. 26, 2016).

generation will generally reduce SO_2 emissions. DOE estimated SO_2 emissions reduction using emissions factors based on *AEO2022*.

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, NOx emissions would remain near the limit even if electricity generation goes down. Depending on the configuration of the power sector in the different regions and the need for allowances, however, NO_X emissions might not remain at the limit in the case of lower electricity demand. That would mean that standards might reduce NOx 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. Standards would be expected to reduce NO_X emissions in the States not covered by CSAPR. DOE used *AEO2022* data to derive NO_X 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 *AEO2022*, which incorporates the MATS.

L. Monetizing Emissions Impacts

As part of the development of this final rule, for the purpose of complying with the requirements of Executive Order 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 final rule.

On March 16, 2022, the Fifth Circuit Court of Appeals (No. 22–30087) granted the federal government's emergency motion for stay pending appeal of the February 11, 2022, preliminary injunction issued in *Louisiana v. Biden*, No. 21–cv–1074–JDC–KK (W.D. La.). As a result of the Fifth Circuit's order, the preliminary injunction is no longer in effect, pending resolution of the federal government's appeal of that injunction or a further court order. Among other things, the preliminary injunction enjoined the defendants in that case from ''adopting, employing, treating as binding, or relying upon'' the interim estimates of the social cost of greenhouse gases—which were issued by the Interagency Working Group on the Social Cost of Greenhouse Gases on February 26, 2021—to monetize the benefits of reducing greenhouse gas emissions. In the absence of further intervening court orders, DOE has reverted to its approach prior to the injunction and present monetized benefits where appropriate and permissible under law. DOE requests comment on how to address the climate benefits and other non-monetized 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 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 final rule in the absence of the social cost of greenhouse gases including the February 2021 interim estimates presented by the Interagency Working Group on the Social Cost of Greenhouse Gases.

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 Executive Order 13990, published in February 2021 by the IWG. 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-GHGs estimates presented here were developed over many years, using transparent process, peer-reviewed methodologies, the best science available at the time of that process, and with input from the public. Specifically, in 2009, the IWG, that 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*.[58] 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 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 (National Academies, 2017).[59] Shortly thereafter, in March 2017, President Trump issued Executive Order 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 rates" (EO 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.

[58] Marten, A. L., E. A. Kopits, C. W. Griffiths, S. C. Newbold, and A. Wolverton. Incremental CH4 and N2O mitigation benefits consistent with the US Government's SC-CO2 estimates. *Climate Policy*. 2015. 15(2): pp. 272–298.

[59] 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.

On January 20, 2021, President Biden issued Executive Order 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 of the National Academies (2017). 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 EO 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 rulemaking. The E.O. instructs the IWG to undertake a fuller update of the SC-GHG estimates by January 2022 that takes into consideration the advice of the National Academies (2017) 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 an efficient allocation of resources for emissions reduction on a global basis—and so benefit the United States 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 underestimate of total damages that accrue to the citizens and residents of the United States 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 (2017) 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,[60] 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% and 7% 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

[60] Interagency Working Group on Social Cost of Carbon. Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12866. 2010. United States Government. (Last accessed April 15, 2022.) www.epa.gov/sites/default/files/2016-12/documents/scc_tsd_2010.pdf; Interagency Working Group on Social Cost of Carbon. Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. 2013. (Last accessed April 15, 2022.) www.federalregister.gov/documents/2013/11/26/2013-28242/technical-support-document-technical-update-of-the-social-cost-of-carbon-for-regulatory-impact; 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. (Last accessed January 18, 2022.) www.epa.gov/sites/default/files/2016-12/documents/sc_co2_tsd_august_2016.pdf ; 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. (Last accessed January 18, 2022.) www.epa.gov/sites/default/files/2016-12/documents/addendum_to_sc-ghg_tsd_august_2016.pdf.

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 concludes that a 7% 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 estimates 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 that was developed using a transparent process, peer-reviewed methodologies, and the science available at the time of that process. 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.[61] Second, the IAMs used to produce

[61] 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: *www.whitehouse.gov/briefing-room/blog/2021/02/26/a-return-to-science-evidence-based-estimates-of-the-benefits-of-reducing-climate-pollution/*.

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 final rule likely underestimate the damages from GHG emissions. DOE concurs with this assessment.

AHAM objected to DOE using the social cost of carbon and other monetization of emissions reductions benefits in its analysis of the factors EPCA requires DOE to balance to determine the appropriate standard. AHAM stated that while it may be acceptable for DOE to continue its current practice of examining the social cost of carbon and monetization of other emissions reductions benefits as informational so long as the underlying interagency analysis is transparent and vigorous, the monetization analysis should not impact the TSLs DOE selects as a new or amended standard. AHAM noted that the scientific and economic knowledge surrounding the contribution of CO_2 and other greenhouse gases to climate change is an upgoing field of study and monetization values are subject to change. AHAM further commented that it was unclear whether DOE relied upon the emissions monetization analysis when proposing a TSL. (AHAM, No. 43 at pp. 29–30)

As stated in section III.E.1.f of this document, DOE maintains that environmental and public health benefits associated with the more efficient use of energy, including those connected to global climate change, are important to take into account when considering the need for national energy conservation, which is one of the factors that EPCA requires DOE to evaluate in determining whether a potential energy conservation standard is economically justified. (42 U.S.C. 6295(o)(2)(B)(i)(VI)) In addition, Executive Order 13563, which was re-affirmed on January 20, 2021, states that each agency must, among other things: "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)."[62] E.O. 13563, Section 1(b). For these reasons, DOE includes monetized emissions reductions in its evaluation of potential standard levels. As previously stated, however, DOE would reach the same conclusion presented in this final rule in the absence of the social cost of greenhouse gases.

The Climate Commenters stated that DOE appropriately applies the social cost estimates developed by the Interagency Working Group on the Social Cost of Greenhouse Gases to its analysis of emissions reduction benefits generated by the proposed rule. They stated that DOE

[62] www.whitehouse.gov/briefing-room/presidential-actions/2021/01/20/modernizing-regulatory-review/

should expand upon its rationale for adopting a global damages valuation and for the range of discount rates it applies to climate effects, as there are additional legal, economic, and policy reasons for such methodological decisions that can further bolster DOE's support for these choices. They added that DOE should consider conducting sensitivity analysis using a sound domestic-only social cost estimate as a backstop, and should explicitly conclude that the rule is cost-benefit justified even using a domestic-only valuation that may still undercount climate benefits. They also urged DOE to consider providing additional sensitivity analysis using discount rates lower than 2.5% for climate impacts. (Climate Commenters, No. 51 at pp. 1–2)

In response, DOE maintains that the reasons for using global measures of the SC-GHG previously discussed are sufficient for the purposes of this rulemaking. DOE notes that further discussion of this topic is contained in the February 2021 SC-GHG TSD, and DOE agrees with the assessment therein. Regarding conducting sensitivity analysis using a domestic-only social cost estimate, DOE agrees with the assessment in the February 2021 SC-GHG TSD that the only currently-available quantitative characterization of domestic damages from GHG emissions is both incomplete and an underestimate of the share of total damages that accrue to the citizens and residents of the United States. Therefore, it would be of questionable value to conduct the suggested sensitivity analysis at this time. DOE considered performing sensitivity analysis using discount rates lower than 2.5% for climate impacts, as suggested by the IWG, but it concluded that such analysis would not add meaningful information or impact the rationale in the context of this rulemaking.

The Climate Commenters also stated that DOE should provide additional justification for combining climate effects discounted at an appropriate consumption-based discount rate with other costs and benefits discounted at a capital-based rate (*i.e.*, 7%).[63] (Climate Commenters, No. 51 at p. 2) The reasons for using consumption-based discount rates for future climate effects were discussed previously, and are further elaborated in the February 2021 SC–GHG TSD. Combining climate benefits with health benefits and consumer economic benefits is in keeping with the guidance of OMB Circular A-4 to count all significant costs and benefits. DOE is aware that there are different approaches to combining climate benefits with other cost and benefits estimates that may use different discount rates, and the approach applied in this document (as well as in numerous other past DOE rulemaking notices) is among those discussed in the National Academies 2017 report (p. 182).[64]

DOE's derivations of the SC-CO_2, SC-N_2O, and SC-CH_4 values used for this final rule are discussed in the following sections, and the results of DOE's analyses estimating the benefits of the reductions in emissions of these pollutants 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. Table IV.8 shows the updated sets of SC-CO_2 estimates from the IWG's TSD in 5-year increments from 2020 to 2050. The full set of annual values that DOE used is presented in appendix 14A of the final rule TSD. For purposes of capturing the

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[63] In several places in this notice (e.g., Table I-X and Table I-X), the climate benefits of potential standards are combined with other benefits and costs that are discounted at rates of 3% and 7%, based on OMB Circular A-4 guidance.

[64] 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. Available at https://nap.nationalacademies.org/catalog/24651/valuing-climate-damages-updating-estimation-of-the-social-cost-of

uncertainties involved in regulatory impact analysis, DOE has determined it is appropriate to include all four sets of SC-CO_2 values, as recommended by the IWG.[65]

Table IV.8. Annual SC-CO_2 Values from 2021 Interagency Update, 2020–2050 (2020$ per Metric Ton CO_2)

Year	Discount Rate			
	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

For 2051 to 2070, DOE used SC-CO_2 estimates published by EPA, adjusted to 2021$.[66] These estimates are based on methods, assumptions, and parameters identical to the 2020-2050 estimates published by the IWG. DOE expects additional climate benefits to accrue for any longer-life room air conditioners 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.

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 2021$ using the implicit price deflator for gross domestic product ("GDP") from the Bureau of Economic Analysis. To

[65] For example, the February 2021 TSD discusses how the understanding of discounting approaches suggests that discount rates appropriate for intergenerational analysis in the context of climate change may be lower than 3 percent.
[66] See EPA, Revised 2023 and Later Model Year Light-Duty Vehicle GHG Emissions Standards: Regulatory Impact Analysis, Washington, D.C., December 2021. Available at: www.epa.gov/system/files/documents/2021-12/420r21028.pdf (last accessed September 12, 2022).

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 final rule were based on the values presented in the February 2021 TSD. Table IV.9 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 final rule 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.

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	1500	2000	3900	5800	18000	27000	48000
2025	800	1700	2200	4500	6800	21000	30000	54000
2030	940	2000	2500	5200	7800	23000	33000	60000
2035	1100	2200	2800	6000	9000	25000	36000	67000
2040	1300	2500	3100	6700	10000	28000	39000	74000
2045	1500	2800	3500	7500	12000	30000	42000	81000
2050	1700	3100	3800	8200	13000	33000	45000	88000

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 2021$ using the implicit price deflator for gross domestic product ("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 final rule, DOE estimated the monetized value of NO_X and SO_2 emissions reductions from electricity generation using benefit per ton estimates for that sector from the EPA's Benefits Mapping and Analysis Program.[67] DOE used EPA's values for PM2.5-related benefits associated with NO_X and SO_2 and for ozone-related benefits associated with NO_X for 2025 and 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 range; for years beyond 2040 the values are held constant. DOE derived values specific to the sector for room air conditioners using a method described in appendix 14B of the final rule TSD.

DOE multiplied the site emissions reduction (in tons) in each year by the associated $/ton values, and then discounted each series using discount rates of 3 percent and 7 percent as appropriate.

M. Utility Impact Analysis

The utility impact analysis estimates several effects on the electric power generation industry that would result from the adoption of new or amended energy conservation standards. The utility impact analysis estimates the changes in installed electrical capacity and generation

[67] Estimating the Benefit per Ton of Reducing PM2.5 Precursors from 21 Sectors. www.epa.gov/benmap/estimating-benefit-ton-reducing-pm25-precursors-21-sectors

that would result for each TSL. The analysis is based on published output from the NEMS associated with *AEO2022*. 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 *AEO2022* Reference case and various side cases. Details of the methodology are provided in the appendices to chapters 13 and 15 of the final rule TSD.

The output of this analysis is a set of time-dependent coefficients that capture the change in electricity generation, primary fuel consumption, installed capacity and power sector emissions due to a unit reduction in demand for a given end use. These coefficients are multiplied by the stream of electricity savings calculated in the NIA to provide estimates of selected utility impacts of 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 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. 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 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.[68] 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.

[68] 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 *www.bea.gov/scb/pdf/regional/perinc/meth/rims2.pdf* (last accessed July 1, 2021).

DOE estimated indirect national employment impacts for the standard levels considered in this final rule using an input/output model of the U.S. economy called Impact of Sector Energy Technologies version 4 ("ImSET").[69] 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 over-estimate actual job impacts over the long run for this rule. Therefore, DOE used ImSET only to generate results for near-term timeframes (2026-2030), where these uncertainties are reduced. For more details on the employment impact analysis, see chapter 16 of the final rule TSD.

V. Analytical Results and Conclusions

The following section addresses the results from DOE's analyses with respect to the considered energy conservation standards for room air conditioners. It addresses the TSLs examined by DOE, the projected impacts of each of these levels if adopted as energy conservation standards for room air conditioners, and the standards levels that DOE is adopting

[69] 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's Guide*. 2015. Pacific Northwest National Laboratory: Richland, WA. PNNL-24563.

in this final rule. Additional details regarding DOE's analyses are contained in the final rule TSD supporting this document.

A. Trial Standard Levels

In general, DOE typically evaluates 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 market cross elasticity from consumer purchasing decisions that may change when different standard levels are set.

In the analysis conducted for this final rule, DOE analyzed the benefits and burdens of five TSLs for room air conditioners. DOE maintained the same TSL structure as proposed in the NOPR. TSL 5 represents the max-tech energy efficiency for all product classes and corresponds to EL 5. TSL 4 corresponds to EL 4 for all product classes, consistent with the implementation of commercially available variable-speed compressors based on the current availability of variable speed compressors at cooling capacities ≥ 8,000 Btu/h. However, as of 2022, there are no models commercially available that incorporate variable-speed compressors for cooling capacities less than 8,000 Btu/h, and the uncertainties of the possibilities of incorporating variable-speed compressors in smaller units may have the potential to eliminate room air conditioners with the smallest cooling capacities from the market. TSL 3, therefore, is constructed with EL 4 for product classes with cooling capacities ≥ 8,000 Btu/h, corresponding to the inclusion of commercially available variable-speed compressors, and EL 3 for cooling capacities < 8,000 Btu/h, corresponding to the incorporation of maximum energy efficient single-speed compressors. TSL 2 corresponds to EL 3 for all product classes and represents room air conditioners with the maximum energy efficient single-speed compressor. TSL 1 corresponds to EL 2 for all product classes and represents the current ENERGY STAR level. DOE presents the results for the TSLs in this document, while the results for all efficiency levels that DOE analyzed are in the final rule TSD. DOE presents the results for the TSLs in this document, while the results for all efficiency levels that DOE analyzed are in the final rule TSD.

Table V.1 presents the TSLs and the corresponding efficiency levels that DOE has identified for potential amended energy conservation standards for room air conditioners.

Table V.1 Trial Standard Levels for Room Air Conditioners

Product Class	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
	CEER (Btu/Wh)				
Room Air Conditioner without reverse cycle, with louvered sides					
<6,000 Btu/h (PC 1)	12.1	13.1	13.1	16.0	20.2
6,000 to 7,900 Btu/h (PC 2)	12.1	13.7	13.7	16.0	21.2
8,000 to 13,900 Btu/h (PC 3)	12.0	14.3	16.0	16.0	21.9
14,000 to 19,900 Btu/h (PC 4)	11.8	14.0	16.0	16.0	19.8
20,000 to 27,900 Btu/h (PC 5a)	10.3	11.8	13.8	13.8	18.7
≥28,000 Btu/h (PC 5b)	9.9	10.3	13.2	13.2	16.3
Room Air Conditioner without reverse cycle, without louvered sides					
<6,000 Btu/h (PC 6)	11.0	12.8	12.8	14.7	19.4
6,000 to 7,900 Btu/h (PC 7)	11.0	12.8	12.8	14.7	19.4
8,000 to 10,900 Btu/h (PC 8a)	10.6	12.3	14.1	14.1	18.7
11,000 to 13,900 Btu/h (PC 8b)	10.5	12.3	13.9	13.9	19.0
14,000 to 19,900 Btu/h (PC 9)	10.2	10.9	13.7	13.7	16.8
≥20,000 Btu/h (PC 10)	10.3	11.0	13.8	13.8	17.0
Room Air Conditioner with reverse cycle, with louvered sides					
<20,000 Btu/h (PC 11)	10.8	12.3	14.4	14.4	18.0
≥20,000 Btu/h (PC 13)	10.2	11.7	13.7	13.7	18.5
Room Air Conditioner with reverse cycle, without louvered sides					
<14,000 Btu/h (PC 12)	10.2	11.3	13.7	13.7	16.4
≥14,000 Btu/h (PC 14)	9.6	11.2	12.8	12.8	17.4
Casement					
Casement-Only (PC 15)	10.5	12.2	13.9	13.9	17.6
Casement-Slide (PC 16)	11.4	13.2	15.3	15.3	19.1

DOE constructed the TSLs for this final rule to include ELs representative of ELs with similar characteristics (*i.e.*, using similar technologies and/or efficiencies, and having roughly comparable equipment availability). The use of representative ELs provided for greater distinction between the TSLs. While representative ELs were included in the TSLs, DOE considered all efficiency levels as part of its analysis.[70] DOE did not consider a TSL with EL 1 because DOE's projected efficiency distribution indicated a significant portion of the market would meet or exceed EL 1 in the no-new-standards case by the compliance year leading to smaller national energy savings and lower LCC savings for a standard set at EL 1 relative to EL 2. As such, the least efficient level considered for TSLs in this final rule is EL 2.

B. Economic Justification and Energy Savings

1. Economic Impacts on Individual Consumers

DOE analyzed the economic impacts on room air conditioners 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 decrease. Inputs used for calculating the LCC and PBP include total installed costs (*i.e.*, product price plus installation costs), and operating costs (*i.e.*, annual energy use, energy prices, energy price trends, repair costs, and maintenance costs). The

[70] Efficiency levels that were analyzed for this NOPR are discussed in section IV.C.1 of this document. Results by efficiency level are presented in chapters 8, 10, and 12 of the final rule TSD.

LCC calculation also uses product lifetime and a discount rate. Chapter 8 of the final rule TSD provides detailed information on the LCC and PBP analyses.

Table V.2 through Table V.25 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, the impacts are measured relative to the efficiency distribution in the 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 Room Air Conditioners PC 1, Without Reverse Cycle and with Louvers, Less than 6,000 Btu/h

EL	TSL	CEER	Average Costs <u>*2021$*</u>				Simple Payback <u>*years*</u>	Average Lifetime <u>*years*</u>
			Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
0	-	11.0	419	64	486	906	-	9.3
1	-	11.4	421	63	474	895	1.0	9.3
2	1	12.1	424	57	428	852	0.6	9.3
3	2,3	13.1	429	52	397	826	0.8	9.3
4	4	16.0	518	43	328	846	4.6	9.3
5	5	20.2	532	35	267	799	3.8	9.3

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 Room Air Conditioners PC 1, Without Reverse Cycle and with Louvers, Less than 6,000 Btu/h

TSL	CEER	Life-Cycle Cost Savings	
		Average LCC Savings* *2021$*	Percent of Consumers that Experience Net Cost
-	11.4	1	0%
1	12.1	41	2%
2,3	13.1	65	3%
4	16.0	47	41%
5	20.2	93	34%

* The savings represent the average LCC for affected consumers.

Table V.4 Average LCC and PBP Results for Room Air Conditioners PC 2, Without Reverse Cycle and with Louvers, 6,000–7,900 Btu/h

EL	TSL	CEER	Average Costs *2021$*				Simple Payback *years*	Average Lifetime *years*
			Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
0	-	11.0	437	82	635	1,072	-	9.3
1	-	11.4	440	80	614	1,054	1.0	9.3
2	1	12.1	444	73	563	1,007	0.7	9.3
3	2,3	13.7	463	65	504	967	1.5	9.3
4	4	16.0	539	56	431	970	3.8	9.3
5	5	21.2	599	44	337	936	4.2	9.3

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 Room Air Conditioners PC 2, Without Reverse Cycle and with Louvers, 6,000–7,900 Btu/h

TSL	CEER	Life-Cycle Cost Savings	
		Average LCC Savings* *2021$*	Percent of Consumers that Experience Net Cost
-	11.4	0	0%
1	12.1	35	2%
2,3	13.7	72	14%
4	16.0	69	38%
5	21.2	103	42%

* The savings represent the average LCC for affected consumers.

Table V.6 Average LCC and PBP Results for Room Air Conditioners PC 3, Without Reverse Cycle, with Louvered Sides, and 8,000–13,900 Btu/h

EL	TSL	CEER	Average Costs *2021$*				Simple Payback *years*	Average Lifetime *years*
			Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
0	-	10.9	561	106	809	1,370	-	9.3
1	-	11.4	564	102	781	1,345	0.7	9.3
2	1	12.0	576	93	710	1,287	1.2	9.3
3	2	14.3	584	79	603	1,187	0.9	9.3
4	3,4	16.0	669	69	524	1,193	2.9	9.3
5	5	21.9	727	51	394	1,122	3.1	9.3

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 Room Air Conditioners PC 3, Without Reverse Cycle, with Louvered Sides, and 8,000–13,900 Btu/h

TSL	CEER	Life-Cycle Cost Savings	
		Average LCC Savings* *2021$*	Percent of Consumers that Experience Net Cost
-	11.4	0	0%
1	12.0	17	2%
2	14.3	105	2%
3,4	16.0	100	26%
5	21.9	171	30%

* The savings represent the average LCC for affected consumers.

Table V.8 Average LCC and PBP Results for Room Air Conditioners PC 4, Without Reverse Cycle and with Louvers, 14,000–19,900 Btu/h

EL	TSL	CEER	Average Costs *2021$*				Simple Payback *years*	Average Lifetime *years*
			Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
0	-	10.7	703	121	921	1,623	-	9.3
1	-	11.1	705	118	896	1,601	0.7	9.3
2	1	11.8	713	107	813	1,526	0.7	9.3
3	2	14.0	739	91	692	1,431	1.2	9.3
4	3,4	16.0	835	77	588	1,423	3.0	9.3
5	5	19.8	868	63	479	1,347	2.8	9.3

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 Room Air Conditioners PC 4, Without Reverse Cycle and with Louvers, 14,000–19,900 Btu/h

TSL	CEER	Life-Cycle Cost Savings	
		Average LCC Savings* *2021$*	Percent of Consumers that Experience Net Cost
-	11.1	0	0%
1	11.8	0	0%
2	14.0	85	9%
3,4	16.0	92	33%
5	19.8	168	30%

* The savings represent the average LCC for affected consumers.

Table V.10 Average LCC and PBP Results for Room Air Conditioners PC 5a, Without Reverse Cycle and with Louvers, 20,000–27,900 Btu/h

EL	TSL	CEER	Average Costs <u>*2021$*</u>				Simple Payback <u>*years*</u>	Average Lifetime <u>*years*</u>
			Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
0	-	9.4	876	148	1,086	1,962	-	9.3
1	-	9.8	879	142	1,047	1,926	0.6	9.3
2	1	10.3	893	132	969	1,862	1.1	9.3
3	2	11.8	909	115	849	1,758	1.0	9.3
4	3,4	13.8	1,014	93	688	1,703	2.5	9.3
5	5	18.7	1,057	69	511	1,567	2.3	9.3

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 Room Air Conditioners PC 5a, Without Reverse Cycle and with Louvers, 20,000–27,900 Btu/h

TSL	CEER	Life-Cycle Cost Savings	
		Average LCC Savings* *2021$*	Percent of Consumers that Experience Net Cost
-	9.8	0	0%
1	10.3	6	1%
2	11.8	99	5%
3,4	13.8	148	30%
5	18.7	284	27%

* The savings represent the average LCC for affected consumers.

Table V.12 Average LCC and PBP Results for Room Air Conditioners PCs 5b, Without Reverse Cycle and with Louvers, Greater than 28,000 Btu/h

EL	TSL	CEER	Average Costs 2021$				Simple Payback *years*	Average Lifetime *years*
			Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
0	-	9.0	926	180	1,322	2,248	-	9.3
1	-	9.4	929	172	1,268	2,197	0.4	9.3
2	1	9.9	935	159	1,170	2,105	0.4	9.3
3	2	10.3	939	151	1,114	2,053	0.5	9.3
4	3,4	13.2	1,080	113	833	1,912	2.3	9.3
5	5	16.3	1,106	91	675	1,781	2.0	9.3

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.13 Average LCC Savings Relative to the No-New-Standards Case for Room Air Conditioners PCs 5b, Without Reverse Cycle and with Louvers, Greater than 28,000 Btu/h

TSL	CEER	Life-Cycle Cost Savings	
		Average LCC Savings* *2021$*	Percent of Consumers that Experience Net Cost
-	9.4	21	0%
1	9.9	101	0%
2	10.3	150	1%
3,4	13.2	284	24%
5	16.3	415	21%

* The savings represent the average LCC for affected consumers.

Table V.14 Average LCC and PBP Results for Room Air Conditioners PC 8a, Without Reverse Cycle and without Louvered Sides, 8,000–10,900 Btu/h

EL	TSL	CEER	Average Costs 2021$				Simple Payback *years*	Average Lifetime *years*
			Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
0	-	9.6	577	108	823	1,400	-	9.3
1	-	10.1	580	103	787	1,368	0.8	9.3
2	1	10.6	584	96	731	1,316	0.6	9.3
3	2	12.3	611	83	634	1,245	1.4	9.3
4	3,4	14.1	695	71	539	1,234	3.2	9.3
5	5	18.7	764	54	417	1,181	3.5	9.3

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.15 Average LCC Savings Relative to the No-New-Standards Case for Room Air Conditioners PC 8a, Without Reverse Cycle and without Louvered Sides, 8,000–10,900 Btu/h

TSL	CEER	Life-Cycle Cost Savings	
		Average LCC Savings* *2021$*	Percent of Consumers that Experience Net Cost
-	10.1	0	0%
1	10.6	6	0%
2	12.3	73	15%
3,4	14.1	84	34%
5	18.7	137	38%

* The savings represent the average LCC for affected consumers.

Table V.16 Average LCC and PBP Results for Room Air Conditioners PC 8b, Without Reverse Cycle and without Louvered Sides, 11,000–13,999 Btu/h

EL	TSL	CEER	Average Costs <u>2021$</u>				Simple Payback <u>*years*</u>	Average Lifetime <u>*years*</u>
			Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
0	-	9.5	626	132	1,010	1,636	-	9.3
1	-	10.0	629	127	968	1,597	0.6	9.3
2	1	10.5	634	116	885	1,520	0.5	9.3
3	2	12.3	670	100	764	1,434	1.4	9.3
4	3,4	13.9	738	86	656	1,394	2.4	9.3
5	5	19.0	846	64	492	1,338	3.2	9.3

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.17 Average LCC Savings Relative to the No-New-Standards Case for Room Air Conditioners PC 8b, Without Reverse Cycle and without Louvered Sides, 11,000–13,900 Btu/h

TSL	CEER	Life-Cycle Cost Savings	
		Average LCC Savings* *2021$*	Percent of Consumers that Experience Net Cost
-	10.0	0	0%
1	10.5	0	0%
2	12.3	81	17%
3,4	13.9	119	26%
5	19.0	175	37%

* The savings represent the average LCC for affected consumers.

Table V.18 Average LCC and PBP Results for Room Air Conditioners PC 9, Without Reverse Cycle and without Louvered Sides, 14,000–19,900 Btu/h

EL	TSL	CEER	Average Costs 2021$				Simple Payback *years*	Average Lifetime *years*
			Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
0	-	9.3	756	119	901	1,658	-	9.3
1	-	9.7	760	115	867	1,627	0.8	9.3
2	1	10.2	770	106	803	1,573	1.1	9.3
3	2	10.9	795	99	754	1,549	2.0	9.3
4	3,4	13.7	877	77	584	1,461	2.9	9.3
5	5	16.8	964	63	482	1,446	3.7	9.3

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.19 Average LCC Savings Relative to the No-New-Standards Case for Room Air Conditioners PC 9, Without Reverse Cycle and without Louvered Sides, 14,000–19,900 Btu/h

TSL	CEER	Life-Cycle Cost Savings	
		Average LCC Savings* *2021$*	Percent of Consumers that Experience Net Cost
-	9.7	12	1%
1	10.2	58	4%
2	10.9	81	19%
3,4	13.7	165	24%
5	16.8	180	39%

* The savings represent the average LCC for affected consumers.

Table V.20 Average LCC and PBP Results for Room Air Conditioners PC 11, With Reverse Cycle and with Louvered Sides, less than 20,000 Btu/h

EL	TSL	CEER	Average Costs 2021$				Simple Payback *years*	Average Lifetime *years*
			Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
0	-	9.8	659	108	829	1,488	-	9.3
1	-	10.4	663	102	788	1,451	0.8	9.3
2	1	10.8	668	94	725	1,392	0.6	9.3
3	2	12.3	705	83	645	1,349	1.9	9.3
4	3,4	14.4	778	71	546	1,324	3.2	9.3
5	5	18.0	826	58	448	1,274	3.4	9.3

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.21 Average LCC Savings Relative to the No-New-Standards Case for Room Air Conditioners PC 11, With Reverse Cycle and with Louvered Sides, less than 20,000 Btu/h

TSL	CEER	Life-Cycle Cost Savings	
		Average LCC Savings* *2021$*	Percent of Consumers that Experience Net Cost
-	10.4	18	2%
1	10.8	69	2%
2	12.3	110	19%
3,4	14.4	134	30%
5	18.0	185	34%

* The savings represent the average LCC for affected consumers.

Table V.22 Average LCC and PBP Results for Room Air Conditioners PC 12, With Reverse Cycle and without Louvered Sides, less than 14,000 Btu/h

EL	TSL	CEER	Average Costs *2021$*				Simple Payback *years*	Average Lifetime *years*
			Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
0	-	9.3	776	88	674	1,449	-	9.3
1	-	9.7	779	85	649	1,428	1.0	9.3
2	1	10.2	788	79	603	1,391	1.3	9.3
3	2	11.3	812	72	550	1,362	2.2	9.3
4	3,4	13.7	854	59	449	1,302	2.6	9.3
5	5	16.4	915	50	383	1,298	3.6	9.3

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.23 Average LCC Savings Relative to the No-New-Standards Case for Room Air Conditioners PC 12, With Reverse Cycle and without Louvered Sides, less than 14,000 Btu/h

TSL	CEER	Life-Cycle Cost Savings	
		Average LCC Savings* *2021$*	Percent of Consumers that Experience Net Cost
-	9.7	8	2%
1	10.2	40	8%
2	11.3	67	22%
3,4	13.7	124	21%
5	16.4	128	36%

* The savings represent the average LCC for affected consumers.

Table V.24 Average LCC and PBP Results for Room Air Conditioners PC 16, Casement-Slider

EL	TSL	CEER	Average Costs <u>2021$</u>				Simple Payback <u>years</u>	Average Lifetime <u>years</u>
			Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
0	-	10.4	554	88	677	1,230	-	9.3
1	-	10.8	556	85	654	1,211	1.0	9.3
2	1	11.4	560	78	599	1,159	0.7	9.3
3	2	13.2	571	69	529	1,100	0.9	9.3
4	3,4	15.3	672	59	452	1,124	4.0	9.3
5	5	19.1	689	48	372	1,061	3.4	9.3

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.25 Average LCC Savings Relative to the No-New-Standards Case for Room Air Conditioners PC 16, Casement-Slider

TSL	CEER	Life-Cycle Cost Savings	
		Average LCC Savings* *2021$*	Percent of Consumers that Experience Net Cost
-	10.8	7	2%
1	11.4	51	3%
2	13.2	107	5%
3,4	15.3	84	38%
5	19.1	147	32%

* 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 for product classes with a sufficient sample size in RECS 2015 to perform a Monte Carlo analysis. Table V.26 through Table V.28 compares the average LCC savings and PBP at each efficiency level for the consumer subgroups with similar metrics for the entire consumer sample for product classes 1, 2, and 3. The percentage of consumers with either a net benefit or cost are calculated relative to consumers within that subgroup. Product Classes 4, 5a, 5b, 8a, 8b, 9, 11, 12, and 16 were not analyzed due to their low presence (< 5%) in low-income and senior-only households based on shipments and stock estimates from RECS 2015. In most cases, the average LCC savings and PBP for low-income households and senior-only households at the considered efficiency levels are not substantially different from the average for all households. Chapter 11 of the final rule TSD presents the complete LCC and PBP results for the subgroups.

Table V.26 Comparison of LCC Savings and PBP for Consumer Subgroups and All Households: Room Air Conditioners PC 1, Without Reverse Cycle and with Louvers, Less than 6,000 Btu/h

	Low-Income Households*	Senior-Only Households**	All Households†
Average LCC Savings (2021$)			
TSL 1	$41	-	$39
TSL 2,3	$66	-	$62
TSL 4	$53	-	$40
TSL 5	$99	-	$84
Payback Period (years)			
TSL 1	0.7	-	0.7
TSL 2,3	0.8	-	0.9
TSL 4	4.7	-	5.1
TSL 5	3.9	-	4.2
Consumers with Net Benefit (%)			
TSL 1	93%	-	92%
TSL 2,3	94%	-	92%
TSL 4	59%	-	53%
TSL 5	72%	-	66%
Consumers with Net Cost (%)			
TSL 1	0%	-	1%
TSL 2,3	1%	-	3%
TSL 4	36%	-	42%
TSL 5	28%	-	34%

*Low-income households represent 60.0 percent of all households for this product class.
** Insufficient sample size to conduct subgroup analysis.
† The savings represent results of residential consumers only and exclude results from commercial consumers.

Table V.27 Comparison of LCC Savings and PBP for Consumer Subgroups and All Households: Room Air Conditioners PC 2, Without Reverse Cycle and with Louvers, 6,000–7,900 Btu/h

	Low-Income Households*	**Senior-Only Households****	**All Households**†
Average LCC Savings (2021$)			
TSL 1	$37	$42	$36
TSL 2,3	$78	$90	$75
TSL 4	$76	$97	$72
TSL 5	$117	$150	$109
Payback Period (years)			
TSL 1	0.7	0.6	0.7
TSL 2,3	1.5	1.3	1.5
TSL 4	3.8	3.3	3.9
TSL 5	4.1	3.6	4.2
Consumers with Net Benefit (%)			
TSL 1	74%	72%	73%
TSL 2,3	83%	83%	80%
TSL 4	60%	66%	59%
TSL 5	61%	68%	60%
Consumers with Net Cost (%)			
TSL 1	1%	3%	2%
TSL 2,3	10%	10%	13%
TSL 4	35%	29%	36%
TSL 5	39%	32%	40%

*Low-income households represent 50.1 percent of all households for this product class.
**Senior-only households represent 24.7 percent of all households for this product class.
† The savings represent results of residential consumers only and exclude results from commercial consumers.

Table V.28 Comparison of LCC Savings and PBP for Consumer Subgroups and All Households: Room Air Conditioners PC 3, Without Reverse Cycle, with Louvered Sides, and 8,000–13,900 Btu/h

	Low-Income Households*	Senior-Only Households**	All Households†
Average LCC Savings (2021$)			
TSL 1	$20	$16	$16
TSL 2	$122	$98	$101
TSL 3,4	$122	$83	$94
TSL 5	$214	$149	$161
Payback Period (years)			
TSL 1	1.1	1.3	1.3
TSL 2	0.8	0.9	0.9
TSL 3,4	2.6	3.2	3.1
TSL 5	2.8	3.4	3.3
Consumers with Net Benefit (%)			
TSL 1	27%	25%	27%
TSL 2	86%	86%	87%
TSL 3,4	64%	55%	64%
TSL 5	71%	60%	70%
Consumers with Net Cost (%)			
TSL 1	2%	4%	2%
TSL 2	2%	2%	2%
TSL 3,4	25%	34%	26%
TSL 5	29%	40%	30%

*Low-income households represent 25.7 percent of all households for this product class.
**Senior-only households represent 26.6 percent of all households for this product class.
† The savings represent results of residential consumers only and exclude results from commercial consumers.

c. Rebuttable Presumption Payback

As discussed in section II.A, 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 procedures for room air conditioners. In contrast, the PBPs presented in section V.B.1.a were calculated using distributions that reflect the range of energy use in the field.

Table V.29 presents the rebuttable-presumption payback periods for the considered TSLs for room air conditioners. While DOE examined the rebuttable-presumption criterion, it considered whether the standard levels considered for this rule 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.29 Rebuttable-Presumption Payback Periods

Product Class	Trial Standard Level				
	1	2	3	4	5
	years				
PC 1: Room Air Conditioners, without reverse cycle, with louvered sides, and less than 6,000 Btu/h	1.1	1.2	1.2	7.2	5.5
PC 2: Room Air Conditioners, without reverse cycle, with louvered sides, and 6,000 to 7,900 Btu/h	1.0	1.8	1.8	6.1	5.1
PC 3: Room Air Conditioners, without reverse cycle, with louvered sides, and 8,000 to 13,900 Btu/h	1.4	0.9	4.0	4.0	3.2
PC 4: Room Air Conditioners, without reverse cycle, with louvered sides, and 14,000 to 19,900 Btu/h	0.7	0.8	2.8	2.8	2.2
PC 5a: Room Air Conditioners, without reverse cycle, with louvered sides, and 20,000 to 27,900 Btu/h	0.7	0.6	1.8	1.8	1.4
PC 5b: Room Air Conditioners, without reverse cycle, with louvered sides, and 28,000 Btu/h or more	0.3	0.3	1.5	1.5	1.3
PC 8a: Room Air Conditioners, without reverse cycle, without louvered sides, and 8,000 to 10,900 Btu/h	0.7	1.2	4.3	4.3	3.5
PC 8b: Room Air Conditioners, without reverse cycle, without louvered sides, and 11,000 to 13,900 Btu/h	0.6	1.3	3.7	3.7	3.2
PC 9: Room Air Conditioners, without reverse cycle, without louvered sides, and 14,000 to 19,900 Btu/h	0.8	1.2	2.7	2.7	2.4
PC 11: Room Air Conditioners, with reverse cycle, with louvered sides, and less than 20,000 Btu/h	0.8	1.9	4.4	4.4	3.5
PC 12: Room Air Conditioners, with reverse cycle, without louvered sides, and less than 14,000 Btu/h	1.5	2.1	3.6	3.6	3.7
PC 16: Room Air Conditioners, Casement-Slider	0.8	1.0	4.9	4.9	3.9

2. Economic Impacts on Manufacturers

DOE performed an MIA to estimate the impact of amended energy conservation standards on manufacturers of room air conditioners. The next section describes the expected impacts on manufacturers at each considered TSL. Chapter 12 of the final rule 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 room air conditioners, as well as the conversion costs that DOE estimates manufacturers of room air conditioners 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 per-unit operating profit, as discussed in section IV.J.2.d of this document. The preservation of gross margin percentage scenario provides the upper bound while the preservation of per-unit operating profit scenario results in the lower (or more severe) 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 publication of the final rule through the end of the analysis period (2023–2055). 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.30 Manufacturer Impact Analysis Results for the Room Air Conditioner Industry*

	Units	No-New STDs Case	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
INPV	$2021 MM	1,198.5	1,188.7 to 1,192.9	1,167.8 to 1,197.2	1,140.8 to 1,284.1	1,097.7 to 1,369.0	857.5 to 1,211.5
Change in INPV	%	-	(0.8) to (0.5)	(2.6) to (0.1)	(4.8) to 7.1	(8.4) to 14.2	(28.4) to 1.1
Free Cash Flow (2025)	$2021 MM	86.1	79.9	72.6	76.9	75.5	(55.3)
Change in Free Cash Flow (2025)	%	-	(7.2)	(15.7)	(10.7)	(12.4)	(164.2)
Conversion Costs	$2021 MM	-	14.6	31.3	24.8	29.0	319.7

*Negative values denoted by parentheses.

At TSL 1, the standard is set to existing ENERGY STAR levels (EL 2) for all product classes. DOE estimates the change in INPV to be minimal under both manufacturer markup scenarios. INPV is expected to range from -0.8 percent to -0.5 percent. At this level, free cash flow is estimated to decrease by 7.2 percent compared to the no-new-standards case value of $86.1 million in the year 2025, the year before the standards year. DOE's shipments analysis estimates approximately 32 percent of current shipments meet this level. At TSL 1, DOE does not expect industry to adopt new or larger chassis sizes. Capital conversion costs may be necessary for incremental updates in tooling. Product conversion costs are driven by specification, sourcing, and testing of more efficient compressors. DOE estimates capital conversion costs of $11.4 million and product conversion costs of $3.2 million. Conversion costs total $14.6 million.

At TSL 2, the standard reflects an efficiency level attainable by units with the most efficient R-32 single-speed compressor on the market, in combination with other design options, for all product classes (EL 3). DOE estimates the change in INPV to range from -2.6 percent to -0.1 percent. At this level, free cash flow is estimated to decrease by 15.7 percent compared to the base-case value in the year before the standards year. DOE's shipments analysis estimates approximately 2 percent of current shipments meet this level. At TSL 2, DOE does not expect industry to adopt new or larger chassis designs. Capital conversion costs may be necessitated by the incorporation of additional design options, such as the inclusion of sub-cooling. Product conversion costs are driven by the need to redesign models to incorporate more efficient single-speed compressors as well as other design options. DOE estimates capital conversion costs of $26.2 million and product conversion costs of $5.1 million. Conversion costs total $31.3 million.

At TSL 3, the standard varies based by product class. For product classes with cooling capacities less than 8,000 Btu/h, the standard reflects an efficiency level attainable by units with the most efficient R-32 single-speed compressor on the market (EL 3) in combination with other design options. For product classes with cooling capacities greater than or equal to 8,000 Btu/h, the standard reflects an efficiency level consistent with the implementation commercially available variable-speed compressors (EL 4). DOE estimates the change in INPV to range from -4.8 percent to 7.1 percent. At this level, free cash flow is estimated to decrease by 10.7 percent compared to the base-case value in the year before the standards year. DOE's shipments analysis estimates approximately 2 percent of current shipments meet this level.

At this level, DOE does not expect industry to adopt new or larger chassis designs. For product classes with cooling capacities greater than or equal to the 8,000 Btu/h threshold, additional capital conversion costs may be necessary to adjust appearance tooling. DOE anticipates greater redesign efforts and product conversion costs as manufacturers move these products to variable-speed compressor designs. DOE estimates capital conversion costs of $7.1 million and product conversion costs of $17.7 million. Conversion costs total $24.8 million.

In interviews and through review of market data, DOE found that all but one OEM currently produce R-32 room air conditioner models. Additionally, based on interview feedback, all OEMs intend to entirely transition to R-32 room air conditioners by 2023 regardless of DOE actions related to the energy conservation standards for room air conditioners. Thus, DOE did not consider the redesign costs related to R-32 as conversion costs that are the result of any amended energy conservation standards. DOE accounted for the costs associated with the transition to low-GWP refrigerants in its modeling of the GRIM, consistent with the April 2022 NOPR.

At TSL 4, the standard reflects the efficiency consistent with the implementation of commercially available variable-speed compressors for all product classes (EL 4). DOE estimates the change in INPV to range from -8.4 percent to 14.2 percent. At this level, free cash flow is estimated to decrease by 12.4 percent compared to the base-case value in the year before the standards year. DOE's shipments analysis estimates that less than 2 percent of current shipments meet this level. At this level, DOE does not expect industry to adopt new or larger chassis designs. Capital conversion costs may be necessary for adjustments in appearance tooling. Compared to lower efficiency levels, DOE anticipates significantly greater redesign efforts and product conversion costs as manufacturers move all products to variable-speed compressor designs. Based on DOE's Compliance Certification Database ("CCD"),[71] DOE estimates that OEMs would need to redesign all product platforms to meet the efficiency levels required by TSL 4. DOE estimates capital conversion costs of $6.9 million and product conversion costs of $22.0 million. Conversion costs total $29.0 million.

At TSL 5, the standard reflects max-tech efficiency (EL 5) for all product classes. DOE estimates the change in INPV to range from -28.4 percent to 1.1 percent. At this level, free cash flow is estimated to decrease by 164.2 percent compared to the base-case value in the year before the standards year. In DOE's review of the market, no models currently meet this level. DOE estimates capital conversion costs of $297.5 million and product conversion costs of $22.2 million. Conversion costs total $319.7 million.

At this level, DOE expects changes to chassis size for certain window and through-the-wall units. As a result, capital conversion costs increase significantly as manufacturers adjust equipment and tooling to accommodate new dimensions. As with EL 4, DOE anticipates significant redesign efforts and product conversion costs as manufacturers move all products to

[71] U.S. Department of Energy's Compliance Certification Database. Available at: *regulations.doe.gov/certification-data/#q=Product_Group_s%3A** (last accessed: March 17, 2021).

variable-speed compressor designs. OEMs would need to redesign all product platforms to meet the efficiency levels required by TSL 5.

At TSL 5, the large conversion costs result in a free cash flow dropping below zero in the years before the standard year. The negative free cash flow calculation indicates manufacturers may need to access cash reserves or outside capital to finance conversion efforts.

b. Direct Impacts on Employment

DOE's research indicates no room air conditioners are currently made in domestic production facilities. DOE expects that amended standards would have no impact on domestic production employment, which would remain at zero. Manufacturers maintain offices in the United States to handle design, marketing, technical support, and other business needs. Large changes in total annual shipments may lead to companies reducing their non-production room air conditioner staff. However, DOE's shipments model does not forecast substantial changes in total annual shipments for TSL 3. If total shipments remain relatively steady DOE would not expect any change to non-production employment as a result of amended standards. See section IV.G of this document for additional details on DOE's shipments analysis.

c. Impacts on Manufacturing Capacity

In interviews, manufacturers noted that the majority of room air conditioners are manufactured overseas by high-volume manufacturers producing product for a range of international markets. Manufacturers had few concerns about production line constraints below the max-tech level (TSL 5). However, at the max-tech level, some manufacturers noted concerns about having sufficient technical resources to oversee the redesign and testing of all room air conditioner products to incorporate variable-speed technology. Additionally, DOE notes that the most efficient variable-speed compressors that were implemented at the max-tech level (TSL 5) are offered by only a single manufacturer. Based on public information, DOE was unable to determine the availability and pricing of these compressors. Given the lack of information regarding availability of these highest efficiency variable-speed compressors and the limited number of variable-speed compressors rated at or near the efficiency of compressors considered for the max-tech efficiency level, there may not be sufficient availability of the highest efficiency variable-speed compressors to meet the entire industry's production capacity needs at all cooling capacities of room air conditioners at the max-tech level (TSL 5).

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 rulemaking based on the results of the industry characterization.

DOE analyzes the impacts on small businesses in a separate analysis in section VII.B of this document as part of the Regulatory Flexibility Analysis. 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 final rule TSD.

e. Cumulative Regulatory Burden

One aspect of assessing manufacturer burden involves looking at the cumulative impact of multiple DOE standards and the regulatory actions of other Federal agencies and States that affect the manufacturers of a covered product or equipment. While any one regulation may not impose a significant burden on manufacturers, the combined effects of several existing or impending regulations may have serious consequences for some manufacturers, groups of manufacturers, or an entire industry. Multiple regulations affecting the same manufacturer can strain profits and lead companies to abandon product lines or markets with lower expected future returns than competing products. For these reasons, DOE conducts an analysis of cumulative regulatory burden as part of its rulemakings pertaining to appliance efficiency.

Table V.31 presents the results of DOE's analysis which includes product-specific regulations that will take effect approximately three years before or after the 2026 compliance date of any amended energy conservation standards for room air conditioners.

Table V.31 Compliance Dates and Expected Conversion Expenses of Federal Energy Conservation Standards Affecting Room Air Conditioner Manufacturers

Federal Energy Conservation Standard	Number of OEMs*	Number of OEMs Affected from the Room Air Conditioner Rule**	Approx. Standards Year	Industry Conversion Costs (*Millions $*)	Industry Conversion Costs / Product Revenue***
Commercial Warm Air Furnaces 81 FR 2420 (January 15, 2016)	16	1	2023	$7.5 to $22.2 (2014$)	1.7% to 5.1%†
Small, Large, and Very Large Commercial Package Air Conditioning and Heating Equipment 81 FR 2420	29	4	2018 and 2023‡	$520.8 (2014$)	4.9%

Federal Energy Conservation Standard	**Number of OEMs***	**Number of OEMs Affected from the Room Air Conditioner Rule****	**Approx. Standards Year**	**Industry Conversion Costs (*Millions $*)**	**Industry Conversion Costs / Product Revenue*****
(January 15, 2016)					
Residential Central Air Conditioners and Heat Pumps 82 FR 1786 (January 6, 2017)	51	8	2023	$342.6 (2015$)	0.5%
Portable Air Conditioners 85 FR 1378 (January 10, 2020)	11	5	2025	$320.9 (2015$)	6.7%
Commercial Packaged Boilers 85 FR 1592 (January 10, 2020)	43	1	2023	$21.2 (2015$)	2.3%
Commercial Water Heating Equipment†† 87 FR 30610 (May 19, 2022)	14	1	2026	$34.6 (2020$)	4.7%
Consumer Furnaces†† 87 FR 40590 (July 7, 2022)	15	2	2029	$150.6 (2020$)	1.4%
Consumer Pool Heaters†† 87 FR 22640 (April 15, 2022)	21	1	2028	$38.8 (2020$)	1.9%
Consumer Clothes Dryers†† 87 FR 51734 (August 23, 2022)	15	4	2027	$149.7 (2020$)	1.8%
Microwave Ovens†† 87 FR 52282 (August 24, 2022)	18	4	2026	$46.1 (2021$)	0.7%
Consumer Conventional Cooking Products†† 88 FR 6818 (February 1, 2023)	34	3	2027	$183.4 (2021$)	1.2%
Residential Clothes Washers†† 88 FR 13520 (March 3, 2023)	19	4	2027	$690.8 (2021$)	5.2%
Refrigerators, Freezers, and Refrigerator-Freezers†† 88 FR 12452 (February 27, 2023)	49	4	2027	$1,323.6 (2021$)	3.8%

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

** This column presents the number of manufacturers producing room air conditioner products that are also listed as manufacturers in the listed energy conservation standard contributing 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 final rule. The conversion period typically ranges from 3 to 5 years, depending on the energy conservation standard.
†Low and high conversion cost scenarios were analyzed as part of this Direct Final Rule. The range of estimated conversion expenses presented here reflects those two scenarios.
‡The Direct Final Rule for Small, Large, and Very Large Commercial Package Air Conditioning and Heating Equipment adopts an amended standard in 2018 and a higher amended standard in 2023. The conversion costs are spread over an 8-year conversion period ending in 2022, with over 80 percent of the conversion costs occurring between 2019 and 2022.
†† These rulemakings are in the proposed rule stage and all values are subject to change until finalized.

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 room air conditioners, 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 (2026–2055). Table V.32 presents DOE's projections of the national energy savings for each TSL considered for room air conditioners. The savings were calculated using the approach described in section IV.H.2 of this document.

Table V.32 Cumulative National Energy Savings for Room Air Conditioners; 30 Years of Shipments (2026–2055)

	Trial Standard Level				
	1	**2**	**3**	**4**	**5**
	quads				
Primary energy	0.30	0.91	1.35	1.80	3.35
FFC energy	0.31	0.95	1.41	1.87	3.48

OMB Circular A-4[72] requires agencies to present analytical results, including separate schedules of the monetized benefits and costs that show the type and timing of benefits and costs. Circular A-4 also directs agencies to consider the variability of key elements underlying the estimates of benefits and costs. For this rulemaking, DOE undertook a sensitivity analysis using 9 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 standards.[73] The review timeframe established in EPCA is generally not synchronized with the product lifetime, product manufacturing cycles, or other factors specific to room air conditioners. 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.33. The impacts are counted over the lifetime of room air conditioners purchased in 2026–2055.

[72] U.S. Office of Management and Budget. *Circular A-4: Regulatory Analysis*. September 17, 2003. *www.whitehouse.gov/omb/circulars_a004_a-4/* (last accessed September 8, 2022).

[73] Section 325(m) of 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. 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.

Table V.33 Cumulative National Energy Savings for Room Air Conditioners; 9 Years of Shipments (2026–2034)

	Trial Standard Level				
	1	2	3	4	5
	quads				
Primary energy savings	0.12	0.36	0.50	0.64	1.09
FFC energy savings	0.12	0.38	0.52	0.67	1.13

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 room air conditioners. In accordance with OMB's guidelines on regulatory analysis,[74] DOE calculated NPV using both a 7-percent and a 3-percent real discount rate. Table V.34 shows the consumer NPV results with impacts counted over the lifetime of products purchased in 2026–2055.

Table V.34 Cumulative Net Present Value of Consumer Benefits for Room Air Conditioners; 30 Years of Shipments (2026–2055)

Discount Rate	Trial Standard Level				
	1	2	3	4	5
	billion 2021$				
3 percent	2.89	8.76	11.46	13.83	24.27
7 percent	1.47	4.45	5.39	6.11	10.63

The NPV results based on the aforementioned 9-year analytical period are presented in Table V.35. The impacts are counted over the lifetime of products purchased in 2026–2055. 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.

[74] U.S. Office of Management and Budget. *Circular A-4: Regulatory Analysis*. September 17, 2003. *www.whitehouse.gov/omb/circulars_a004_a-4/* (last accessed July 1, 2022).

Table V.35 Cumulative Net Present Value of Consumer Benefits for Room Air Conditioners; 9 Years of Shipments (2026–2034)

Discount Rate	Trial Standard Level				
	1	2	3	4	5
	billion 2021$				
3 percent	1.45	4.39	4.94	5.34	9.33
7 percent	0.92	2.77	2.96	3.02	5.31

The previous results reflect the use of a default trend to estimate the change in price for room air conditioners over the analysis period (see section IV.H.3 of this document). DOE also conducted a sensitivity analysis that considered one scenario with a lower rate of price decline than the reference case and one scenario with a higher rate of price decline than the reference case. The results of these alternative cases are presented in appendix 10C of the final rule TSD. In the high-price-decline case, the NPV of consumer benefits is higher than in the default case. In the low-price-decline case, the NPV of consumer benefits is lower than in the default case. Under each sensitivity scenario, net benefits remain positive at the adopted TSL.

c. Indirect Impacts on Employment

DOE estimates that amended energy conservation standards for room air conditioners will 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 (2026–2030), where these uncertainties are reduced.

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

4. Impact on Utility or Performance of Products

As discussed in section IV.C.1.b of this document, DOE has concluded that the standards adopted in this final rule will not lessen the utility or performance of the room air conditioners under consideration in this rulemaking. Manufacturers of these products currently offer units that meet or exceed the adopted standards.

5. Impact of Any Lessening of Competition

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, EPCA directs the Attorney General of the United States ("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 in writing to the Secretary within 60 days of the publication of a proposed rule, together with an analysis of the nature and extent of the impact. To assist the Attorney General in making this determination, DOE provided DOJ with copies of the NOPR and the TSD for review. In its assessment letter responding to DOE, DOJ concluded that the proposed energy conservation standards for room air conditioners are unlikely to have a significant adverse impact on competition. DOE is publishing the Attorney General's assessment at the end of this final rule.

6. Need of the Nation to Conserve Energy

Enhanced energy efficiency, where economically justified, improves the Nation's energy security, strengthens the economy, and reduces the environmental impacts (costs) of energy production. Reduced electricity demand due to energy conservation standards is also likely to reduce the cost of maintaining the reliability of the electricity system, particularly during peak-load periods. Chapter 15 in the final rule 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 room air conditioners is expected to yield environmental benefits in the form of reduced emissions of certain air pollutants and greenhouse gases. Table V.36 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.J.3. DOE reports annual emissions reductions for each TSL in chapter 13 of the final rule TSD.

Table V.36 Cumulative Emissions Reduction for Room Air Conditioners Shipped in 2026–2055

	Trial Standard Level				
	1	**2**	**3**	**4**	**5**
Power Sector and Site Emissions					
CO_2 (*million metric tons*)	9.97	30.44	45.05	59.87	110.45
CH_4 (*thousand tons*)	0.72	2.21	3.26	4.32	7.94
N_2O (*thousand tons*)	0.10	0.31	0.45	0.60	1.10
NO_X (*thousand tons*)	4.99	15.27	22.48	29.81	54.71
SO_2 (*thousand tons*)	4.40	13.45	19.80	26.26	48.20
Hg (*tons*)	0.03	0.08	0.12	0.16	0.30
Upstream Emissions					
CO_2 (*million metric tons*)	0.76	2.31	3.43	4.56	8.45
CH_4 (*thousand tons*)	71.16	216.71	322.37	429.43	796.29
N_2O (*thousand tons*)	0.00	0.01	0.02	0.02	0.04
NO_X (*thousand tons*)	11.42	34.77	51.71	68.88	127.68
SO_2 (*thousand tons*)	0.06	0.17	0.25	0.33	0.61
Hg (*tons*)	0.00	0.00	0.00	0.00	0.00
Total FFC Emissions					
CO_2 (*million metric tons*)	10.73	32.74	48.48	64.43	118.90
CH_4 (*thousand tons*)	71.88	218.92	325.63	433.76	804.23
N_2O (*thousand tons*)	0.10	0.32	0.47	0.62	1.15
NO_X (*thousand tons*)	16.41	50.04	74.20	98.69	182.39
SO_2 (*thousand tons*)	4.46	13.62	20.05	26.60	48.82
Hg (*tons*)	0.03	0.08	0.12	0.16	0.30

As part of the analysis for this rule, DOE estimated monetary benefits likely to result from the reduced emissions of CO_2 that DOE estimated for each of the considered TSLs for room air conditioners. Section IV.L.1 of this document discusses the estimated SC-CO_2 values that DOE used. Table V.37 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 selected TSL in chapter 14 of the final rule TSD.

Table V.37 Present Value of CO_2 Emissions Reduction for Room Air Conditioners Shipped in 2026–2055

TSL	SC-CO_2 Case			
	Discount Rate and Statistics			
	5%	3%	2.5%	3%
	Average	Average	Average	95th percentile
	million 2021$			
1	111	461	714	1,402
2	342	1,415	2,189	4,307
3	499	2,075	3,215	6,313
4	658	2,745	4,257	8,350
5	1,194	5,013	7,789	15,250

As discussed in section IV.L.2, 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 room air conditioners. Table V.38 presents the value of the CH_4 emissions reduction at each TSL, and Table V.39 presents the value of the N_2O emissions reduction at each TSL. The time-series of annual values is presented for the selected TSL in chapter 14 of the final rule TSD.

Table V.38 Present Value of Methane Emissions Reduction for Room Air Conditioners Shipped in 2026–2055

TSL	SC-CH_4 Case			
	Discount Rate and Statistics			
	5%	3%	2.5%	3%
	Average	Average	Average	95th percentile
	million 2021$			
1	34	95	132	253
2	103	292	403	775
3	151	431	596	1,144
4	200	573	793	1,519
5	365	1,055	1,463	2,797

Table V.39 Present Value of Nitrous Oxide Emissions Reduction for Room Air Conditioners Shipped in 2026–2055

TSL	SC-N_2O Case			
	Discount Rate and Statistics			
	5%	3%	2.5%	3%
	Average	Average	Average	95th percentile
	million 2021$			
1	0.4	1.6	2.4	4.2
2	1.3	4.8	7.4	12.8
3	1.8	7.0	10.8	18.7
4	2.4	9.3	14.3	24.8
5	4.4	17.0	26.1	45.1

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, however, that the adopted standards would be economically justified even without inclusion of monetized benefits of reduced GHG emissions.

DOE also estimated the monetary value of the economic benefits associated with NO_X and SO_2 emissions reductions anticipated to result from the considered TSLs for room air conditioners. The dollar-per-ton values that DOE used are discussed in section IV.L of this document. Table V.40 presents the present value for NO_X emissions reduction for each TSL calculated using 7-percent and 3-percent discount rates, and Table V.41 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 selected TSL in chapter 14 of the final rule TSD.

Table V.40 Present Value of NO_X Emissions Reduction for Room Air Conditioners Shipped in 2026–2055

TSL	7% Discount Rate	3% Discount Rate
	million 2021$	
1	329	713
2	1,022	2,196
3	1,465	3,209
4	1,915	4,238
5	3,408	7,714

Table V.41 Present Value of SO_2 Emissions Reduction for Room Air Conditioners Shipped in 2026–2055

TSL	7% Discount Rate	3% Discount Rate
	million 2021$	
1	127	264
2	394	814
3	560	1,182
4	730	1,556
5	1,290	2,813

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.42 presents the NPV values that result from adding the estimates of the 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 room air conditioners, and are measured for the lifetime of products shipped in 2026–2055. The benefits associated with reduced GHG emissions resulting from the adopted standards are global benefits, and are also calculated based on the lifetime of room air conditioners shipped in 2026–2055.

Table V.42 Consumer NPV Combined with Present Value of Benefits from Climate and Health

Category	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
3% discount rate for NPV of Consumer and Health Benefits (billion 2021$)					
5% d.r., Average SC-GHG case	4.0	12.2	16.5	20.5	36.4
3% d.r., Average SC-GHG case	4.4	13.5	18.4	22.9	40.9
2.5% d.r., Average SC-GHG case	4.7	14.4	19.7	24.7	44.1
3% d.r., 95th percentile SC-GHG case	5.5	16.9	23.3	29.5	52.9
7% discount rate for NPV of Consumer and Health Benefits (billion 2021$)					
5% d.r., Average SC-GHG case	2.1	6.3	8.1	9.6	16.9
3% d.r., Average SC-GHG case	2.5	7.6	9.9	12.1	21.4
2.5% d.r., Average SC-GHG case	2.8	8.5	11.2	13.8	24.6
3% d.r., 95th percentile SC-GHG case	3.6	11.0	14.9	18.7	33.4

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))

In the April 2022 NOPR, DOE proposed energy conservation standards for room air conditioners at TSL 3, as constructed for that analysis. The minimum CEERs corresponding to TSL 3 from the April 2022 NOPR are shown in Table V.43. 87 FR 20608, 20678 (Apr. 7, 2022).

Table V.43: April 2022 NOPR Proposed Energy Conservation Standards for Room Air Conditioners

Equipment Class	CEER (*Btu/Wh*)
1. Without reverse cycle, with louvered sides, and less than 6,000 Btu/h	13.1
2. Without reverse cycle, with louvered sides and 6,000 to 7,900 Btu/h	13.7
3. Without reverse cycle, with louvered sides and 8,000 to 13,900 Btu/h	16.0
4. Without reverse cycle, with louvered sides and 14,000 to 19,900 Btu/h	16.0
5a. Without reverse cycle, with louvered sides and 20,000 to 27,900 Btu/h	13.8
5b. Without reverse cycle, with louvered sides and 28,000 Btu/h or more	13.2
6. Without reverse cycle, without louvered sides, and less than 6,000 Btu/h	12.8
7. Without reverse cycle, without louvered sides and 6,000 to 7,900 Btu/h	12.8
8a. Without reverse cycle, without louvered sides and 8,000 to 10,900 Btu/h	14.1
8b. Without reverse cycle, without louvered sides and 11,000 to 13,900 Btu/h	13.9
9. Without reverse cycle, without louvered sides and 14,000 to 19,900 Btu/h	13.7
10. Without reverse cycle, without louvered sides and 20,000 Btu/h or more	13.8
11. With reverse cycle, with louvered sides, and less than 20,000 Btu/h	14.4
12. With reverse cycle, without louvered sides, and less than 14,000 Btu/h	13.7
13. With reverse cycle, with louvered sides, and 20,000 Btu/h or more	13.7
14. With reverse cycle, without louvered sides, and 14,000 Btu/h or more	12.8
15. Casement-Only	13.9
16. Casement-Slider	15.3

Gradient, NYSERDA, NEEA and NWPCC supported DOE's proposed standards and stated that these proposed standards are technologically achievable and cost-effective, and should therefore be adopted in order to provide the predicted cost and energy savings. (Gradient, No. 40 at pp. 1-2; NYSERDA, No. 41 at p. 2; NEEA and NWPCC, No. 50 at pp. 1-2)

While NYSERDA supported DOE's proposed energy conservation standards for room air conditioners, NYSERDA strongly urged DOE to set more aggressive standards at or potentially even above the proposed ELs if the analysis supports more aggressive standards such as those that incorporate ECM fan motors in the smaller capacity product class sizes, given the multitude of technology options DOE showed could be used to achieve higher efficiencies. (NYSERDA, No. 41 at p. 2)

DOE reviewed the comments directly concerning proposed standards and TSLs analyzed in the April 2022 NOPR. In this final rule, DOE reassessed the benefits and burdens of the TSLs while considering all comments received, as detailed below.

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

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

DOE also notes that the economics literature provides a wide-ranging discussion of how consumers trade off upfront costs and energy savings in the absence of government intervention. Much of this literature attempts to explain why consumers appear to undervalue energy efficiency improvements. There is evidence that consumers undervalue future energy savings as a result of (1) a lack of information; (2) a lack of sufficient salience of the long-term or aggregate benefits; (3) a lack of sufficient savings to warrant delaying or altering purchases; (4) excessive focus on the short term, in the form of inconsistent weighting of future energy cost savings relative to available returns on other investments; (5) computational or other difficulties associated with the evaluation of relevant tradeoffs; and (6) a divergence in incentives (for example, between renters and owners, or builders and purchasers). Having less than perfect foresight and a high degree of uncertainty about the future, consumers may trade off these types of investments at a higher than expected rate between current consumption and uncertain future energy cost savings.

In DOE's current regulatory analysis, potential changes in the benefits and costs of a regulation due to changes in consumer purchase decisions are included in two ways. First, if consumers forego the purchase of a product in the standards case, this decreases sales for product manufacturers, and the impact on manufacturers attributed to lost revenue is included in the MIA. Second, DOE accounts for energy savings attributable only to products actually used by consumers in the standards case; if a 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 final rule TSD. However, DOE's current analysis does not explicitly control for heterogeneity in consumer preferences, preferences across subcategories of products or specific features, or consumer price sensitivity variation according to household income.[75]

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.[76] 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 Room Air Conditioner Standards

Table V.44 and Table V.45 summarize the quantitative impacts estimated for each TSL for room air conditioners. The national impacts are measured over the lifetime of room air conditioners purchased in the 30-year period that begins in the anticipated year of compliance with amended standards (2026–2055). The energy savings, emissions reductions, and value of emissions reductions refer to full-fuel-cycle results. DOE is presenting monetized benefits in accordance with the applicable Executive Orders and DOE would reach the same conclusion presented in this notice in the absence of the social cost of greenhouse gases, including the

[75] 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*.
[76] Sanstad, A. H. *Notes on the Economics of Household Energy Consumption and Technology Choice*. 2010. Lawrence Berkeley National Laboratory. www1.eere.energy.gov/buildings/appliance_standards/pdfs/consumer_ee_theory.pdf (last accessed July 1, 2021).

Interim Estimates presented by the Interagency Working Group. The efficiency levels contained in each TSL are described in section V.A of this document.

Table V.44 Summary of Analytical Results for Room Air Conditioners TSLs: National Impacts

Category	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
Cumulative FFC National Energy Savings					
Quads	0.31	0.95	1.41	1.87	3.48
Cumulative FFC Emissions Reduction					
CO_2 (*million metric tons*)	10.73	32.74	48.48	64.43	118.90
CH_4 (*thousand tons*)	71.88	218.92	325.63	433.76	804.23
N_2O (*thousand tons*)	0.10	0.32	0.47	0.62	1.15
NO_X (*thousand tons*)	16.41	50.04	74.20	98.69	182.39
SO_2 (*thousand tons*)	4.46	13.62	20.05	26.60	48.82
Hg (*tons*)	0.03	0.08	0.12	0.16	0.30
Present Value of Benefits and Costs (*3% discount rate, billion 2021$*)					
Consumer Operating Cost Savings	3.23	9.99	14.63	19.37	35.77
Climate Benefits*	0.56	1.71	2.51	3.33	6.09
Health Benefits**	0.98	3.01	4.39	5.79	10.53
Total Benefits†	4.76	14.71	21.54	28.49	52.38
Consumer Incremental Product Costs‡	0.33	1.23	3.17	5.55	11.49
Consumer Net Benefits	2.89	8.76	11.46	13.83	24.27
Total Net Benefits	4.43	13.48	18.37	22.95	40.89
Present Value of Benefits and Costs (*7% discount rate, billion 2021$*)					
Consumer Operating Cost Savings	1.66	5.20	7.46	9.79	17.65
Climate Benefits*	0.56	1.71	2.51	3.33	6.09
Health Benefits**	0.46	1.42	2.02	2.65	4.70
Total Benefits†	2.68	8.32	12.00	15.76	28.43
Consumer Incremental Product Costs‡	0.19	0.75	2.08	3.67	7.02
Consumer Net Benefits	1.47	4.45	5.39	6.11	10.63
Total Net Benefits	2.49	7.58	9.92	12.08	21.41

Note: This table presents the costs and benefits associated with room air conditioners shipped in 2026–2055. These results include benefits to consumers which accrue after 2055 from the products shipped in 2026–2055.
* 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 the Department does not have a single central SC-GHG point estimate. On March 16, 2022, the Fifth Circuit Court of Appeals (No. 22-30087) granted the federal government's emergency motion for stay pending appeal of the February 11, 2022, preliminary injunction issued in Louisiana v. Biden, No. 21-cv-1074-JDC-KK (W.D. La.). As a result of the Fifth Circuit's order, the preliminary injunction is no longer in effect, pending resolution of the federal government's appeal of that injunction or a further court order. Among other things, the preliminary injunction enjoined the defendants in that case from "adopting, employing, treating as binding, or relying upon" the interim estimates of the social cost of greenhouse gases—which were issued by the Interagency Working Group on the Social Cost of Greenhouse Gases on February 26, 2021—to monetize the benefits of reducing greenhouse gas emissions. As reflected in this rule, DOE has reverted to its approach prior to the injunction and presents monetized greenhouse gas abatement benefits where appropriate and permissible under law.
** 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 the Department does not have a single central SC-GHG point estimate. DOE 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.45 Summary of Analytical Results for Room Air Conditioners TSLs: Manufacturer and Consumer Impacts

Category	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
Manufacturer Impacts					
Industry NPV (*million 2021$*) (No-new-standards case INPV = 1,189.5)	1,188.7 to 1,192.9	1,167.8 to 1,197.2	1,140.8 to 1,284.1	1,097.7 to 1,369.0	857.5 to 1,211.5
Industry NPV (*% change*)	(0.8) to (0.5)	(2.6) to (0.1)	(4.8) to 7.1	(8.4) to 14.2	(28.4) to 1.1
Consumer Average LCC Savings (*2021$*)					
PC1: Room Air Conditioners, without reverse cycle, with louvered sides, and less than 6,000 Btu/h	41	65	65	47	93
PC2: Room Air Conditioners, without reverse cycle, with louvered sides, and 6,000 to 7,900 Btu/h	35	72	72	69	103
PC3: Room Air Conditioners, without reverse cycle, with louvered sides, and 8,000 to 13,900 Btu/h	17	105	100	100	171
PC4: Room Air Conditioners, without reverse cycle, with louvered sides, and 14,000 to 19,900 Btu/h	0	85	92	92	168
PC5a: Room Air Conditioners, without reverse cycle, with louvered sides, and 20,000 to 27,900 Btu/h	6	99	148	148	284
PC5b: Room Air Conditioners, without reverse cycle, with louvered sides, and 28,000 Btu/h or more	101	150	284	284	415
PC8a: Room Air Conditioners, without reverse cycle, without louvered sides, and 8,000 to 10,900 Btu/h	6	73	84	84	137
PC8b: Room Air Conditioners, without reverse cycle, without louvered sides, and 11,000 to 13,900 Btu/h	0	81	119	119	175
PC9: Room Air Conditioners, without reverse cycle, without louvered sides, and 14,000 to 19,900 Btu/h	58	81	165	165	180
PC11: Room Air Conditioners, with reverse cycle, with louvered sides, and less than 20,000 Btu/h	69	110	134	134	185
PC12: Room Air Conditioners, with reverse cycle, without louvered sides, and less than 14,000 Btu/h	40	67	124	124	128

Category	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
PC16: Room Air Conditioners, Casement-Slider	51	107	84	84	147
Shipment-Weighted Average*	27	83	85	78	134
Consumer Simple PBP (*years*)					
PC1: Room Air Conditioners, without reverse cycle, with louvered sides, and less than 6,000 Btu/h	0.6	0.8	0.8	4.6	3.8
PC2: Room Air Conditioners, without reverse cycle, with louvered sides, and 6,000 to 7,900 Btu/h	0.7	1.5	1.5	3.8	4.2
PC3: Room Air Conditioners, without reverse cycle, with louvered sides, and 8,000 to 13,900 Btu/h	1.2	0.9	2.9	2.9	3.1
PC4: Room Air Conditioners, without reverse cycle, with louvered sides, and 14,000 to 19,900 Btu/h	0.7	1.2	3.0	3.0	2.8
PC5a: Room Air Conditioners, without reverse cycle, with louvered sides, and 20,000 to 27,900 Btu/h	1.1	1.0	2.5	2.5	2.3
PC5b: Room Air Conditioners, without reverse cycle, with louvered sides, and 28,000 Btu/h or more	0.4	0.5	2.3	2.3	2.0
PC8a: Room Air Conditioners, without reverse cycle, without louvered sides, and 8,000 to 10,900 Btu/h	0.6	1.4	3.2	3.2	3.5
PC8b: Room Air Conditioners, without reverse cycle, without louvered sides, and 11,000 to 13,900 Btu/h	0.5	1.4	2.4	2.4	3.2
PC9: Room Air Conditioners, without reverse cycle, without louvered sides, and 14,000 to 19,900 Btu/h	1.1	2.0	2.9	2.9	3.7
PC11: Room Air Conditioners, with reverse cycle, with louvered sides, and less than 20,000 Btu/h	0.6	1.9	3.2	3.2	3.4
PC12: Room Air Conditioners, with reverse cycle, without louvered sides, and less than 14,000 Btu/h	1.3	2.2	2.6	2.6	3.6
PC16: Room Air Conditioners, Casement-Slider	0.7	0.9	4.0	4.0	3.4
Shipment-Weighted Average*	0.8	1.0	1.9	3.6	3.5
Percent of Consumers that Experience a Net Cost					
PC1: Room Air Conditioners, without reverse cycle, with louvered sides, and less than 6,000 Btu/h	2%	3%	3%	41%	34%
PC2: Room Air Conditioners, without reverse cycle, with louvered sides, and 6,000 to 7,900 Btu/h	2%	14%	14%	38%	42%
PC3: Room Air Conditioners, without reverse cycle, with louvered sides, and 8,000 to 13,900 Btu/h	2%	2%	26%	26%	30%

Category	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5
PC4: Room Air Conditioners, without reverse cycle, with louvered sides, and 14,000 to 19,900 Btu/h	0%	9%	33%	33%	30%
PC5a: Room Air Conditioners, without reverse cycle, with louvered sides, and 20,000 to 27,900 Btu/h	1%	5%	30%	30%	27%
PC5b: Room Air Conditioners, without reverse cycle, with louvered sides, and 28,000 Btu/h or more	0%	1%	24%	24%	21%
PC8a: Room Air Conditioners, without reverse cycle, without louvered sides, and 8,000 to 10,900 Btu/h	0%	15%	34%	34%	38%
PC8b: Room Air Conditioners, without reverse cycle, without louvered sides, and 11,000 to 13,900 Btu/h	0%	17%	26%	26%	37%
PC9: Room Air Conditioners, without reverse cycle, without louvered sides, and 14,000 to 19,900 Btu/h	4%	19%	24%	24%	39%
PC11: Room Air Conditioners, with reverse cycle, with louvered sides, and less than 20,000 Btu/h	2%	19%	30%	30%	34%
PC12: Room Air Conditioners, with reverse cycle, without louvered sides, and less than 14,000 Btu/h	8%	22%	21%	21%	36%
PC16: Room Air Conditioners, Casement-Slider	3%	5%	38%	38%	32%
Shipment-Weighted Average*	2%	6%	17%	34%	34%

Parentheses indicate negative (-) values

* Weighted by shares of each product class in total projected shipments in 2026.

DOE first considered TSL 5, which represents the max-tech efficiency levels. At this level, DOE expects room air conditioners would require the maximum available efficiency variable-speed compressor at all product classes. TSL 5 would save an estimated 3.48 quads of energy, an amount DOE considers significant. Under TSL 5, the NPV of consumer benefit would be $10.63 billion using a discount rate of 7 percent, and $24.27 billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 5 are 118.9 Mt of CO_2, 48.8 thousand tons of SO_2, 182.4 thousand tons of NO_X, 0.3 tons of Hg, 804.2 thousand tons of CH_4, and 1.1 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 5 is $6.09 billion. The estimated monetary value of the health benefits from reduced SO_2 and NO_X emissions at TSL 5 is $4.70 billion using a 7-percent discount rate and $10.53 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 5 is $21.41 billion. Using a 3-percent discount rate for all benefits and costs, the estimated total NPV at TSL 5 is $40.89 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.

At TSL 5, for the product classes with the largest market share, the average LCC impact is $93 for PC 1, $103 for PC 2, and $171 for PC 3. The simple payback period is 3.8 years for PC 1, 4.2 years for PC 2, and 3.1 years for PC 3. The fraction of consumers who experience a net LCC cost is 34 percent for PC 1, 42 percent for PC 2, and 30 percent for PC 3. Overall, 34 percent of consumers would experience a net cost.

At TSL 5, the projected change in INPV ranges from a decrease of $341.0 million to an increase of $13.0 million, which corresponds to a decrease of 28.4 percent and an increase of 1.1 percent, respectively. Conversion costs total $319.7 million.

As discussed in section IV.C.1 of this document, DOE believes there is uncertainty regarding the estimated compressor cost and availability of the highest efficiency variable-speed compressors across the full range of capacities at TSL 5, particularly in the smaller capacity room air conditioners. These uncertainties stem from the fact that the efficiency level for TSL 5 is obtained by using the highest efficiency variable-speed compressors that are currently available to be incorporated into room air conditioners at the time the analysis was competed. In addition, variable speed compressors representing these efficiencies are manufactured by just one manufacturer. It is unclear whether the highest efficiency variable-speed compressors will be available to all manufacturers of room air conditioners since there is only a single supplier at this time. In addition, these highest efficiency variable-speed compressors are not currently available in the full range of capacities of air room air conditioners, which could limit the current product offerings by manufacturers. Furthermore, due to the single supplier for these highest efficiency variable-speed compressors and their unknown manufacturing volume and potential bottlenecks for ramp-up manufacturing capabilities, there is a likelihood that there may not be sufficient supply to meet the demand of the market for the full range of cooling capacities for room air conditioners, should TSL 5 be selected. This may have the potential to result in the unavailability of room air conditioners of certain cooling capacities from the market, which would contradict the requirements in 42 U.S.C. 6295(o)(4) for any amended energy conservation standards, as well impact the overall number of room air conditioners available on the market should TSL 5 be selected.

The Secretary concludes that at TSL 5 for room air conditioners, the benefits of energy savings, positive NPV of consumer benefits, emission reductions, and the estimated monetary value of the climate and health benefits would be outweighed by the impacts on manufacturers, including the conversion costs and profit margin impacts that could result in a large reduction in INPV, and the potential for product unavailability due to limitations in key components such as the highest efficiency variable-speed compressors necessary to reach the max-tech efficiency levels. Consequently, the Secretary has concluded that TSL 5 is not economically justified.

DOE then considered TSL 4. At TSL 4, DOE expects that all room air conditioners product classes would require variable-speed compressors. TSL 4 would save an estimated 1.87 quads of energy, an amount DOE considers significant. Under TSL 4, the NPV of consumer benefit would be $6.11 billion using a discount rate of 7 percent, and $13.83 billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 4 are 64.4 Mt of CO_2, 26.6 thousand tons of SO_2, 98.7 thousand tons of NO_X, 0.16 tons of Hg, 433.8 thousand tons of CH_4, and 0.62 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 $3.33 billion. The estimated monetary value of the health benefits from reduced SO_2 and NO_X emissions at TSL 4 is $2.65 billion using a 7-percent discount rate and $5.79 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 $12.08 billion. Using a 3-percent discount rate for all benefits and costs, the estimated total NPV at TSL 4 is $22.95 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.

At TSL 4, for the product classes with the largest market share, the average LCC impact is $47 for PC 1, $69 for PC 2, and $100 for PC 3. The simple payback period is 4.6 years for PC 1, 3.8 years for PC 2, and 2.9 years for PC 3. The fraction of consumers who experience a net LCC cost is 41 percent for PC 1, 38 percent for PC 2, and 26 percent for PC 3. Overall, 34 percent of consumers would experience a net cost across all product classes.

At TSL 4, the projected change in INPV ranges from a decrease of $100.8 million to an increase of $170.5 million, which corresponds to a decrease of 8.4 percent and an increase of 14.2 percent, respectively. Conversion costs total $29.0 million.

TSL 4 represents commercially available room air conditioners that implement variable-speed compressors, based on models with cooling capacities greater than 8,000 Btu/h. However, for room air conditioners with the smallest cooling capacities (*i.e.*, less than 8,000 Btu/h), uncertainties exist regarding both the availability of variable-speed compressors that can be integrated into these smaller-size units and the feasibility of incorporating these variable-speed compressors with related components into a more space-constrained chassis than for larger-capacity room air conditioners. There are no models commercially available that incorporate variable-speed compressors for cooling capacities less than 8,000 Btu/h, and the uncertainty in the availability of those compressors may have the potential to eliminate room air conditioners with the smallest cooling capacities from the market, should TSL 4 be selected. While there are similarly no room air conditioners currently on the market with variable-speed compressors at cooling capacities greater than 22,000 Btu/h, other air conditioning products with such cooling capacities (*e.g.*, mini-split air conditioners) do exist in the U.S. market, thereby not giving rise to the same uncertainties as for the smallest cooling capacities. Based on an analysis of RECS 2015 and historical shipments data, approximately 78 percent of consumers in the low-income sample purchase units in PC 1 and PC 2. The unavailability of products at this capacity range would disproportionally impact the low-income consumers and their ability to access cooling from room air conditioners.

The Secretary concludes that at TSL 4 for room air conditioners, the benefits of energy savings, positive NPV of consumer benefits, emission reductions, and the estimated monetary value of the climate and health benefits would be outweighed by the impacts on manufacturers, including the conversion costs and profit margin impacts that could result in a reduction in INPV and potential unavailability of key components for small-capacity product classes. Consequently, the Secretary has concluded that TSL 4 is not economically justified.

DOE then considered TSL 3, which would save an estimated 1.41 quads of energy, an amount DOE considers significant. TSL 3 represents the same efficiency levels as TSL 4 for product classes with cooling capacities greater than or equal to 8,000 Btu/h. For product classes, less than 8,000 Btu/h, TSL 3 corresponds to the implementation of the maximum efficiency single-speed compressor (*i.e.*, one efficiency level lower than at TSL 4). At TSL 3, the NPV of consumer benefit would be \$5.39 billion using a discount rate of 7 percent, and \$11.46 billion using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 3 are 48.5 Mt of CO_2, 20.1 thousand tons of SO_2, 74.2 thousand tons of NO_X, 0.1 tons of Hg, 325.6 thousand tons of CH_4, and 0.5 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 \$2.51 billion. The estimated monetary value of the health benefits from reduced SO_2 and NO_X emissions at TSL 3 is \$2.02 billion using a 7-percent discount rate and \$4.39 billion using a 3-percent discount rate.

Using a 7-percent discount rate for consumer benefits and costs, SO_2 reduction benefits, and NO_X reduction benefits, and the 3-percent discount rate for GHG social costs, the estimated combined monetized NPV at TSL 3 is \$9.92 billion. Using a 3-percent discount rate for all consumer and emissions benefits and costs, the estimated combined monetized NPV at TSL 3 is \$18.37 billion. The estimated total monetized NPV is provided for additional information; however, DOE primarily relies upon the consumer NPV when determining whether a standard level is economically justified.

At TSL 3, for the product classes with the largest market share, the average LCC impact is \$65 for PC 1, \$72 for PC 2, and \$100 for PC 3. The simple payback period is 0.8 years for PC 1, 1.5 years for PC 2, and 2.9 years for PC 3. The fraction of consumers who experience a net LCC cost is 3 percent for PC 1, 14 percent for PC 2, and 26 percent for PC 3. Overall, 17 percent of consumers would experience a net cost across all product classes.

Based on an analysis of RECS 2015 and historical shipments data, approximately 78% of consumers in the low-income sample purchase units in PC 1 and PC 2. At TSL 3, the percentage of consumers who experience a net LCC cost is 1 percent for PC 1 and 10 percent for PC 2. Additionally, the low-income subgroup analysis conservatively estimates the impact to low-income consumers by assuming all renters (64% of low-income sample) are paying the first cost of a room air conditioner. In cases where the landlord purchases the unit and renter pays electricity bill, the renter would not pay an increased first cost, but would benefit from operating cost savings due to a higher efficiency standard.

At TSL 3, the projected change in manufacturer INPV ranges from a decrease of $57.7 million to an increase of $85.6 million, which corresponds to a decrease of 4.8 percent and an increase of 7.1 percent, respectively. Conversion costs total $24.8 million.

After considering the analysis and weighing the benefits and burdens, the Secretary has concluded that a standard set at TSL 3 for room air conditioners would be economically justified. At this TSL, the average LCC savings for room air conditioner consumers is positive, meaning that the average consumer would experience net savings from the standard. An estimated 17 percent of room air conditioner consumers would experience a net cost. The FFC national energy savings of 1.41 quads 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 96 times higher than the maximum estimated manufacturers' loss in INPV. The positive LCC savings – a different way of quantifying consumer benefits – reinforces this conclusion. The standard levels at TSL 3 are economically justified even without weighing the estimated monetary value of emissions reductions. When those monetized climate benefits from GHG emissions reductions and health benefits from SO_2 and NO_X emissions reductions are included – representing $2.51 billion in climate benefits (associated with the average SC-GHG at a 3-percent discount rate), and $4.39 billion (using a 3-percent discount rate) or $2.02 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 amended energy conservation standards, DOE notes that as compared to TSL 4 and TSL 5, TSL 3 has a shorter payback period, smaller percentages of consumer experiencing a net cost, a lower maximum decrease in INPV, and lower manufacturer conversion costs.

Although DOE considered amended standard levels for room air conditioners by grouping the efficiency levels for each product class into TSLs, DOE evaluates all analyzed efficiency levels in its analysis. For room air conditioners with cooling capacities greater than or equal to 8,000 Btu/h, TSL 3 corresponds to EL 4, the highest efficiency level below max-tech, incorporating commercially available variable-speed compressors. The variable-speed compressor required to achieve the max-tech efficiency level is currently available from only a single manufacturer, leading to the likelihood there may not be sufficient supply at that efficiency level to meet the demand of the market for the full range of cooling capacities for room air conditioners. For room air conditioners with cooling capacities less than 8,000 Btu/h, TSL 3 corresponds to EL 3, incorporating the maximum energy efficient single-speed compressors commercially available. Both EL 4 and EL 5 for room air conditioners with cooling capacities less than 8,000 Btu/h incorporate variable-speed compressors based on modeling of available compressors for models with cooling capacities greater than or equal to 8,000 Btu/h. Uncertainties exist at those efficiency levels regarding both the availability of variable-speed compressors that can be integrated into these smaller-size units and the feasibility of incorporating these variable-speed compressors with related components into a more space-constrained chassis than for larger-capacity room air conditioners. There are no models commercially available that incorporate variable-speed compressors for cooling capacities less than 8,000 Btu/h. Additionally, average LCC savings are higher at EL 3 relative to EL 4 for product classes with cooling capacities less than 8,000 Btu/h. The adopted standard levels at TSL 3 results in positive LCC savings for all product classes, significantly reduce the number of consumers experiencing a net cost, and reduce the decrease in INPV and conversion costs to the point where DOE has concluded they are economically justified, as discussed for TSL 3 in the preceding paragraphs.

Therefore, based on the previous considerations, DOE adopts the energy conservation standards for room air conditioners at TSL 3. The amended energy conservation standards for room air conditioners, which are expressed as CEER, are shown in Table V.46Table V.46.

Table V.46 Amended Energy Conservation Standards for Room Air Conditioners

Product Class	Adopted Standard CEER (Btu/h)
Room Air Conditioner without reverse cycle, with louvered sides	
<6,000 Btu/h (1)	13.1
6,000 to 7,900 Btu/h (2)	13.7
8,000 to 13,900 Btu/h (3)	16.0
14,000 to 19,900 Btu/h (4)	16.0
20,000 to 27,900 Btu/h (5a)	13.8
≥28,000 Btu/h (5b)	13.2
Room Air Conditioner without reverse cycle, without louvered sides	
<6,000 Btu/h (6)	12.8
6,000 to 7,900 Btu/h (7)	12.8
8,000 to 10,900 Btu/h (8a)	14.1
11,000 to 13,900 Btu/h (8b)	13.9
14,000 to 19,900 Btu/h (9)	13.7
≥20,000 Btu/h (10)	13.8
Room Air Conditioner with reverse cycle, with louvered sides	
<20,000 Btu/h (11)	14.4
≥20,000 Btu/h (13)	13.7
Room Air Conditioner with reverse cycle, without louvered sides	
<14,000 Btu/h (12)	13.7
≥14,000 Btu/h (14)	12.8
Casement	
Casement-Only (15)	13.9
Casement-Slider (16)	15.3

2. Annualized Benefits and Costs of the Adopted Standards

The benefits and costs of the adopted standards can also be expressed in terms of annualized values. The annualized net benefit is (1) the annualized national economic value (expressed in 2021$) of the benefits from operating products that meet the adopted 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.

Table V.47 shows the annualized values for room air conditioners under TSL 3, expressed in 2021$. 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 reductions, and the 3-percent discount rate case for GHG social costs, the estimated cost of the adopted standards for room air conditioners is $205.2 million per year in increased equipment installed costs, while the estimated annual benefits are $736.9 million from reduced equipment operating costs, $140.1 million in GHG reductions, and $199.9 million from reduced NO_X and SO_2 emissions. In this case, the net benefit amounts to $871.7 million per year.

Using a 3-percent discount rate for all benefits and costs, the estimated cost of the adopted standards for room air conditioners is $176.8 million per year in increased equipment costs, while the estimated annual benefits are $815.8 million in reduced operating costs, $140.1 million from GHG reductions, and $244.8 million from reduced NO_X and SO_2 emissions. In this case, the net benefit amounts to $1,023.9 million per year.

Table V.47 Annualized Benefits and Costs of Adopted Standards (TSL 3) for Room Air Conditioners

	Million 2021$/year		
	Primary Estimate	**Low-Net-Benefits Estimate**	**High-Net-Benefits Estimate**
3% discount rate			
Consumer Operating Cost Savings	815.8	784.9	851.9
Climate Benefits*	140.1	137.6	142.5
Health Benefits**	244.8	240.6	248.9
Total Benefits†	1,200.6	1,163.2	1,243.3
Consumer Incremental Product Costs‡	176.8	199.0	152.2
Net Benefits	1,023.9	964.1	1,091.1
7% discount rate			
Consumer Operating Cost Savings	736.9	712.3	765.4
Climate Benefits*	140.1	137.6	142.5
Health Benefits**	199.9	196.8	203.0
Total Benefits†	1,076.9	1,046.7	1,111.0
Consumer Incremental Product Costs‡	205.2	227.0	181.0
Net Benefits	871.7	819.7	930.0

Note: This table presents the costs and benefits associated with room air conditioners shipped in 2026−2055. 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 AEO2022 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 notice). For presentational purposes of this table, the climate benefits associated with the average SC-GHG at a 3 percent discount rate are shown, but the Department does not have a single central SC-GHG point estimate, and it emphasizes the importance and value of considering the benefits calculated using all four sets of SC-GHG estimates. On March 16, 2022, the Fifth Circuit Court of Appeals (No. 22-30087) granted the federal government's emergency motion for stay pending appeal of the February 11, 2022, preliminary injunction issued in *Louisiana v. Biden*, No. 21-cv-1074-JDC-KK (W.D. La.). As a result of the Fifth Circuit's order, the preliminary injunction is no longer in effect, pending resolution of the federal government's appeal of that injunction or a further court order. Among other things, the preliminary injunction enjoined the defendants in that case from "adopting, employing, treating as binding, or relying upon" the interim estimates of the social cost of greenhouse gases—which were issued by the Interagency Working Group on the Social Cost of Greenhouse Gases on February 26, 2021—to monetize the benefits of reducing greenhouse gas emissions. As reflected in this rule, DOE has reverted to its approach prior to the injunction and presents monetized greenhouse gas abatement benefits where appropriate and permissible under law.

** Health benefits are calculated using benefit-per-ton values for NO_X and SO_2. DOE is currently only monetizing (for SO2 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. 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 the Department does not have a single central SC-GHG point estimate.
‡ Costs include incremental equipment costs as well as installation costs.

VI. Cooling Capacity Verification

In the April 2022 NOPR, DOE proposed to add the cooling capacity of room air conditioners to 10 CFR 429.134 to help regulated entities understand how DOE will determine the product class that applies to a given basic model in the context of an enforcement investigation. DOE proposed a similar approach to other products, where DOE would compare the mean of the tested cooling capacity from the units of a given basic model that DOE has tested for enforcement rounded to the nearest hundred to the certified cooling capacity by the manufacturer. DOE would use the certified cooling capacity of the manufacturer if the mean of the DOE tested units is within 5 percent of the certified cooling capacity. If the manufacturer does not have a valid certification, including if the certified cooling capacity was incorrectly certified, or the certified cooling capacity is found to be outside of the 5 percent tolerance, DOE would use the rounded mean of the DOE tested units within the enforcement sample to determine the applicable product class and energy conservation standard for this particular basic model.

DOE received no comments on the proposed cooling capacity verification instructions and maintains that the provisions proposed in the April 2022 NOPR provide additional clarity and transparency to the enforcement process. Therefore, DOE is adopting the 10 CFR 429.134 amendments, as proposed in the April 2022 NOPR, in this final rule.

VII. Procedural Issues and Regulatory Review

A. Review Under Executive Orders 12866 and 13563

Executive Order ("E.O.") 12866, "Regulatory Planning and Review," 58 FR 51735 (Oct. 4, 1993), as supplemented and reaffirmed by E.O. 13563, "Improving Regulation and Regulatory Review", 76 FR 3821 (Jan. 21, 2011), 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 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/final 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 final 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 final 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") and a final regulatory flexibility analysis ("FRFA") 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 (*energy.gov/gc/office-general-counsel*).

DOE reviewed this final rule under the provisions of the Regulatory Flexibility Act and the procedures and policies published on February 19, 2003. DOE certifies that the final rule would not have significant economic impact on a substantial number of small entities. The factual basis of this certification is set forth in the following paragraphs.

For manufacturers of room air conditioners, the U.S. Small Business Administration ("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 room air conditioners is classified under NAICS 333415, "Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing." The SBA sets a threshold of 1,250 employees or fewer for an entity to be considered as a small business for this category.

EPCA 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[77] established the Energy Conservation Program for Consumer Products Other Than Automobiles. (42 U.S.C. 6291-6309) These products include room air conditioners, the subject of this 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 significant conservation of energy. (42 U.S.C. 6295(o)(3)(B)) EPCA also provides that not later than 6 years after issuance of any final rule establishing or amending a standard, DOE must publish either a notice of determination that standards for the product do not need to be amended, or a notice of proposed rulemaking including new proposed energy conservation standards (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 is adopting amended energy conservation standards for room air conditioners.

To estimate the number of companies that could be small business manufacturers of products covered by this rulemaking, DOE conducted a market survey using public information and subscription-based company reports to identify potential small manufacturers. DOE's

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

research involved DOE's Compliance Certification Database ("CCD"),[78] California Energy Commission's Modernized Appliance Efficiency Database System ("MAEDbS"),[79] ENERGY STAR Product Finder,[80] individual company websites, and market research tools (*e.g.*, reports from Dun & Bradstreet[81]) to create a list of companies that manufacture, produce, import, or assemble the products covered by this rulemaking. DOE also asked stakeholders and industry representatives if they were aware of any other small manufacturers during manufacturer interviews and at DOE public meetings.

DOE identified eight OEMs of room air conditioner products sold in the United States. Upon initial review, one OEM was identified as a small manufacturer based in the United States. However, in August 2021, a large manufacturer acquired the small manufacturer.[82] Following that acquisition, no domestic room air conditioner OEMs qualify as a small business. Given the lack of small entities with a direct compliance burden, DOE certifies that the proposed rule would not have "a significant economic impact on a substantial number of small entities."

DOE did not receive written comments in response to the April 2022 NOPR that specifically addressed the potential impacts on small businesses.

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[78] U.S. Department of Energy's Compliance Certification Database. Available at: *regulations.doe.gov/certification-data/#q=Product_Group_s%3A** (Last accessed: March 17, 2021)
[79] California Energy Commission's Modernized Appliance Efficiency Database System. Available at: *cacertappliances.energy.ca.gov/Pages/ApplianceSearch.aspx* (Last accessed: March 17, 2021)
[80] U.S. Environmental Protection Agency's ENERGY STAR data set. Available at: *energystar.gov/productfinder/* (Last accessed March 17, 2021).
[81] Dun & Bradstreet subscription login is available at: *app.dnbhoovers.com* (Last accessed September 14, 2022).
[82] Rheem Manufacturing Company. *Press Release.* Available at: *www.rheem.com/about/news-releases/rheem-acquires-friedrich-air-conditioning* (Published August 30, 2021).

DOE has transmitted the certification and supporting statement of factual basis to the Chief Counsel for Advocacy of the SBA for review under 5 U.S.C. 605(b).

C. Review Under the Paperwork Reduction Act

Manufacturers of room air conditioners 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 room air conditioners, 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 room air conditioners. (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

Pursuant to the National Environmental Policy Act of 1969 ("NEPA"), DOE has analyzed this proposed action rule in accordance with NEPA and DOE's NEPA implementing regulations (10 CFR part 1021). DOE has determined that this rule qualifies for categorical exclusion under 10 CFR part 1021, subpart D, appendix B5.1 because it is a rulemaking that establishes energy conservation standards for consumer products or industrial equipment, none of the exceptions identified in B5.1(b) apply, no extraordinary circumstances exist that require further environmental analysis, and it meets the requirements for application of a categorical exclusion. See 10 CFR 1021.410. Therefore, DOE has determined that promulgation of this rule is not a major Federal action significantly affecting the quality of the human environment within the meaning of NEPA, and does not require an environmental assessment or an environmental impact statement.

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 rule and has determined that it would not have a substantial direct effect on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. EPCA governs and prescribes Federal preemption of State regulations as to energy conservation for the products that are the subject of this final rule. States can petition DOE for exemption from such preemption to the extent, and based on criteria, set forth in EPCA. (42 U.S.C. 6297) Therefore, no further action is required by Executive Order 13132.

F. Review Under Executive Order 12988

With respect to the review of existing regulations and the promulgation of new regulations, section 3(a) of E.O. 12988, "Civil Justice Reform," 61 FR 4729 (Feb. 7, 1996), 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 E.O. 12988 requires Executive agencies to review regulations in light of applicable standards in section 3(a) and section 3(b) to determine whether they are met or it is unreasonable to meet one or more of them. DOE has completed the required review and determined that, to the extent permitted by law, this final rule meets the relevant standards of 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. Pub. L. 104-4, section. 201 (codified at 2 U.S.C. 1531). For a regulatory action likely to result in a rule that may cause the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector of $100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish a written statement that estimates the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a), (b)) The UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal governments on a "significant intergovernmental mandate," and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect them. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. 62 FR 12820. DOE's policy statement is also available at *energy.gov/sites/prod/files/gcprod/documents/umra_97.pdf.*

DOE has concluded that this final rule may require expenditures of $100 million or more in any one year by the private sector. Such expenditures may include (1) investment in research and development and in capital expenditures by room air conditioner manufacturers in the years between the final rule and the compliance date for the new standards and (2) incremental additional expenditures by consumers to purchase higher-efficiency room air conditioners, starting at the compliance date for the applicable standard.

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

Under section 205 of UMRA, the Department is obligated to identify and consider a reasonable number of regulatory alternatives before promulgating a rule for which a written statement under section 202 is required. (2 U.S.C. 1535(a)) DOE is required to select from those alternatives the most cost-effective and least burdensome alternative that achieves the objectives of the rule unless DOE publishes an explanation for doing otherwise, or the selection of such an alternative is inconsistent with law. As required by 42 U.S.C. 6295(m), this final rule establishes amended energy conservation standards for room air conditioners that are designed to achieve the maximum improvement in energy efficiency that DOE has determined to be both technologically feasible and economically justified, as required by 6295(o)(2)(A) and 6295(o)(3)(B). A full discussion of the alternatives considered by DOE is presented in chapter 17 of the TSD for this final rule.

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

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

I. Review Under Executive Order 12630

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

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

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

K. Review Under Executive Order 13211

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

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

L. 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 prepared a report describing that peer review.[83] 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 the Department's analyses. DOE is in the process of evaluating the resulting report.[84]

[83] The 2007 "Energy Conservation Standards Rulemaking Peer Review Report" is available at the following website: *energy.gov/eere/buildings/downloads/energy-conservation-standards-rulemaking-peer-review-report-0* (last accessed September 12, 2022).
[84] The report is available at www.nationalacademies.org/our-work/review-of-methods-for-setting-building-and-equipment-performance-standards.

M. Congressional Notification

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

VIII. Approval of the Office of the Secretary

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

List of Subjects

10 CFR Part 429

Administrative practice and procedure, Confidential business information, Energy conservation, Household appliances, Reporting and recordkeeping requirements.

10 CFR Part 430

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

Signing Authority

This document of the Department of Energy was signed on March 22, 2023, by Francisco Alejandro Moreno, Acting 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 March 22, 2023

FRANCISCO MORENO

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Date: 2023.03.22 15:59:08 -04'00'

X ______________________

Alejandro Moreno
Acting Assistant Secretary for
Energy Efficiency and Renewable Energy

For the reasons set forth in the preamble, DOE amends part 429 of chapter II, subchapter D, of title 10 of the Code of Federal Regulations, as set forth below:

In §429.134, add paragraph (s) to read as follows:

§429.134 Product-specific enforcement provisions.

*　　*　　*　　*　　*

(s) *Room air conditioners.* Verification of cooling capacity. The cooling capacity will be measured pursuant to the test requirements of 10 CFR part 430 for each unit tested. The results of the measurement(s) will be averaged and compared to the value of cooling capacity certified by the manufacturer for the basic model. The certified cooling capacity will be considered valid only if the measurement is within five percent of the certified cooling capacity.

(1) If the certified cooling capacity is found to be valid, the certified cooling capacity will be used as the basis for determining the minimum combined energy efficiency ratio allowed for the basic model.

(2) If the certified cooling capacity is found to be invalid, the average measured cooling capacity of the units in the sample will be used as the basis for determining the minimum combined energy efficiency ratio allowed for the basic model.

For the reasons set forth in the preamble, DOE amends part 430 of chapter II, subchapter D, of title 10 of the 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. In §430.32, edit paragraph (b) to read as follows:

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

* * * * *

(b)

The following standards remain in effect from June 1, 2014 until INSERT DATE 3 YEARS AFTER PUBLICATION OF THE FINAL RULE:

Equipment Class	Combined Energy Efficiency Ratio
1. Without reverse cycle, with louvered sides, and with a certified cooling capacity* less than 6,000 Btu/h	11.0
2. Without reverse cycle, with louvered sides and with a certified cooling capacity of 6,000 to 7,999 Btu/h	11.0
3. Without reverse cycle, with louvered sides and with a certified cooling capacity of 8,000 to 13,999 Btu/h	10.9
4. Without reverse cycle, with louvered sides and with a certified cooling capacity of 14,000 to 19,999 Btu/h	10.7
5a. Without reverse cycle, with louvered sides and with a certified cooling capacity of 20,000 Btu/h to 27,999 Btu/h	9.4
5b. Without reverse cycle, with louvered sides and with a certified cooling capacity of 28,000 Btu/h or more	9.0
6. Without reverse cycle, without louvered sides, and with a certified cooling capacity less than 6,000 Btu/h	10.0
7. Without reverse cycle, without louvered sides and with a certified cooling capacity of 6,000 to 7,999 Btu/h	10.0
8a. Without reverse cycle, without louvered sides and with a certified cooling capacity of 8,000 to 10,999 Btu/h	9.6
8b. Without reverse cycle, without louvered sides and with a certified cooling capacity of 11,000 to 13,999 Btu/h	9.5
9. Without reverse cycle, without louvered sides and with a certified cooling capacity of 14,000 to 19,999 Btu/h	9.3
10. Without reverse cycle, without louvered sides and with a certified cooling capacity of 20,000 Btu/h or more	9.4
11. With reverse cycle, with louvered sides, and with a certified cooling capacity less than 20,000 Btu/h	9.8
12. With reverse cycle, without louvered sides, and with a certified cooling capacity less than 14,000 Btu/h	9.3
13. With reverse cycle, with louvered sides, and with a certified cooling capacity of 20,000 Btu/h or more	9.3
14. With reverse cycle, without louvered sides, and with a certified cooling capacity of 14,000 Btu/h or more	8.7
15. Casement-Only	9.5
16. Casement-Slider	10.4

* The certified cooling capacity is determined by the manufacturer in accordance with 10 CFR 429.15(a)(3).

The following standards apply to products manufactured starting 3 YEARS AFTER PUBLICATION OF THE FINAL RULE:

Equipment Class	Combined Energy Efficiency Ratio
1. Without reverse cycle, with louvered sides, and with a certified cooling capacity* less than 6,000 Btu/h	13.1
2. Without reverse cycle, with louvered sides and with a certified cooling capacity of 6,000 to 7,900 Btu/h	13.7
3. Without reverse cycle, with louvered sides and with a certified cooling capacity of 8,000 to 13,900 Btu/h	16.0
4. Without reverse cycle, with louvered sides and with a certified cooling capacity of 14,000 to 19,900 Btu/h	16.0
5a. Without reverse cycle, with louvered sides and with a certified cooling capacity of 20,000 Btu/h to 27,900 Btu/h	13.8
5b. Without reverse cycle, with louvered sides and with a certified cooling capacity of 28,000 Btu/h or more	13.2
6. Without reverse cycle, without louvered sides, and with a certified cooling capacity less than 6,000 Btu/h	12.8
7. Without reverse cycle, without louvered sides and with a certified cooling capacity of 6,000 to 7,900 Btu/h	12.8
8a. Without reverse cycle, without louvered sides and with a certified cooling capacity of 8,000 to 10,900 Btu/h	14.1
8b. Without reverse cycle, without louvered sides and with a certified cooling capacity of 11,000 to 13,900 Btu/h	13.9
9. Without reverse cycle, without louvered sides and with a certified cooling capacity of 14,000 to 19,900 Btu/h	13.7
10. Without reverse cycle, without louvered sides and with a certified cooling capacity of 20,000 Btu/h or more	13.8
11. With reverse cycle, with louvered sides, and with a certified cooling capacity less than 20,000 Btu/h	14.4
12. With reverse cycle, without louvered sides, and with a certified cooling capacity less than 14,000 Btu/h	13.7
13. With reverse cycle, with louvered sides, and with a certified cooling capacity of 20,000 Btu/h or more	13.7
14. With reverse cycle, without louvered sides, and with a certified cooling capacity of 14,000 Btu/h or more	12.8
15. Casement-Only	13.9
16. Casement-Slider	15.3

* The certified cooling capacity is determined by the manufacturer in accordance with 10 CFR 429.15(a)(3).

*	*	*	*	*

Note: The following letter will not appear in the Code of Federal Regulations.

U.S. DEPARTMENT OF JUSTICE
Antitrust Division
JONATHAN S. KANTER
Assistant Attorney General
Main Justice Building
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(202) 514-2401 / (202) 616-2645 (Fax)
May 31, 2022

Ami Grace-Tardy
Assistant General Counsel for Legislation, Regulation and
Energy Efficiency
U.S. Department of Energy
Washington, DC 20585
Ami.Grace-Tardy@hq.doe.gov

Dear Assistant General Counsel Grace-Tardy:

I am responding to your April 7, 2022, letter seeking the views of the Attorney General about the potential impact on competition of proposed energy conservation standards for room air conditioners (room ACs). Your request was submitted under Section 325(o)(2)(B)(i)(V) of the Energy Policy and Conservation Act, as amended (EPCA), 42 U.S.C. 6295(o)(2)(B)(i)(V) and 42 U.S.C. 6316(a), which requires the Attorney General to make a determination of the impact of any lessening of competition that is likely to result from the imposition of proposed energy conservation standards. The Attorney General's responsibility for responding to requests from other departments about the effect of a program on competition has been delegated to the Assistant Attorney General for the Antitrust Division in 28 CFR § 0.40(g).

In conducting its analysis, the Antitrust Division examines whether a proposed standard may lessen competition, for example, by substantially limiting consumer choice or increasing industry concentration. A lessening of competition could result in higher prices to manufacturers and consumers. We have reviewed the proposed standards contained in the Notice of Proposed Rulemaking (87 Fed. Reg. 20608 April 7, 2022), and the related technical support documents. We also reviewed the transcript from the public meeting held on May 3, 2022 and reviewed public comments submitted by industry members in response to DOE's Request for Information in this matter.

Based on the information currently available, we do not believe that the proposed energy conservation standards for room ACs are likely to have a significant adverse impact on competition.

Sincerely,

Jonathan S. Kanter