DEPARTMENT OF ENERGY

10 CFR Part 430

[EERE-2019-BT-STD-0030]

RIN 1904-AE40

Energy Conservation Program: Energy Conservation Standards for General Service Fluorescent Lamps

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

ACTION: Final determination.

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 general service fluorescent lamps (GSFLs). EPCA also requires the U.S. Department of Energy (DOE) to periodically determine whether more-stringent, amended standards would be technologically feasible and economically justified, and would result in significant energy savings. In this final determination, DOE has determined that energy conservation standards for GSFLs do not need to be amended.

DATES: The effective date of this final determination is **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]**.

ADDRESSES: The docket for this activity, 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, some documents listed in the index, such as information that is exempt from public disclosure, may not be publicly available.

The docket webpage can be found at *https://www.regulations.gov/docket/EERE-2019-BT-STD-0030*. The docket webpage 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: Mr. Bryan Berringer, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Office, EE-5B, 1000 Independence Avenue, SW., Washington, DC, 20585-0121. Email: *ApplianceStandardsQuestions@ee.doe.gov*.

Ms. Celia Sher, U.S. Department of Energy, Office of the General Counsel, GC-33, 1000 Independence Avenue, SW., Washington, DC, 20585-0121. Telephone: (202) 287-6122. Email: *Celia.Sher@hq.doe.gov*.

SUPPLEMENTARY INFORMATION:

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I. Synopsis of the Final Determination

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 GSFLs, the subject of this final determination. (42 U.S.C. 6292(a)(14)), 42 U.S.C. 6295(i)(3)-(5))

DOE is issuing this final determination pursuant to the EPCA requirement that not later than 6 years after issuance of any final rule establishing or amending a standard, DOE must publish either a notification of determination that standards for the product do not need to be amended, or a notice of proposed rulemaking (NOPR) including new proposed energy conservation standards (proceeding to a final rule, as appropriate). (42 U.S.C. 6295(m))

For this final determination, DOE analyzed GSFLs subject to standards specified in the Code of Federal Regulations (CFR) at 10 CFR 430.32(n)(1)-(3).

DOE first analyzed the technological feasibility of more energy efficient GSFLs. For those GSFLs for which DOE determined higher standards to be technologically feasible, DOE estimated energy savings that would result from potential energy conservation standards by conducting a national impacts analysis (NIA). DOE evaluated whether higher standards would be cost effective by estimating the net present value (NPV) of the total costs and benefits experienced by consumers.

Based on the results of the analyses, summarized in section V of this document, DOE determined that current standards for GSFLs do not need to be amended.

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[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.

II. Introduction

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

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 GSFLs, the subject of this document. (42 U.S.C. 6292(a)(14)) EPCA prescribed energy conservation standards for these products (42 U.S.C. 6295(i)(1)(B)), and directs DOE to conduct future rulemakings to determine whether to amend these standards. (42 U.S.C. 6295(i)(3)-(5))

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).

Subject to certain criteria and conditions, DOE is required to develop test procedures to measure the energy efficiency, energy use, or estimated annual operating cost of each covered product. (42 U.S.C. 6295(o)(3)(A) and 42 U.S.C. 6295(r)) Manufacturers of covered products must use the prescribed DOE test procedure as the basis for certifying to DOE that their products comply with the applicable energy

conservation standards adopted under EPCA and when making representations to the public regarding the energy use or efficiency of those products. (42 U.S.C. 6293(c) and 42 U.S.C. 6295(s)) Similarly, DOE must use these test procedures to determine whether the products comply with standards adopted pursuant to EPCA. (42 U.S.C. 6295(s)) The DOE test procedures for GSFLs appear at 10 CFR part 430, subpart B, appendix R.

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

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)) In this analysis, DOE considers such energy use in its determination of whether energy conservation standards need to be amended. DOE has determined that standby mode and off mode do not apply to GSFLs and that their energy use is accounted for entirely in the active mode. Therefore, DOE is not addressing standby and off modes, and will only address active mode in this final determination.

DOE must periodically review its already established energy conservation standards for a covered product no later than 6 years from the issuance of a final rule establishing or amending a standard for a covered product. (42 U.S.C. 6295(m)) This 6-year look-back provision requires that DOE publish either a determination that standards do not need to be amended or a NOPR, including new proposed standards (proceeding to a final rule, as appropriate). (42 U.S.C. 6295(m)(1)) EPCA further provides that, not later than 3 years after the issuance of a final determination not to amend standards, DOE must publish either a notification 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)(3)(B)) DOE must make the analysis on which a determination is based publicly available and provide an opportunity for written comment. (42 U.S.C. 6295(m)(2))

A determination that amended standards are not needed must be based on consideration of whether amended standards will result in significant conservation of energy, are technologically feasible, and are cost effective. (42 U.S.C. 6295(m)(1)(A) and (n)(2)) Additionally, any new or amended energy conservation standard prescribed by the Secretary for any type (or class) of covered product shall be designed to achieve the maximum improvement in energy efficiency which the Secretary determines is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A)) Among the factors DOE considers in evaluating whether a proposed standard level is economically justified includes whether the proposed standard at that level is cost-effective, as defined under 42 U.S.C. 6295(o)(2)(B)(i)(II). Under 42 U.S.C. 6295(o)(2)(B)(i)(II), an evaluation of cost-effectiveness requires DOE to consider 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. (42 U.S.C. 6295(n)(2) and (o)(2)(B)(i)(II)) DOE is publishing this final determination in satisfaction of the 6-year review requirement in EPCA.

B. Background

1. Current Standards

In a final rule published on January 26, 2015, DOE prescribed the current energy conservation standards for GSFLs. 80 FR 4042 (January 2015 final rule). These standards are set forth in DOE's regulations at 10 CFR 430.32(n)(3) and repeated in Table II.1.

Table II.1 Federal Energy Conservation Standards for GSFLs

Lamp Type	**Correlated Color Temperature**	**Minimum Average Lamp Efficacy** *Lumens per watt ("lm/W")*
Four-Foot Medium Bipin ("MBP")	≤ 4,500 Kelvin ("K")	92.4
	> 4,500 K and ≤ 7,000 K	88.7
Two-Foot U-Shaped	≤ 4,500 K	85.0
	> 4,500 K and ≤ 7,000 K	83.3
Eight-Foot Single Pin ("SP") Slimline	≤ 4,500 K	97.0
	> 4,500 K and ≤ 7,000 K	93.0
Eight-Foot Recessed Double Contact ("RDC") High Output	≤ 4,500 K	92.0
	> 4,500 K and ≤ 7,000 K	88.0
Four-Foot Miniature Bipin Standard Output	≤ 4,500 K	95.0
	> 4,500 K and ≤ 7,000 K	89.3
Four-Foot Miniature Bipin High Output	≤ 4,500 K	82.7
	> 4,500 K and ≤ 7,000 K	76.9

2. History of Standards Rulemakings for GSFLs

Amendments to EPCA in the Energy Policy Act of 1992 (EPAct 1992; Pub. L. 102-486) established energy conservation standards for certain classes of GSFLs and incandescent reflector lamps ("IRLs"), and authorized DOE to conduct two rulemaking

cycles to determine whether these standards should be amended. (42 U.S.C. 6295(i)(1) and (3)-(4)) EPCA also authorized DOE to adopt standards for additional GSFLs, if such standards were warranted. (42 U.S.C. 6295(i)(5)) DOE completed the first of these rulemaking cycles in a final rule published on July 14, 2009, that adopted amended performance standards for GSFLs and IRLs manufactured on or after July 14, 2012. 74 FR 34080. That rule adopted standards for additional GSFLs, amended the definition of "colored fluorescent lamp" and "rated wattage," and also adopted test procedures applicable to the newly covered GSFLs. *Id*. DOE completed a second rulemaking cycle to amend the standards for GSFLs and IRLs by publishing a final rule on January 26, 2015. 80 FR 4042. In that final rule, DOE amended standards for GSFLs and concluded that amending standards for IRLs would not be economically justified. *Id*. Energy conservation standards for GSFLs are set forth in 10 CFR 430.32(n). DOE test procedures for GSFLs appear at 10 CFR part 430, subpart B, appendix R.

In support of the present review of the GSFL energy conservation standards, DOE published a request for information (RFI) on May 1, 2020, which identified various issues on which DOE sought comment to inform its determination of whether amended standards for GSFLs and IRLs are warranted. 85 FR 25326 (May 2020 RFI). On May 31, 2022, DOE published a notice of proposed determination not to amend standards for GSFLs. 87 FR 32329 (May 2022 NOPD). In the May 2022 NOPD, DOE stated that it was only considering amending standards for GSFLs, and not IRLs, because of two final rules recently published on May 9, 2022. The first rule, among other things, expanded the definition of general service lamps ("GSL") to include IRLs. 87 FR 27461. The second rule, published on that same day, implemented a statutory backstop requirement for GSLs of 45 lumens per watt (lm/W). 87 FR 27439. Because IRLs, a newly covered GSL, cannot meet the 45 lm/W backstop requirement, DOE did not evaluate amended

standards for IRLs in the May 2022 NOPD. Similarly, in this final determination, DOE evaluated amended standards only for GSFLs.

DOE received comments in response to the May 2022 NOPD from the interested parties listed in Table II.2.

Table II.2 May 2022 NOPD Written Comments

Commenter(s)	Reference in this Final Determination	Comment No. in the Docket	Commenter Type
Appliance Standards Awareness Project ("ASAP"), the American Council for an Energy-Efficient Economy ("ACEEE"), the New York State Energy Research and Development Authority ("NYSERDA"), and the Northwest Energy Efficiency Alliance ("NEEA")	ASAP et al.	19	Efficiency Organizations
National Electrical Manufacturers Association	NEMA	18	Trade Association

A parenthetical reference at the end of a comment quotation or paraphrase provides the location of the item in the public record.[3]

III. General Discussion

DOE developed this final determination after considering comments, data, and information from interested parties that represent a variety of interests. This final determination 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

[3] The parenthetical reference provides a reference for information located in the docket. (Docket No. EERE-2019-BT-STD-0030, which is maintained at *www.regulations.gov*) The references are arranged as follows: (commenter name, comment docket ID number, page of that document).

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)) The product classes for this final determination are discussed in further detail in section IV.A.4 of this document. This final determination covers GSFLs defined as any fluorescent lamp which can be used to satisfy the majority of fluorescent lighting applications, but does not include any lamp designed and marketed for the following nongeneral application: (1) Fluorescent lamps designed to promote plant growth; (2) Fluorescent lamps specifically designed for cold temperature applications; (3) Colored fluorescent lamps; (4) Impact-resistant fluorescent lamps; (5) Reflectorized or aperture lamps; (6) Fluorescent lamps designed for use in reprographic equipment; (7) Lamps primarily designed to produce radiation in the ultra-violet region of the spectrum; and (8) Lamps with a Color Rendering Index of 87 or greater. 10 CFR 430.2. The scope of coverage is discussed in further detail in section IV.A.1 of this 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. (42 U.S.C. 6295(s) and 42 U.S.C. 6293(c)) DOE's current energy conservation standards for GSFLs are expressed in terms of lm/W (*see* 10 CFR part 430, subpart B, appendix R).

On July 6, 2009, DOE published a final rule that updated citations to industry standards and made several other modifications to the GSFL test procedure. 74 FR

31829. DOE further amended the test procedures to update references to industry standards for GSFLs in a final rule published on January 27, 2012. 77 FR 4203. On August 8, 2017, DOE published a RFI seeking comments on the current test procedures for GSFLs, IRLs, and general service incandescent lamps (GSILs). 82 FR 37031. On June 3, 2021, DOE published a NOPR proposing amendments to DOE's GSFL, IRL and GSIL test procedures. 86 FR 29888. On August 31, 2022, DOE published a final rule adopting the proposed amendments. 87 FR 53618. In that final rule, with regard to GSFLs, DOE updated the latest versions of the referenced industry test standards and provided cites to specific sections of these standards; clarified definitions, test conditions and methods, and measurement procedures; clarified test frequency and inclusion of cathode power in measurements; allowed manufacturers to make voluntary (optional) representations of GSFLs at high frequency settings; revised the sampling requirements; and aligned sampling and certification requirements with adopted test procedure terminology and with the Federal Trade Commission's labeling program. 87 FR 53618, 53620-53621.

The current test procedures for GSFLs are codified in appendix R to subpart B of 10 CFR part 430.

C. Technological Feasibility

1. General

In evaluating potential amendments to energy conservation standards, 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 determination. 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 10 CFR part 430, subpart C, appendix A (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. Sections 6(b)(3)(ii)-(v) and 7(b)(2)-(5) of appendix A. Section IV.A.3 of this document discusses the results of the screening analysis for GSFLs, particularly the designs DOE considered, those it screened out, and those that are the basis for the standards considered in this final determination. For further details on the screening analysis for this final determination, see chapter 4 of the final determination technical support document (TSD).

2. Maximum Technologically Feasible Levels

As when DOE proposes to adopt an amended standard for a type or class of covered product, in this analysis it must determine the maximum improvement in energy efficiency or maximum reduction in energy use that is technologically feasible for such a 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 GSFLs, 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 analysis are described in section IV.B of this final determination and in chapter 5 of the final determination TSD.

D. Energy Savings

1. Determination of Savings

For each efficiency level (EL) evaluated, DOE projected energy savings from application of the EL to the GSFLs purchased in the 30-year period that begins in the assumed year of compliance with the potential standards (2026–2055). The savings are measured over the entire lifetime of the GSFLs purchased in the previous 30-year period. In order to account for wider market dynamics, DOE also modeled the purchases and energy consumption of tubular light-emitting diodes (TLEDs) over the same period that would compete for GSFL demand. DOE quantified the energy savings attributable to each EL as the difference in energy consumption of both GSFLs and TLEDs between each standards case and the no-new-standards case. The no-new-standards case represents a projection of energy consumption that reflects how the market for a product would likely evolve in the absence of amended energy conservation standards. DOE used its NIA spreadsheet model[4] to estimate national energy savings (NES) from potential amended or new standards for GSFLs. The NIA spreadsheet model (described in section IV.F 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 NES in terms of primary energy savings, which is the savings in the energy that is used to generate and transmit the site electricity. DOE also calculates NES in terms of full-fuel-cycle (FFC) energy savings. The FFC metric includes the energy consumed in extracting, processing, and transporting primary fuels (*i.e.*, coal, natural gas, petroleum fuels), and thus presents a more complete picture of the impacts of energy conservation standards.[5] DOE's approach is based on the calculation of an FFC

[4] A model coded in the Python programming language to estimate lamp purchases, energy consumption, and national energy savings.

[5] 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).

multiplier for each of the energy types used by covered products or equipment. For more information on FFC energy savings, see section IV.F of this document.

2. Significance of Savings

In determining whether amended standards are needed, DOE must consider whether such standards will result in significant conservation of energy. (42 U.S.C. 6295(m)(1)(A)) 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, 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.

E. Cost Effectiveness

Under EPCA's six-year-lookback review provision for existing energy conservation standards at 42 U.S.C. 6295(m)(1), cost-effectiveness of potential amended standards is a relevant consideration both where DOE proposes to adopt such standards, as well as where it does not. In considering cost-effectiveness when making a determination of whether amended energy conservation standards do not need to be amended, DOE considers the savings in operating costs throughout the estimated average life of the covered product 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(m)(1)(A) (*referencing* 42 U.S.C. 6295(n)(2))) Additionally, any new or amended energy conservation standard prescribed by the Secretary for any type (or class) of covered product shall be designed to achieve the maximum

improvement in energy efficiency which the Secretary determines is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A)) Cost-effectiveness is one of the factors that DOE considers under 42 U.S.C. 6295(o)(2)(B) in determining whether new or amended standards are economically justified. (42 U.S.C. 6295(o)(2)(B)(i)(II))

In determining cost effectiveness of amending standards for covered products, DOE generally conducts life-cycle cost (LCC) and payback period (PBP) analyses that estimate the costs and benefits to users from potential standards. Based on the rapidly declining shipments of GSFLs, and limited and uncertain energy savings opportunity, as discussed in sections IV.C, IV.E, and V.C of this final determination, DOE did not conduct LCC and PBP analyses to evaluate the economic impacts on individual consumers of amended GSFL energy conservation standards. To further inform DOE's consideration of the cost effectiveness of potential amended standards, DOE considered the NPV of total costs and benefits estimated as part of the NIA. 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.

F. Further Considerations

Pursuant to EPCA, absent DOE publishing a notification of determination that energy conservation standards for GSFLs do not need to be amended, DOE must issue a NOPR that includes new proposed standards. (42 U.S.C. 6295(m)(1)(B)) The new proposed standards in any such NOPR must be based on the criteria established under 42 U.S.C. 6295(o) and follow the procedures established under 42 U.S.C. 6295(p). (42

U.S.C. 6295(m)(1)(B)) The criteria in 42 U.S.C. 6295(o) require that standards be designed to achieve the maximum improvement in energy efficiency, which the Secretary determines is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A)) 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 for, or maintenance expenses of 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 considers relevant.

(42 U.S.C. 6295(o)(2)(B)(i)(I)–(VII))

IV. Methodology and Discussion of Related Comments

This section addresses the analyses DOE has performed for this final determination with regard to GSFLs. Separate subsections address each component of DOE's analyses. DOE used several analytical tools to estimate the impact of potential energy conservation standards. The NIA uses a spreadsheet set that provides shipments projections and calculates NES and net present value of total consumer costs and savings expected to result from potential energy conservation standards. These spreadsheet tools are available on the website: *www.regulations.gov/docket?D=EERE-2019-BT-STD-0030.*

DOE received general comments on the May 2022 NOPD. NEMA stated that it agreed with DOE's proposed determination to not amend current energy conservation standards for GSFLs because the technology is highly mature, and its market share is in sharp decline. (NEMA, No. 18 at p. 2)

ASAP et al. commented that in the May 2022 NOPD, DOE stated that projected energy savings from more stringent standards are due to a faster market shift to solid state lighting rather than reduction in GSFL energy use. ASAP et al. stated that this conclusion indicates that significant savings can be achieved by regulating linear lamps under a technology-neutral standard, which would accelerate transition of the market to light-emitting diodes (LEDs). ASAP et al. stated that NEMA's lamp sales index in the first quarter (Q1) of 2022 reported about two thirds of linear lamp shipments were still

fluorescent. Specifically, ASAP et al. stated that because GSFLs and TLEDs provide the same utility for consumers, it makes sense to subject them to the same standards. (ASAP et al., No. 19 at pp. 1-2)

Further, ASAP et al. stated that replacing a linear fluorescent lamp with the more efficient TLED can reduce power consumption by 50 percent. It also stated that a 2022 ASAP and American Council for an Energy-Efficient Economy report estimated that a complete transition from fluorescent to LED lighting would yield cumulative carbon dioxide (CO_2) emissions reductions of about 200 million metric tons through 2050, the vast majority of which would come from linear lamps. ASAP et al. acknowledged that in the May 2022 NOPD, DOE stated that this rulemaking cannot address any product that does not meet the definition of a GSFL. ASAP et al. encouraged DOE to explore the possibility of setting a technology-neutral standard for all linear lamps in a separate rulemaking. (ASAP et al., No. 19 at p. 2)

In the May 2022 NOPD, DOE stated that the proposed determination addresses only GSFLs defined in 10 CFR 430.2, which do not include TLEDs. DOE stated that it is not authorized to consider any product not meeting this definition, such as TLEDs, as a part of this proposed determination. 87 FR 32329, 32336. Hence in the May 2022 NOPD, DOE did not conduct an analysis in which the scope of coverage included TLEDs. For the same reasons as stated in the May 2022 NOPD, DOE did not include TLEDs in the analysis of this final determination. However, as in the May 2022 NOPD, DOE agrees with ASAP et al. that TLEDs have gained market share at the expense of GSFLs and are suitable substitutes for GSFLs. Certain types of TLEDs are included in the definition of GSL in 10 CFR 430.2, and DOE is currently evaluating amending standards for GSLs in a NOPR published on January 11, 2023. 88 FR 1638.

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 final determination include (1) a determination of the scope 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 GSFLs. The key findings of DOE's market assessment are summarized in the following sections. See chapter 3 of the final determination TSD for further discussion of the market and technology assessment.

1. Scope of Coverage and Product Classes

In this analysis, DOE relied on the definition of fluorescent lamp and general service fluorescent lamp in 10 CFR 430.2. A fluorescent lamp is a low pressure mercury electric-discharge source in which a fluorescing coating transforms some of the ultraviolet energy generated by the mercury discharge into light, including only the following: (1) any 4-foot straight-shaped, medium bipin lamp with a rated wattage of 25 or more; (2) any 2-foot U-shaped, medium bipin (MBP) lamp with a rated wattage of 25 or more; (3) any 8-foot rapid start, recessed double contact (RDC) base, high output (HO) lamp; (4) any 8-foot instant start, single pin (SP) base, slimline lamp with a rated wattage of 49 or more; (5) any 4-foot straight-shaped, miniature bipin (MiniBP) standard output (SO) lamp with a rated wattage of 25 or more; and (6) any 4-foot straight-shaped,

MiniBP HO lamp with a rated wattage of 44 or more. 10 CFR 430.2. GSFL is defined as any fluorescent lamp which can be used to satisfy the majority of fluorescent lighting applications, but does not include any lamp designed and marketed for the following nongeneral application: (1) fluorescent lamps designed to promote plant growth; (2) fluorescent lamps specifically designed for cold temperature applications; (3) colored fluorescent lamps; (4) impact-resistant fluorescent lamps; (5) reflectorized or aperture lamps; (6) fluorescent lamps designed for use in reprographic equipment; (7) lamps primarily designed to produce radiation in the ultra-violet region of the spectrum; and (8) lamps with a color rendering index (CRI) of 87 or greater. 10 CFR 430.2. Any product meeting the definition of GSFL is included in DOE's scope of coverage, though all products within the scope of coverage may not be subject to standards.

NEMA stated that there are energy saving opportunities in regulating the currently exempt linear fluorescent lamps with CRI of 87 or greater (high CRI). NEMA further stated that over the past years nine states (VT, CO, HI, WA, MA, OR, NV, NJ, MD) and the District of Columbia have passed regulations requiring high CRI linear fluorescent lamps meet current DOE efficiency standards. NEMA stated that these regulations are inconsistent in terms of effective dates and types of restriction (*e.g.,* sell-by, install by, manufacture by) and therefore, are administratively burdensome and increase risk of non-compliance and enforcement confusion for manufacturers, distributors, and retailers. NEMA further stated that in its April 2022 Forward Regulatory Plan, Canada's Office of Energy Efficiency also proposed to remove the exemption of high CRI fluorescent lamps from its energy efficiency standards. Based on potential energy savings and to provide uniformity in regulations at the national level and to continue to align with Canada's appliance energy efficiency standards, NEMA recommended that DOE expand the scope of this rulemaking to include high CRI linear

fluorescent lamps and subject them to current energy efficiency standards. (NEMA, No. 18 at p. 2)

NEMA recommended a three-year implementation period of subjecting the high CRI lamps to current energy efficiency standards based on a manufacture by end-date. NEMA stated that three-year implementation periods are common in DOE's lighting product rulemakings and industry is familiar with the timeline. (NEMA, No. 18 at p. 2)

ASAP et al. also encouraged DOE to address energy savings opportunities from exempt fluorescent lamps including high CRI lamps. ASAP et al. stated that as standards for non-exempt GSFLs have been implemented, use of certain exempt lamps has become more widespread as the lamps are marketed for general use. In particular, ASAP et al. commented that high CRI and impact resistant linear lamps have gained in market share and will continue to do so. ASAP et al. stated that this is particularly problematic as most high CRI and to a lesser extent impact resistant lamps are being sold as T12 lamps, which are generally the most inefficient. ASAP et al. stated that the 2015 U.S. Lighting Market Characterization (LMC) report showed average efficacies of T12 lamps to be 70 to 80 lumens per watt (lm/W) and a recent review of the market showed a high CRI 4-foot medium bipin T12 lamp for sale with an efficacy of 55 lm/W (*i.e.,* almost 40 percent less efficacious than a lamp that just meets current GSFL energy efficiency standards). Further, ASAP et al. stated that the shift to TLEDs is impacting T8 lamps while the market share of T12 lamps remains relatively steady and will continue to do so in the absence of standards. ASAP et al. stated that according to NEMA lamp sales indexes, in Q1 2022, T8, T12, and T5 lamps accounted for 49.6, 9.7, and 7.5 percent of the market of linear fluorescent lamps, respectively. ASAP et al. also stated that a 2019 California Energy Commission report estimated that replacing a 4-foot T12, 8-foot standard output

T12, and 8-foot high output T12 with a compliant T8 lamp yields energy savings of 45 kilowatt hour per year (kWh/yr), 83 kWh/yr, and 126 kWh/yr, respectively. (ASAP et al., No. 19 at pp. 2-3)

Finally, similar to comments provided by NEMA (see NEMA, No. 18 at p. 2), ASAP et al. cited states that had adopted regulations for high CRI lamps and additionally noted that in May 2022, New York state passed legislation that would give the New York State Energy Research and Development Authority the power to set standards for federally exempt fluorescent lamps, and in July 2022, the California Energy Commission announced "Federally Exempted Linear Fluorescent Lamps" as an upcoming standards rulemaking. (ASAP et al., No. 19 at p. 3)

ASAP et al. acknowledged that DOE stated in the May 2022 NOPD that it cannot modify the definition of GSFL to include statutorily exempt lamps in this rulemaking. ASAP et al. encouraged DOE to pursue setting standards for exempt lamps in a separate rulemaking. (ASAP et al., No. 19 at pp. 2-3)

In the May 2022 NOPD, DOE stated that exemptions for high CRI lamps and impact resistant fluorescent lamps are included in the statutory definition of "general service fluorescent lamp" (42 U.S.C. 6291(30)(B)) and it is not within the scope of DOE's authority in this rulemaking to modify these statutory exemptions. Additionally, as stated in the May 2022 NOPD, DOE finds no basis in the language of EPCA to support assertions that the agency's authority to consider energy conservation standards for "additional" GSFL under 42 U.S.C. 6295(i)(5) is unlimited. As discussed in the May 2022 NOPD, DOE interprets section 6295(i)(5) to cover additional GSFL that are not one of the lamps excluded from the definition of GSFL in 42 U.S.C. 6291(30)(B). 87 FR

32329, 32335-36. For these reasons, DOE did not consider high CRI lamps to be in the scope of this rulemaking.

2. Technology Options

In the May 2022 NOPD, DOE identified several technology options that would be expected to improve the efficiency (*i.e.,* efficacy or lumens per watt) of GSFLs, as measured by the DOE test procedure. To develop a list of technology options, DOE reviewed manufacturer catalogs, recent trade publications and technical journals, and the January 2015 final rule. In addition to the technology options identified in the January 2015 final rule, DOE identified mercury isotopes as a technology option that can be implemented to improve the efficiency of GSFLs. Mercury used in GSFLs is composed of seven different isotopes, each having a distinct excited state that provides ultraviolet (UV) light. The abundance of these isotopes can be altered to optimize the amount of UV light emitted and increase the efficiency of the lamp. 87 FR 32329, 32336. For more detail on this technology option, see chapter 3 of the final determination TSD.

NEMA stated that it agreed with DOE's assessment of technology options. (NEMA, No. 18 at p. 2)

In summary, in this final determination, DOE considers the technology options proposed in the May 2022 NOPD and shown in Table IV.1. Detailed descriptions of these technology options can be found in chapter 3 of the final determination TSD.

Table IV.1 GSFL Technology Options

Technology Option	Description
Highly Emissive Electrode Coatings	Improved electrode coatings allow electrons to be more easily removed from electrodes, reducing lamp power and increasing overall efficacy.
Higher Efficiency Lamp Fill Gas Composition	Fill gas compositions improve cathode thermionic emission or increase mobility of ions and electrons in the lamp plasma.
Higher Efficiency Phosphors	Phosphors increase the conversion of UV light into visible light.
Glass Coatings	Coatings on inside of bulb enable the phosphors to absorb more UV energy, so that they emit more visible light.
Higher Efficiency Lamp Diameter	Optimal lamp diameters improve lamp efficacy.
Multi-Photon Phosphors	Phosphors emit more than one visible photon for each incident UV photon.
Mercury Isotopes	The abundance of mercury isotopes can be altered to optimize the amount of UV light emitted and increase the efficiency of the lamp.

3. Screening Analysis

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

(1) *Technological feasibility*. Technologies that are not incorporated in commercial products or in commercially viable, existing prototypes will not be considered further.

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

(3) *Impacts on product utility*. If a technology is determined to have a significant adverse impact on the utility of the product to subgroups of consumers, or result in the unavailability of any covered product type with performance characteristics (including reliability), features, sizes, capacities,

and volumes that are substantially the same as products generally available in the United States at the time, it will not be considered further.

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

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

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

In summary, if DOE determines that a technology, or a combination of technologies, fails to meet one or more of the listed five criteria, it will be excluded from further consideration in the engineering analysis. NEMA commented that it agreed with DOE's screening analysis in the May 2022 NOPD. (NEMA, No. 18 at p. 2)

a. Screened-Out Technologies

In the May 2022 NOPD, DOE did not find that multi-photon phosphors or mercury isotopes are being used in working prototypes or in commercially available products. 87 FR 32329, 32337. Therefore, as in the May 2022 NOPD, in this final determination DOE has screened out multi-photon phosphors and mercury isotopes based on technological feasibility. See chapter 4 of the final determination TSD for further details on the GSFL screening analysis.

b. Remaining Technologies

After reviewing each technology, and consistent with the May 2022 NOPD (87 FR 32329, 32337), DOE did not screen out the following technology options and considers them as design options in the engineering analysis:

(1) Highly Emissive Electrode Coatings

(2) Higher Efficiency Lamp Fill Gas Composition

(3) Higher Efficiency Phosphors

(4) Glass Coatings

(5) Higher Efficiency Lamp Diameter

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 determination TSD.

4. Product Classes

In general, when evaluating and establishing energy conservation standards, DOE divides the covered product into classes by (1) the type of energy used, (2) the capacity of the product, or (3) any other performance-related feature that affects energy efficiency and justifies different standard levels, considering factors such as consumer utility. (42 U.S.C. 6295(q))

a. Existing Product Classes

For GSFLs, the current energy conservation standards specified in 10 CFR 430.32(n)(4) are based on 12 product classes, separated according to the following three factors: (1) correlated color temperature (CCT); (2) physical constraints of lamps (*i.e.*,

lamp shape and length); and (3) lumen package (*i.e.*, standard output ("SO") versus high output (HO)).

b. Summary

Having received no comments on product classes, as proposed in the May 2022 NOPD (87 FR 32329, 32337), DOE maintains the existing separate product classes for GSFLs based on the following three factors: (1) CCT (*i.e.,* less than or equal to versus greater than 4,500 K); (2) physical constraints of lamps (*i.e.*, lamp shape and length); and (3) lumen package (*i.e.,* SO versus HO). In summary, DOE assesses the product classes shown in Table IV.2 in its analysis.

Table IV.2 GSFL Product Classes

Lamp Type	CCT
4-foot medium bipin ("MBP")	≤ 4,500 K
	> 4,500 K
2-foot U-shaped	≤ 4,500 K
	> 4,500 K
8-foot single pin slimline	≤ 4,500 K
	> 4,500 K
8-foot recessed double contact high output	≤ 4,500 K
	> 4,500 K
4-foot T5, miniature bipin standard output	≤ 4,500 K
	> 4,500 K
4-foot T5, miniature bipin high output	≤ 4,500 K
	> 4,500 K

B. Engineering and Cost Analysis

The purpose of the engineering analysis is to establish the relationship between the efficiency and cost of GSFLs. There are two elements to consider in the engineering analysis; the selection of efficiency levels to analyze (*i.e.*, the "efficiency analysis") and the determination of product cost at each efficiency level (*i.e.*, the "cost analysis"). In determining the performance of higher-efficiency products, DOE considers technologies

and design option combinations not eliminated by the screening analysis. For each product class, DOE estimates the baseline cost, as well as the incremental cost for the product at efficiency levels above the baseline. The output of the engineering analysis is a set of cost-efficiency "curves" that are used in downstream analyses (*i.e.*, the LCC and PBP analyses and the NIA).

1. Efficiency Analysis

DOE typically uses one of two approaches to develop energy efficiency levels for the engineering analysis: (1) relying on observed efficiency levels in the market (*i.e.*, the efficiency-level approach), or (2) determining the incremental efficiency improvements associated with incorporating specific design options to a baseline model (*i.e.*, the design-option approach). Using the efficiency-level approach, the efficiency levels established for the analysis are determined based on the market distribution of existing products (in other words, based on the range of efficiencies and efficiency level "clusters" that already exist on the market). Using the design option approach, the efficiency levels established for the analysis are determined through detailed engineering calculations and/or computer simulations of the efficiency improvements from implementing specific design options that have been identified in the technology assessment. DOE may also rely on a combination of these two approaches. For example, the efficiency-level approach (based on actual products on the market) may be extended using the design option approach to 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 final determination, DOE is adopting an efficiency-level approach for GSFLs. For GSFLs, efficiency levels (ELs) are determined as lumens per watt, which is known as the lamp's efficacy. DOE derives ELs in the efficiency analysis and end-user prices in the cost analysis. DOE estimates the end-user price of GSFLs directly because reverse-engineering a lamp is impractical, as the lamps are not easily disassembled. By combining the results of the efficiency analysis and the cost analysis, DOE derives typical inputs for use in the LCC and NIA. Section IV.B.2 discusses the cost analysis (see chapter 5 of the final determination TSD for further details).

The methodology for the efficiency analysis consists of the following steps: (1) select representative product classes, (2) select baseline lamps, (3) identify more efficacious substitutes, (4) develop ELs by directly analyzing representative product classes, and (5) scale ELs to non-representative product classes. The efficiency analysis is discussed in the sections following and further details are provided in chapter 5 of the final determination TSD.

a. Representative Product Classes

In the case where a covered product has multiple product classes, DOE identifies and selects certain product classes as "representative" and concentrates its analytical effort on those classes. DOE chooses product classes as representative primarily because of their high market volumes. DOE then scales its analytical findings for those representative product classes to other product classes that are not directly analyzed. As in the May 2022 NOPD (87 FR 32329, 32338), in this final determination, based on its assessment of product offerings, DOE analyzed as representative all GSFLs with CCTs less than or equal to 4,500 K with the exception of the 2-foot U-shaped lamps, as shown in gray in Table IV.3 of this document. DOE did not directly analyze GSFLs with CCTs

greater than 4,500 K or GSFLs that are 2-foot U-shaped lamps of any CCT due to low shipment volumes.

Table IV.3. GSFL Representative Product Classes

Lamp Type	CCT
4-foot medium bipin	≤ 4,500 K
	> 4,500 K
2-foot U-shaped	≤ 4,500 K
	> 4,500 K
8-foot single pin slimline	≤ 4,500 K
	> 4,500 K
8-foot recessed double contact high output	≤ 4,500 K
	> 4,500 K
4-foot T5, miniature bipin standard output	≤ 4,500 K
	> 4,500 K
4-foot T5, miniature bipin high output	≤ 4,500 K
	> 4,500 K

b. Baseline Efficiency

For each product 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 class represents the characteristics of a product 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.

In the May 2022 NOPD, to identify baseline lamps for this analysis, DOE reviewed data in the compliance certification database, product offerings in catalogs and on retailer websites, and manufacturer feedback obtained during interviews. DOE used the efficacy values of lamps in the compliance certification database to select baseline lamps. For representative product classes without certification data at the baseline, DOE

used catalog and retailer data to select a baseline lamp. Specifically, DOE selected a baseline lamp from a retailer for the 8-foot SP slimline product class because DOE was unable to identify any lamp in the compliance certification database that just meets the existing standards with common attributes for lamps in the product class. 87 FR 32329, 32338. DOE utilized the same methodology in this final determination as in the May 2022 NOPD. In this final determination, as in the May 2022 NOPD (87 FR 32329, 32338), DOE selected the GSFL baseline lamps specified in Table IV.4. See chapter 5 of the final determination TSD for more detail.

Table IV.4 GSFL Baseline Lamps

Representative Product Class	Lamp Diameter	Nominal Wattage	Efficacy**	Initial Lumen Output	Mean Lumen Output	Rated Life***	CRI
		W	*lm/W*	*lm*	*lm*	*hr*	
4-foot MBP	T8	32	92.4	3,050	2,910	24,000	85
8-foot SP slimline	T8	59	98.2	5,900	5,430	15,000	82
8-foot RDC HO	T8	86	94.6	8,000	7,520	18,000	78
4-foot T5 MiniBP SO*	T5	28	95.9	2,610	2,453	24,000	85
4-foot T5 MiniBP HO*	T5	54	83	4,500	4,140	30,000	85

* 4-foot T5 MiniBP SO and HO initial lumen output, and mean lumen output given at 25 °C. Initial and mean lumens are calculated from catalog lumens at 35°C by applying a 10 percent lumen reduction.

** Efficacy is from the compliance certification database, if available, or catalog initial lumen output divided by the American National Standards Institute ("ANSI") rated wattage if the lamp does not have certification data

*** Rated life is based on an instant start ballast with 3 hour starts for the 4-foot MBP and 8-foot SP slimline product classes and a programmed start ballasts with 3 hour starts for all other product classes.

c. More Efficacious Substitutes

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. DOE selects more efficacious replacements for the baseline lamps considered within each

representative product class. DOE considers only design options identified in the screening analysis. In the May 2022 NOPD, more efficacious substitutes were selected such that, where possible, potential substitutions maintained light output within 10 percent of the baseline lamp's light output. DOE also sought to keep characteristics of substitute lamps, such as CCT, CRI, and lifetime, as similar as possible to the baseline lamps. DOE used efficacy data from the compliance certification database to identify more efficacious substitutes in all product classes. DOE ensured that all more efficacious substitutes selected showed an improvement in efficacy of at least one percent from the previous level. DOE identified more efficacious substitutes that typically represent a group of lamps in the compliance certification database with similar efficacy data. 87 FR 32329, 32339.

NEMA commented that it agreed with DOE's assessment of potentially more efficacious substitutes, in particular issues regarding performance such as dimming and other inversely proportional relationships between technology options and performance. (NEMA, No. 18 at p. 3)

DOE utilized the same methodology for identifying more efficacious substitutes in this final determination as in the May 2022 NOPD. In this final determination, as in the May 2022 NOPD (87 FR 32329, 32339), DOE analyzed the more efficacious substitutes shown in Table IV.5 of this document. See chapter 5 of the final determination TSD for more detail.

Table IV.5 GSFL More Efficacious Substitutes

Product Classes	EL	Lamp Diameter	Nominal Wattage	Efficacy**	Initial Light Output	Mean Light Output	Rated Life***	CRI
			W	lm/W	lm	lm	hr	
4-foot MBP	EL 1	T8	32	93.6	3,200	3,010	24,000	85
	EL 2	T8	32	94.6	3,100	2,915	24,000	85
	EL 2	T8	25	100.8	2,300	2,230	32,000	85
	EL 2	T8	28	100.3	2,725	2,560	24,000	85
8-foot SP slimline	EL 1	T8	59	99.6	5,900	5,430	18,000	82
	EL 2	T8	59	102.8	6,100	5,730	24,000	85
	EL 2	T8	49	105.4	5,000	4,700	24,000	82
8-foot RDC HO	EL 1	T8	86	99.0	8,200	7,800	18,000	85
	EL 2	T8	86	108.4	8,200	7,710	18,000	85
T5 MiniBP SO*	EL 1	T5	28	97.0	2,610	2,394	30,000	85
	EL 2	T5	28	98.8	2,610	2,427	36,000	85
	EL 3	T5	28	100.8	2,610	2,408	24,000	82
	EL 3	T5	26	101.0	2,610	2,394	25,000	85
T5 MiniBP HO*	EL 1	T5	54	85.6	4,500	4,185	30,000	85
	EL 1	T5	49	88.8	4,365	4,140	36,000	85
	EL 2	T5	54	89.8	4,500	4,050	30,000	82
	EL 2	T5	47	90.0	4,320	3,969	30,000	84
	EL 3	T5	54	96.4	4,365	4,140	36,000	85
	EL 3	T5	49	96.5	4,500	4,005	30,000	85

* 4-foot T5 MiniBP SO and HO rated efficacy, initial lumen output, and mean lumen output given at 25 °C. Initial and mean lumens are calculated from catalog lumens at 35°C by applying a 10 percent lumen reduction.

** Efficacy is from the compliance certification database, if available, or catalog/retailer initial lumen output divided by the ANSI rated wattage if the lamp does not have certification data.

*** Rated life is based on an instant start ballast with 3 hour starts for the 4-foot MBP and 8-foot SP slimline product classes and a programmed start ballasts with 3 hour starts for all other product classes.

d. Higher Efficiency Levels

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.

After identifying more efficacious substitutes for each of the baseline lamps, in the May 2022 NOPD, DOE developed ELs based on the consideration of several factors, including: (1) The design options associated with the specific lamps being studied (e.g., grades of phosphor); (2) the ability of lamps across wattages to comply with the standard level of a given product class; and (3) max-tech level. Although fluorescent lamps are a component of a system that often includes ballasts and fixtures, DOE based its ELs only on lamp performance because GSFLs are the subject of this analysis. DOE acknowledges, however, that the energy consumption of fluorescent lamps is related to the ballast on which they operate. Therefore, in the May 2022 NOPD, DOE paired each lamp with an appropriate ballast to better approximate real-world conditions. 87 FR 32329, 32340. DOE utilized the same methodology in this final determination as in the May 2022 NOPD (see section IV.B.1.e of this document for more information).

In the May 2022 NOPD, to determine appropriate ELs, DOE used efficacy values of lamps certified in its compliance certification database. DOE considered only ELs at which a full wattage version of the lamp type was available because reduced wattage lamps have limited dimming capability. 87 FR 32329, 32340. DOE utilized the same methodology in this final determination as in the May 2022 NOPD. In this final determination, as in the May 2022 NOPD, DOE identified the ELs summarized in Table IV.6 of this document. See chapter 5 of the final determination TSD for more detail.

Table IV.6 Summary of ELs for GSFL Representative Product Classes

CCT	Lamp Type	Efficacy Level lm/W		
		1	2	3
≤ 4,500 K	4-foot MBP	93.6	94.6	N/A
	8-foot SP slimline	99.6	102.8	N/A
	8-foot RDC HO	99.0	108.4	N/A
	4-foot T5 MiniBP SO	97.0	98.8	100.8
	4-foot T5 MiniBP HO	85.6	89.8	96.4

e. Lamp-and-Ballast Systems

Because fluorescent lamps operate on a ballast in practice, in the May 2022 NOPD, DOE analyzed lamp-and-ballast systems in the engineering analysis. DOE determined that pairing a lamp with a ballast more accurately captures real-world energy use and light output. 87 FR 32329, 32340.

In the May 2022 NOPD, DOE considered two different scenarios in the engineering analysis: (1) A lamp replacement scenario in which the consumer selects a replacement lamp that can operate on the installed ballast and (2) a lamp-and-ballast replacement scenario in which the consumer selects a new lamp and also selects a new ballast with potentially different performance characteristics, such as ballast factor[6] (BF) or ballast luminous efficiency[7] (BLE). DOE only selected replacement systems that do not have higher energy consumption than the baseline system. For both substitution

[6] BF is defined as the output of a ballast delivered to a reference lamp in terms of power or light divided by the output of the relevant reference ballast delivered to the same lamp (ANSI C82.13– 2002). Because BF affects the light output of the system, manufacturers design ballasts with a range of ballast factors to allow consumers to vary the light output, and thus power consumed, of a fluorescent system. See the fluorescent lamp ballast (FLB) final determination (published on October 22, 2019, 85 FR 81558) TSD chapter 3. The FLB Energy Conservation Standards final determination materials are available at *www.regulations.gov/docket?D=EERE-2015-BT-STD-0006*.

[7] BLE is the ratio of the total lamp arc power to ballast input power, multiplied by the appropriate frequency adjustment factor.

scenarios, DOE determined energy consumption by calculating the system input power of the lamp-and-ballast system. 87 FR 32329, 32340.

The system input power represents the energy consumption rate of both the lamp and ballast, and therefore is greater than the rated power of the lamp alone. In addition to the rated lamp power, the system input power is also affected by the number of lamps operated per ballast, BLE of ballast used, starting method, and the BF of that ballast.

DOE used the same methodology and determined the same results as in the May 2022 NOPD for the energy consumption of the lamp and ballast systems in this final determination. See chapter 5 of the final determination TSD for more detail.

f. Scaling to Other Product Classes

As noted previously, DOE analyzes the representative product classes directly. DOE then scales the levels developed for the representative product classes to determine levels for product classes not analyzed directly. For GSFLs, the representative product classes analyzed were all lamp types with CCTs ≤ 4,500 K, with the exception of 2-foot U-shaped lamps.

In the May 2022 NOPD, lamp types with CCTs less than or equal to 4,500 K were scaled to obtain levels for higher CCT product classes not analyzed. DOE found variation in the percent reduction in efficacy associated with increased CCT among product classes and therefore chose to develop a separate scaling factor for each product class. DOE developed scaling factors by identifying pairs and comparing the efficacies between the same lamp type from the same manufacturer within the same product class but that differed by CCT. 87 FR 32329, 32340.

In the May 2022 NOPD, for 2-foot U-shaped lamps, DOE compared catalog and certification data for 2-foot U-shaped lamps with equivalent 4-foot MBP lamps, and determined an average efficacy reduction of 6 percent from the 4-foot MBP lamps was appropriate. For the higher CCT product classes, DOE determined a 4 percent scaling factor for the 4-foot MBP product class, 2 percent scaling factor for the 2-foot U-shaped product class, 3 percent scaling factor for the 8-foot SP slimline product class, 3 percent scaling factor for the 8-foot RDC HO product class, 6 percent scaling factor for the T5 SO product class, and 6 percent scaling factor for the T5 HO product class were appropriate. 87 FR 32329, 32341.

DOE used the same methodology and determined the same results as in the May 2022 NOPD for the scaled ELs of the non-representative product classes in this final determination. See chapter 5 of the final determination TSD for more detail. Table IV.7 summarizes the ELs for all GSFL product classes.

Table IV.7 Summary of All Efficacy Levels for GSFLs

CCT	Lamp Type	Efficacy Level		
		1	2	3
≤ 4,500 K	4-foot medium bipin	93.6	94.6	-
	2-foot U-shaped	88.0	88.9	-
	8-foot single pin slimline	99.6	102.8	-
	8-foot recessed double contact HO	99.0	108.4	-
	4-foot T5 miniature bipin SO	97.0	98.8	100.8
	4-foot T5 miniature bipin HO	85.6	89.8	96.4
> 4,500 K	4-foot medium bipin	89.9	90.8	-
	2-foot U-shaped	86.2	87.1	-
	8-foot single pin slimline	96.6	99.7	-
	8-foot recessed double contact HO	96.0	105.1	-
	4-foot T5 miniature bipin SO	91.2	92.9	94.8
	4-foot T5 miniature bipin HO	80.5	84.4	90.6

2. Cost Analysis

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

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

Catalog teardowns: In lieu of physically deconstructing a product, DOE identifies each component using parts diagrams (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 May 2022 NOPD, DOE conducted the cost analysis using the price survey approach. Typically, DOE develops manufacturer selling prices ("MSPs") for covered products and applies markups to create end-user prices to use as inputs to the LCC

analysis and NIA. Because GSFLs are difficult to reverse-engineer (*i.e.,* not easily disassembled), DOE directly derived end-user prices for the covered lamps in the May 2022 NOPD. The end-user price refers to the product price a consumer pays before tax and installation. Because GSFLs operate with a ballast in practice, DOE also incorporated prices for ballasts that operate those lamps in the May 2022 NOPD. 87 FR 32329, 32341.

Because the range of end-user prices paid for a lamp depended on distribution channel, DOE identified the following three main distribution channels to analyze in the May 2022 NOPD: Small consumer-based distributors (*i.e.,* internet retailers, drug stores); large retail distributors (*i.e.,* home centers, mass merchants, hardware stores, and electrical distributors); and state procurement. 87 FR 32329, 32341.

In the May 2022 NOPD, for each distribution channel, DOE calculated an average price for the representative lamp unit at each EL using prices for the representative lamp unit and similar lamp models at the same level. Because the lamps included in the calculation were equivalent to the representative lamp unit in terms of performance and utility (*i.e.,* had similar wattage, CCT, shape, base type, CRI, and technology), DOE considered the pricing of these lamps to be representative of the technology of the EL. DOE developed average end-user prices for the representative lamp units sold in each of the three main distribution channels analyzed. DOE then calculated an average weighted end-user price using estimated shipments through each distribution channel. 87 FR 32329, 32341.

DOE used the same methodology and determined the same results as in the May 2022 NOPD for end-user prices in this final determination. Table IV.8 summarizes the weightings used for the GSFL main distribution channels.

Table IV.9 summarizes the weightings within the large retail distributors. See chapter 5 of the final determination TSD for more detail.

Table IV.8 Weightings for GSFL Distribution Channels

Main Channels	Weighting
State Procurement	10%
Large retail distributors	70%
Online Retailers	20%

Table IV.9 Weightings Within Large Retail Distributor Channel

Main Channels	Description	GSFL Weighting
Large Retail Distributors	Mass merchants and Home centers	11%
	Hardware stores	1%
	Electrical distributors	88%

C. Energy Use Analysis

The purpose of the energy use analysis is to determine the annual energy consumption of GSFLs 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 GSFL efficiency. The energy use analysis estimates the range of energy use of GSFLs in the field (*i.e.*, as they are actually used by consumers). The energy use analysis provides the basis for other analyses DOE performed, particularly assessments of the energy savings and the savings in consumer operating costs that could result from adoption of amended or new standards.

DOE determined the annual energy consumption of GSFLs using information on their power (*i.e.,* the rate of energy they consume), developed in the engineering analysis, and the way consumers use them (*i.e.,* their operating hours per year).

To estimate operating hours for linear lamps in the residential sector, DOE utilized the same methods as in the May 2022 NOPD. DOE estimated the national weighted-average hours-of-use (HOU) of linear lamps to be 2.1 hours per day in the residential sector. The national weighted-average HOU for linear lamps GSFLs in the commercial sector were estimated at 8.1 hours per day.

Max-tech parameters, including system arc power, BF, and BLE have not been updated for the max-tech levels described in section IV.B.1 of this final determination.

Table 6.3.1 in section 6.3 of the final determination TSD presents results of the energy use analysis for GSFL purchases in units of kilowatt-hours per year (kWh/yr).

Chapter 6 of the final determination TSD provides details on DOE's energy use analysis for GSFLs.

D. Life-Cycle Cost and Payback Period Analysis

DOE conducts LCC and PBP analyses to evaluate the economic impacts on individual consumers of potential energy conservation standards for covered products. 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 typically uses 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.

Based on the rapidly declining shipments of GSFLs, and limited and uncertain energy savings opportunity, as discussed in sections IV.D, IV.F, and V.C of this final determination, DOE did not conduct LCC and PBP analyses to evaluate the economic impacts on individual consumers of amended GSFL energy conservation standards. DOE received no comments on its decision not to conduct LCC and PBP analyses.

E. 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.[8] The shipments model takes an accounting approach in 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

[8] 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.

key input to calculations of both the NES and NPV, because operating costs for any year depend on the age distribution of the stock. DOE used a model coded in the Python programming language to compute an estimate of shipments and stock in each projection year up through the end of the analysis period (2021 – 2055). DOE included 4-foot T8, 4-foot T5 standard output and 4-foot T5 high output representative lamps in its shipments model. While T8 lamps represent the largest part of the GSFL market, the T5 product classes have engineering options with lower wattage options at higher ELs that may result in energy savings for consumers. The 8-foot RDC HO product class does not include any lamp options at higher ELs that reduce energy compared to the baseline lamp, and the only lamp option in the 8-foot SP slimline product class that would reduce energy consumption does not offer the same utility as the other representative lamp options because its lumen output is more than 10 percent lower. These lamp categories with smaller markets and without potential energy savings at higher efficiency levels were excluded from analysis due to the fact that there would be either no or miniscule savings.

DOE seeded this model with estimates of total historical shipments derived from the January 2015 final rule (up through data year 2015) and sales indices of the linear lamp market published by NEMA[9] (for data years 2015 – 2020). These indices show a steep decline of GSFL sales for lamps of all types over this five year period. In order to account for LED competition for GSFL applications, DOE included representative T8 and T5 LED replacement lamps in the shipments model (see the chapter 7 of the final determination TSD for details). DOE assumed that in each shipment's projection year, demand for replacements would be the only source of demand for new lamp purchases. Demand for replacement lamps in each year is allotted among available replacement options using a consumer choice model that derives market share based on the features of

[9] *https://www.nema.org/analytics/lamp-indices*.

available representative lamps. This model includes consumer sensitivity to price, lifetime, energy savings, and mercury content as measured in a market study[10] of consumer preference for lamps. Though these parameters represent the preference of residential consumers, DOE adopted them for the linear lamp market in the absence of available alternatives. DOE expects that because these parameters place more weight on first-cost than other attributes, the model results in a conservative estimate of LED adoption since commercial and industrial consumers are more likely to weigh decreases in operating costs in purchasing decisions.

DOE assumes that the purchase price of TLED lamp options will drop over the course of the analysis period due to price learning associated to cumulative shipments of LED lamps of all types (consistent with the price learning analysis detailed in a Lawrence Berkeley National Laboratory report on the impact of the GSL backstop[11]). Further, DOE assumes that while consumers may replace fluorescent lamps with either a fluorescent or TLED lamp option, those with failing LEDs will only opt for an LED replacement. Lastly, DOE applies an efficiency trend, based on a fit to projections of linear fixture efficiency from the 2019 Solid State Lighting Report,[12] to the most efficient LEDs available. Over the course of the shipments projection period, the application of this trend expands the range of available LED efficiencies and attempts to account for increases in LED market share that would occur as a result of this shift. Due in part to these assumptions, the shipments model projects that the linear lamp market continues to

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[10] Steven Krull and Dan Freeman, "Next Generation Light Bulb Optimization" (Pacific Gas and Electric Company, February 10, 2012), *http://www.etcc-ca.com/sites/default/files/OLD/images/stories/Lighting_Conjoint_Study_v020712f.pdf*.

[11] C.L.S. Kantner et al., "Impact of the EISA 2007 Backstop Requirement on General Service Lamps" (Berkeley, CA: Lawrence Berkeley National Laboratory, December 2021), *https://eta.lbl.gov/publications/impact-eisa-2007-backstop-requirement*.

[12] Navigant Consulting, Inc., "Energy Savings Forecast of Solid-State Lighting in General Illumination Applications" (Washington, D.C.: U.S. Department of Energy, December 2019), *https://www.energy.gov/eere/ssl/downloads/2019-ssl-forecast-report*.

shift quickly towards LED over the analysis period in the no-new-standards case. See chapter 7 of the final determination TSD for more details.

DOE also assumed that a fixed fraction of all tubular lamp stock in each year will leave the market due to retrofits or renovation with integrated LED fixtures. This assumption has the effect of reducing the number of lamps that might retire, and therefore the size of the market, in each year.

The only comment DOE received on the shipments analysis was from NEMA, referring DOE to the NEMA Lamp Index for GSFLs,[13] consistent with DOE's approach. (NEMA, No. 18 at p. 3)

F. National Impact Analysis

The NIA assesses the 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.[14] 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 estimated or provided from other sources. For the present analysis, DOE projected the energy savings, operating cost savings, product costs, and NPV of consumer benefits over the lifetime of GSFLs sold from 2026 through 2055.

DOE evaluates the effects of new or amended standards by comparing a case without such standards with standards-case projections. The no-new-standards case

[13] See footnote 9.
[14] The NIA accounts for impacts in the 50 states and Washington D.C.

characterizes energy use and consumer costs for each GSFL 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 ELs or standards cases) for that class. For the standards cases, DOE considers how a given standard would likely affect the market shares of GSFLs with efficiencies greater than the standard and TLED substitutes using the consumer-choice model discussed previously.

The only potential standard for which NES and NPV were calculated was the max-tech levels, where the standard for each GSFL product class is set at the maximum available level. NES and NPV at this candidate standard define an upper bound on how much savings could be realized at any lower standard.

Because an LCC was not performed for consumers of lamps covered under this analysis, DOE estimated the per-unit annual energy use of available GSFL options based on system input power derived in the engineering analysis (described in section IV.B of this document) and separate average HOU estimates for individual sectors.

DOE derived LED alternatives to the T8 GSFL lamps represented in this analysis by looking at the efficiency and estimated cost of TLED lamps found in manufacturer catalogs and retailer websites (in order of data priority). DOE chose seven total TLED lamps ranging from 120 to 177 lm/W, and an estimated pre-tax price of $8.78 to $14.20 in 2021 USD. DOE assumed that the efficiency of T5 and 8-foot TLED lamps would be the same as LED T8 lamps, and estimated their wattage by assuming they would have the same lumen output of their GSFL competitors described in the engineering analysis.

Like with the GSFLs, the annual energy use of TLED lamps was estimated using average hours of use and wattage. The price of any given T5 or 8-foot LED alternative is estimated as the sum of: (a) the cost of the least efficient GSFL option of that lamp type, and (b) the incremental cost between the least efficient T8 GSFL and the LED T8 with the same efficiency as the given lamp. See chapter 7 and chapter 8 of the final determination TSD for more details.

DOE uses a model written in the Python programming language to calculate the energy savings and the national consumer costs and savings from each EL.

Table IV.10 summarizes the inputs and methods DOE used for the NIA analysis for the final determination. Discussion of these inputs and methods follows the table. See chapter 8 of the final determination TSD for details.

Table IV.10 Summary of Inputs and Methods for the National Impact Analysis

Inputs	Method
Shipments	Annual shipments from shipments model.
Modeled Compliance Date of Standard	2026
Efficiency Trends	Consumer choice model, assuming increasing efficiency for max tech linear LED lamp option and decreasing LED prices over time
Annual Energy Consumption per Unit	Energy consumption values of modeled representative lamps are a function of EL.
Total Installed Cost per Unit	Purchase price of modeled representative lamps.
Repair and Maintenance Cost per Unit	Annual values do not change with efficiency level.
Energy Prices	Energy Information Administration's Annual Energy Outlook ("AEO") 2022 projections (to 2050) and extrapolation through 2095.
Energy Site-to-Primary and FFC Conversion	A time-series conversion factor based on AEO2022
Discount Rate	3 percent and 7 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. DOE uses a shipments model that implements consumer choice over available lamp options in each year in order to compute the efficiency distribution. At each standard level and the no-new-standards case, the consumer choice model uses consumer sensitivity to price, relative energy savings, lamp lifetime, and mercury content to estimate the efficiency distribution of purchases in each year.

2. National Energy Savings

The NES analysis involves a comparison of national energy consumption of the considered products between each potential standards case (EL) 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.

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 NIA 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 Energy Information Administration's (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[15] that EIA uses to prepare its AEO. 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 8B of the final determination TSD.

3. Net Present Value Analysis

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

DOE assumed that the price of TLED lamps would decrease over the analysis period due to price learning, as described in section IV.F, which affected the market share projected by the shipments model. The gradual decrease in LED prices also affects the total installed cost over the analysis period, and has the effect of reducing lamp costs in

[15] For more information on NEMS, refer to *The National Energy Modeling System: An Overview 2009*, DOE/EIA-0581(2009), October 2009. Available at *www.eia.gov/analysis/pdfpages/0581(2009)index.php* (last accessed December 1, 2022).

both the standards- and no-new-standards cases as well as the incremental cost of a standard.

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 energy price changes in the Reference case from *AEO2022*, which has an end year of 2050. To estimate price trends after 2050, DOE assumed that prices would remain constant after 2050. NIA results based on these cases are presented in appendix 8C of the final determination TSD.

In calculating the NPV, DOE multiplies the net savings in future years by a discount factor to determine their present value. For this final determination, 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.[16] 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.

V. Analytical Results and Conclusions

[16] United States Office of Management and Budget. *Circular A-4: Regulatory Analysis*. September 17, 2003. Section E. Available at *https://www.whitehouse.gov/wp-content/uploads/legacy_drupal_files/omb/circulars/A4/a-4.pdf* (last accessed December 1, 2022).

The following section addresses the results from DOE's analyses with respect to the considered energy conservation standards for GSFLs. It addresses the max tech levels examined by DOE and the projected impacts of these levels. Additional details regarding DOE's analyses are contained in the final determination TSD supporting this document.

A. Economic Impacts on Individual Consumers

Based on the lack of energy savings and declining shipments of GSFLs, as discussed in sections IV.C and IV.E of this final determination, DOE did not conduct LCC and PBP analyses to evaluate the economic impacts on individual consumers of amended GSFL energy conservation standards.

B. National Impact Analysis

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

1. Significance of Energy Savings

To estimate the energy savings attributable to potential amended standards for GSFLs, DOE compared their energy consumption under the no-new-standards case to their anticipated energy consumption under the max-tech levels for 4-foot T8 and 4-foot standard and high output T5 GSFL product classes. 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).

The NIA model projected relatively low potential savings from a max-tech standard level and that the majority of savings realized by setting a GSFL standard are

the result of incurring quicker market shift to LED alternatives, rather than the reduction in energy consumption of a constant GSFL market share. Further, because the entire tubular lamp market is projected to decline over the analysis period, most savings occur in the first decade of a potential standard. For more details, see chapters 7 and 8 of the final determination TSD.

Table V.1 presents DOE's projections of the NES for the max-tech standard level considered for GSFLs. The savings were calculated using the approach described in section IV.F of this document.

Table V.1 Cumulative National Energy Savings for GSFLs (Quads); 9 Years of Shipments (2026–2034) and 30 Years of Shipments (2026–2055)

	Max Tech Savings	
	9 years shipments (2026 – 2034)	**30 years shipments (2026 – 2055)**
Source Energy	0.02	0.03
FFC Energy	0.02	0.03

OMB Circular A-4[17] 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 final determination, 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.[18] The review timeframe established in EPCA is

[17] OMB. *Circular A-4: Regulatory Analysis*. September 17, 2003. Available at *obamawhitehouse.archives.gov/omb/circulars_a004_a-4/* (last accessed March 4, 2022).

[18] 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. If DOE makes a determination that amended standards are not needed, it must conduct

generally not synchronized with the product lifetime, product manufacturing cycles, or other factors specific to GSFLs. 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.1. The impacts are counted over the lifetime of GSFLs purchased in 2026–2034.

2. 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 max-tech levels considered for GSFLs. In accordance with OMB's guidelines on regulatory analysis,[19] DOE calculated NPV using both a 7-percent and a 3-percent real discount rate. Table V.2, Cumulative Net Present Value of Consumer Benefits for GSFLs (billions of 2021 USD); 9 Years of Shipments (2026–2034) and 30 Years of Shipments (2026–2055), shows the consumer NPV results with impacts counted over the lifetime of products purchased in 2026–2055.

Table V.2 Cumulative Net Present Value of Consumer Benefits for GSFLs (billions of 2021 USD); 9 Years of Shipments (2026–2034) and 30 Years of Shipments (2026–2055)

Discount Rate	Maximum Tech Standard	
	9 Years of Shipments (2026 – 2034)	30 Years of Shipments (2026 – 2055)
3 percent	0.15	0.20
7 percent	0.11	0.14

The NPV results based on the aforementioned 9-year analytical period are also presented in Table V.2, Cumulative Net Present Value of Consumer Benefits for GSFLs

a subsequent review within three years following such a determination. As DOE is evaluating the need to amend the standards, the sensitivity analysis is based on the review timeframe associated with amended 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.

[19] See footnote 17.

(billions of 2021 USD); 9 Years of Shipments (2026–2034) and 30 Years of Shipments (2026–2055). The impacts are counted over the lifetime of GSFLs purchased in 2026–2034. 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.

C. Final Determination

In order to make a final determination that standards for GSFLs do not need to be amended, EPCA requires that DOE analyze whether amended standards for GSFLs would result in significant conservation of energy, be technologically feasible, and be cost effective. (42 U.S.C. 6295(m)(1)(A) and (n)(2)) Any new or amended standards issued by the Secretary would be required to comply with the economic justification requirements of 42 U.S.C. 6295(o). The criteria considered under 42 U.S.C. 6295(m)(1)(A) and the additional analysis relating to economic justification are discussed in this section V.C.

1. Technological Feasibility

EPCA mandates that DOE consider whether amended energy conservation standards for GSFLs would be technologically feasible. (42 U.S.C. 6295(m)(1)(A) and (n)(2)(B)) DOE has determined that there are technology options that would improve the efficacy of GSFLs. These technology options are being used in commercially available GSFLs and therefore are technologically feasible. Hence, DOE has determined that amended energy conservation standards for GSFLs are technologically feasible.

2. Cost Effectiveness

EPCA requires DOE to consider whether energy conservation standards for GSFLs would be cost effective through an evaluation of the savings in operating costs throughout the estimated average life of the covered GSFLs compared to any increase in the price of, or in the initial charges for, or maintenance expenses of, the covered GSFLs which are likely to result from the imposition of an amended standard. (42 U.S.C. 6295(m)(1)(A), (n)(2)(C), and (o)(2)(B)(i)(II)) In the absence of an LCC analysis, DOE considers NPV estimated by the NIA model to estimate the potential monetary benefits of amended standards for GSFLs. (See results in Table V.2.) As noted, the inputs for determining the NPV 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 observes that most of the estimated NPV resulting from a potential standard comes from operating cost savings associated to a slightly faster market transition to LED alternatives, rather than savings associated to lower energy consumption for GSFL consumers.

3. Significant Conservation of Energy

EPCA also mandates that DOE consider whether amended energy conservation standards for GSFLs would result in significant conservation of energy. (42 U.S.C. 6295(m)(1)(A) and (n)(2)(A)) DOE observed that a max-tech FFC energy savings of 0.03 quads over 30 years of shipments represents an approximately 1 percent decrease in total energy use of lamps shipped in the period 2026-2055. In addition, the model used to estimate these savings projects that most of this reduction comes in incurring a faster market shift to solid state lighting rather than a reduction in energy use among existing GSFL consumers.

DOE also notes that GSFLs are manufactured and sold at standard wattage levels, which restricts the effect of efficiency gains to increasing the amount of light provided by GSFLs rather than directly reducing energy consumption. For 4-foot T8 GSFLs, which represent the bulk of GSFL shipments, the same wattage options are available at the max tech standard level as at the baseline, so no GSFL consumer must use less energy as a result of a standard. The 0.02 FFC quads of potential energy savings associated with these lamps is thus uncertain, as consumers may simply continue to purchase a GSFL of the same wattage as their current lamp, rather than shift to a lower wattage lamp or different lighting technology. Consumers who have not already transitioned to LED lighting, once the vast majority of the market has done so, may be less inclined to do so than the typical consumer modeled by the consumer-choice model.

The 8-foot RDC HO product class and the 8-foot SP slimline product class do not include any lamp options at higher ELs that would reduce energy compared to the baseline lamp, with the exception of one lamp option in the 8-foot SP slimline product class that doesn't offer the same utility as the other representative lamp options because its lumen output is more than 10 percent lower. Thus, there are no potential energy savings from more efficient GSFLs for the 8-foot product classes.

The potential FFC energy savings from the remaining (4-foot T5 standard output and high output) product classes is only 0.01 quads over 30 years of shipments. While these product classes do offer a lower wattage option at max tech, in addition to an option with the same wattage as the baseline lamp, DOE notes that for standard output T5 lamps, the lower wattage lamp costs more than the baseline-equivalent wattage option, and for the high output T5 lamps, the lower wattage lamp costs similar to the baseline-equivalent option, again suggesting uncertainty that consumers will switch to a lower

wattage lamp. Additionally, most potential energy savings would come from consumers switching to LEDs, and as with 4-foot T8 GSFLs, there is no guarantee that consumers will switch to LEDs as a result of a standard, rather than continue to purchase GSFLs of the same wattage as their current lamp.

Further, while consumers historically might save energy under a standard by retrofitting their systems with lower ballast factor ballasts to reduce the operating wattage of their lamps (while retaining light output), it appears unlikely in the current market that consumers would retrofit their ballasts in this way as opposed to installing a solid-state lighting solution. This removes the potential lamp-and-ballast replacement approach as a strategy to save energy, and consequently this approach was not modeled in this analysis of potential energy savings.

4. Further Considerations

As discussed previously, any amended standards for GSFLs would be required to comply with the economic justification and other requirements of 42 U.S.C. 6295(o). Based on the: (1) uncertainty of potential energy savings discussed in detail in section V.C.3 of this document; (2) the fact that an amended standard for GSFLs would require manufacturers to invest in the manufacture of more efficient GSFLs at a time when the market is already rapidly declining, as discussed in section IV.F; and (3) international uncertainty regarding the ability to sell GSFLs in the future following the second segment of the fourth meeting of the Conference of the Parties to the Minamata Convention on

Mercury,[20] DOE has determined that energy conservation standards for GSFLs would not be economically justified.

5. Summary

Based on the reasons stated in the foregoing discussion, DOE determines that the energy conservation standards for GSFLs do not need to be amended because amended standards would not be economically justified.

VI. Procedural Issues and Regulatory Review

A. Review Under Executive Orders 12866 and 13563

Executive Order (E.O.) 12866, "Regulatory Planning and Review," as supplemented and reaffirmed by E.O. 13563, "Improving Regulation and Regulatory Review," 76 FR 3821 (Jan. 21, 2011), 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;

[20] clasp, "Convention on Mercury Promises CFLs Phase-Out; Action on LFLs Delayed," available at *https://www.clasp.ngo/updates/convention-on-mercury-agrees-to-phase-out-major-category-of-fluorescent-light-bulbs-but-last-minute-interventions-delay-action-on-another/*; UN Environment Programme, "Minamata COP-4 closes with global commitment to strengthen efforts against toxic mercury," available at *https://www.unep.org/news-and-stories/press-release/minamata-cop-4-closes-global-commitment-strengthen-efforts-against*; UN Environment Programme, "Minamata Convention on Mercury," available at *https://www.mercuryconvention.org/en*.

and (5) identify and assess available alternatives to direct regulation, including providing economic incentives to encourage the desired behavior, such as user fees or marketable permits, or providing information upon which choices can be made by the public. DOE emphasizes as well that E.O. 13563 requires agencies to use the best available techniques to quantify anticipated present and future benefits and costs as accurately as possible. In its guidance, the Office of Information and Regulatory Affairs (OIRA) in the Office of Management and Budget (OMB) has emphasized that such techniques may include identifying changing future compliance costs that might result from technological innovation or anticipated behavioral changes. For the reasons stated in the preamble, this 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 does not constitute a "significant regulatory action" under section 3(f) of E.O. 12866. Accordingly, this action was not submitted to OIRA for review under E.O. 12866.

B. Review Under the Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) requires preparation of an initial regulatory flexibility analysis ("IRFA") for any rule that by law must be proposed for public comment and a final regulatory flexibility analysis (FRFA) for any such rule that an agency adopts as a final rule, unless the agency certifies that the rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. As required by E.O. 13272, "Proper Consideration of Small Entities in Agency Rulemaking," 67 FR 53461 (Aug. 16, 2002), DOE published procedures and policies on February 19, 2003, to ensure that the potential impacts of its rules on small entities are properly considered during the rulemaking process. 68 FR 7990. DOE has

made its procedures and policies available on the Office of the General Counsel's website (*www.energy.gov/gc/office-general-counsel*).

DOE reviewed this final determination under the provisions of the Regulatory Flexibility Act and the policies and procedures published on February 19, 2003. Because DOE is not amending standards for GSFLs, the determination will not amend any energy conservation standards. On the basis of the foregoing, DOE certifies that the final determination will have no significant economic impact on a substantial number of small entities. Accordingly, DOE has not prepared an FRFA for this final determination. DOE has transmitted this certification and supporting statement of factual basis to the Chief Counsel for Advocacy of the Small Business Administration for review under 5 U.S.C. 605(b).

C. Review Under the Paperwork Reduction Act

This final determination, which concludes that no amended energy conservation standards for GSFLs are needed, imposes no new information or recordkeeping requirements. Accordingly, OMB clearance is not required under the Paperwork Reduction Act. (44 U.S.C. 3501 *et seq*.)

D. Review Under the National Environmental Policy Act of 1969

DOE has analyzed this final action in accordance with the National Environmental Policy Act of 1969 (NEPA) and DOE's NEPA implementing regulations (10 CFR part 1021). DOE's regulations include a categorical exclusion for actions which are interpretations or rulings with respect to existing regulations. 10 CFR part 1021, subpart D, appendix A4. DOE has determined that this final determination qualifies for categorical exclusion A4 because it is an interpretation or ruling in regard to an existing

regulation and otherwise meets the requirements for application of a categorical exclusion. See 10 CFR 1021.410. Accordingly, neither an environmental assessment nor an environmental impact statement is required.

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 E.O. 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 final determination and has tentatively determined that it would not have a substantial direct effect on the States, on the relationship between the National Government and the States, or on the distribution of power and responsibilities among the various levels of government. EPCA governs and prescribes Federal preemption of State regulations as to energy conservation for the GSFLs that are the subject of this final determination. 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 E.O. 13132.

F. Review Under Executive Order 12988

With respect to the review of existing regulations and the promulgation of new regulations, section 3(a) of E.O. 12988, "Civil Justice Reform," imposes on Federal agencies the general duty to adhere to the following requirements: (1) eliminate drafting errors and ambiguity, (2) write regulations to minimize litigation, (3) provide a clear legal standard for affected conduct rather than a general standard, and (4) promote simplification and burden reduction. 61 FR 4729 (Feb. 7, 1996). Regarding the review required by section 3(a), section 3(b) of E.O. 12988 specifically requires that Executive agencies make every reasonable effort to ensure that the regulation: (1) clearly specifies the preemptive effect, if any, (2) clearly specifies any effect on existing Federal law or regulation, (3) provides a clear legal standard for affected conduct while promoting simplification and burden reduction, (4) specifies the retroactive effect, if any, (5) adequately defines key terms, and (6) addresses other important issues affecting clarity and general draftsmanship under any guidelines issued by the Attorney General. Section 3(c) of 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 determination 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, sec. 201 (codified at 2 U.S.C. 1531). For a regulatory action likely to result in a rule that may cause the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector of $100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA

requires a Federal agency to publish a written statement that estimates the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a), (b)) The UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal governments on a proposed "significant intergovernmental mandate," and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect them. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. 62 FR 12820. DOE's policy statement is also available at *www.energy.gov/sites/prod/files/gcprod/documents/umra_97.pdf*.

DOE examined this final determination according to UMRA and its statement of policy and determined that the final determination does not contain a Federal intergovernmental mandate, nor is it expected to require expenditures of $100 million or more in any one year by State, local, and Tribal governments, in the aggregate, or by the private sector. As a result, the analytical requirements of UMRA do not apply.

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

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

I. Review Under Executive Order 12630

Pursuant to E.O. 12630, "Governmental Actions and Interference with Constitutionally Protected Property Rights," 53 FR 8859 (Mar. 15, 1988), DOE has determined that this final determination 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 determination 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 the Office of Information and Regulatory Affairs (OIRA) at OMB, a Statement of Energy Effects for any proposed significant energy action. A "significant energy action" is defined as any action by an agency that promulgates or is expected to lead to promulgation of a final rule, and that (1) is a significant regulatory action under

E.O. 12866, or any successor E.O.; 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.

This final determination, which does not amend energy conservation standards for GSFLs, is not a significant regulatory action under E.O. 12866. Moreover, it would not 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.

L. Review Under the Information Quality Bulletin for Peer Review

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

In response to OMB's Bulletin, DOE conducted formal peer reviews of the energy conservation standards development process and the analyses that are typically used and has prepared Peer Review report pertaining to the energy conservation standards rulemaking analyses.[21] 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.[22]

M. Congressional Notification

As required by 5 U.S.C. 801, DOE will report to Congress on the promulgation of this final determination prior to its effective date. The report will state that it has been determined that the final determination is not a "major rule" as defined by 5 U.S.C. 804(2).

VII. Approval of the Office of the Secretary

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

Signing Authority

[21] "Energy Conservation Standards Rulemaking Peer Review Report." 2007. Available at *energy.gov/eere/buildings/downloads/energy-conservation-standards-rulemaking-peer-review-report-0* (last accessed Nov. 7, 2022).

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

This document of the Department of Energy was signed on January 30, 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 February 7, 2023.

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Treena V. Garrett
Federal Register Liaison Officer,
U.S. Department of Energy

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